UNIVERSITY OF ALBERTA
DEPARTMENT OF AGRICULTURAL,
FOOD & NUTRITIONAL SCIENCE

2017–2018
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 the health and quality of life.

CONTENTS

MESSAGE FROM THE CHAIR

With pleasure, we present the 2017–18 annual report for our Department of Agricultural, Food and Nutritional Science.

It has been another excellent year in our department as we have continued to provide science-based solutions that have had an impact on Alberta, Canada and around the world. Highlights for this year include using pulse grains as ingredients for food products, enhancing lipid formation in oilseeds, understanding body composition changes in women during breastfeeding, and the delivery of genomic solutions to enhance sustainable production systems.

Our successes are built on our excellent faculty and staff who continue to teach and train students and postdoctoral fellows. Together, they conduct leading-edge research and teaching, with the support of our many partners, including Natural Sciences and Engineering Research Council (NSERC), Alberta Agriculture and Forestry, the Alberta Crop Industry Development Fund (ACIDF), Alberta Health Services, Alberta Innovates Bio Solutions as well as industry partners. These groups have funded research projects and strategic initiatives such as the Livestock Gentec and the Poultry Research Centre; they are also committed to funding NSERC-Industrial Research Chairs.

Indeed, AFNS's commitment to excellence is seen in the strengths 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 newly accredited dietetics specialization program trains future registered dietitians, and our updated animal health program and animal science major were reviewed together. Our future is bright as our undergraduate student numbers remain strong, especially in 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 of our partners to provide solutions that have a local and global impact.

Sincerely,

Ruurd Zijlstra

CHAIR, DEPARTMENT OF AGRICULTURAL, FOOD & NUTRITIONAL SCIENCE

PLANT BIOSYSTEMS

FACULTY

EDWARD BORK *Mattheis Chair in Rangeland Ecology and Management* | **CAMERON CARLYLE** *Rangeland Ecology* | **GUANQUN (GAVIN) CHEN** *Plant Lipid Biotechnology* | **LINDA HALL** *Environmental Biosafety and Integrated Weed Management* | **BARRY IRVING** *Manager, Research Stations* | **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*

MAKING MORE FOOD

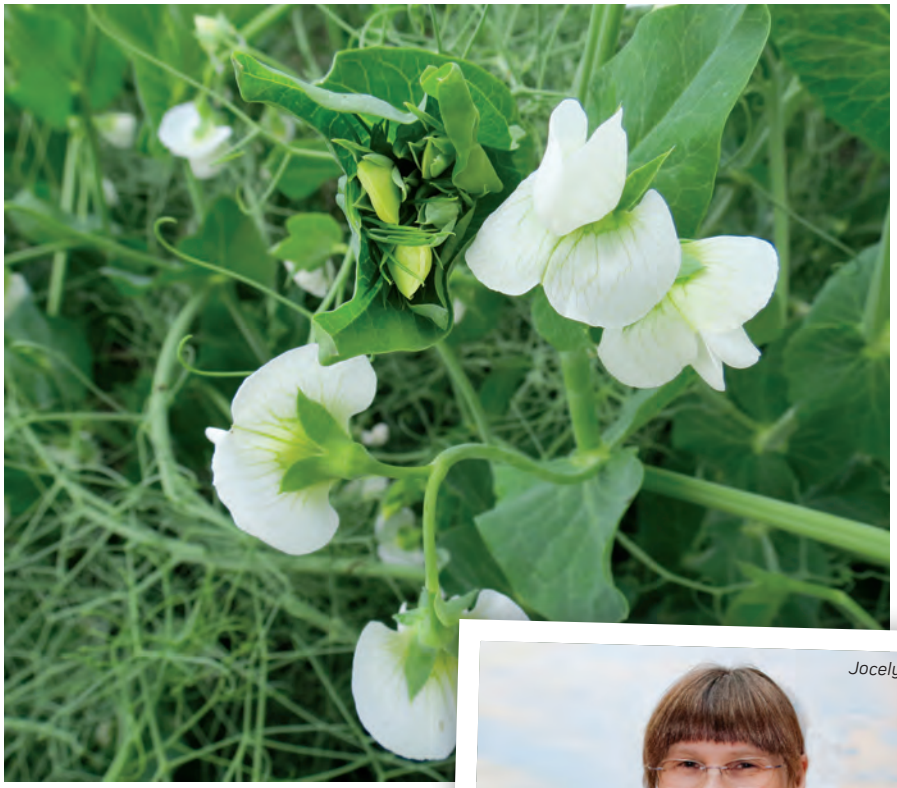
AFNS SCIENTISTS ARE APPLYING LEADING-EDGE GENOMICS TO INCREASE WORLD'S FOOD PRODUCTION

Why It's Necessary

By 2050, the Earth will be home to more than 9.2 billion people. To feed them all, global food production must double; a challenge made even more daunting as the climate changes.

To improve food production, researchers in the Department of Agricultural, Food and Nutritional Science are applying innovative genomic technologies to both livestock and crops.

Here are some of the gains AFNS is pursuing in plants in conjunction with Genome Canada and federal and provincial agencies.



Field Peas

"Legume crops, such as the field pea, contribute to sustainable cropping systems by providing nitrogen to the legume crop, as well as for any subsequent crops," says crop scientist **Jocelyn Ozga**.

The use of grain legumes in the human diet also offers health and nutritional benefits. To increase yield in field peas, Ozga is studying how the plant "partitions" nutrients and sugars to its seeds. Her goal is to get more food to the seeds to increase their size and number for increased yield. She has already discovered that when the levels of the plant hormone gibberellin are higher in the developing seed, more of the sugar is partitioned to the seed. But too much of the hormone makes the plants themselves longer and thinner, causing them to lodge (fall over) and become harder to harvest.

In a project funded by the Alberta Crop Industry Development Fund, Ozga is comparing plant lines that overproduce gibberellin, and those that do not, to see exactly what the hormone is doing to stimulate an increase in their size and number per pod.

"By understanding that, we can cherry-pick aspects that increase the key aspect of partitioning just in the seeds and not have it affect the stature of the plant," she says.

Jocelyn Ozga

Barley

Genomic research is targeting ways to shorten the breeding cycle for cereal crops like barley, says statistical geneticist **Rong-Cai Yang**, who is a research scientist at Alberta Agriculture & Forestry and an academic affiliate at the University of Alberta.

In Western Canada, it currently takes 12 years to create a new variety of barley. Once that new variety is produced, breeders rely on the breed's phenotype (the observable characteristics like height and yield) to see how it interacts with the environment.

Information gleaned from genomics could reduce the time that process takes, says Yang.

In the past, barley breeders relied on data collected in the field to improve crops. Now, by combining field data with lab data from geneticists, through a new approach known as genomic selection, breeders could save several generations of breeding and many years of field testing to select crops with higher yields, improved disease resistance, and higher quality.

Working with his barley breeding colleagues at Alberta Agriculture and Forestry in Lacombe, Yang's team has developed software, called the Barley Breeding Platform, which brings phenotypic and genomic data together. The researchers are now working on an updated version with multivariate genomics, which allows breeders to select varieties based on multiple traits.

"This will be very important to the agriculture industry in Canada," says Yang. "We need to produce high-quality, disease-free wheat and barley crops to be competitive globally."

Rong-Cai Yang

Canola

To feed more people, we also need to be more efficient at nourishing meat-producing animals.

A Genome Canada project started several years ago, by now-retired crop scientist **Randall Weselake** and currently led by **Guanqun (Gavin) Chen**, is looking at how to increase and enhance canola seed oil for human consumption, and improve canola meal to make it more nutritious as an animal feedstock. For more, see "5 Facts about My Research on Seed Oil" on page 8.

Genomics & Livestock

For the research AFNS is doing with beef and pigs, and how informatics works, see "Making More Food" on page 14. ■

More on Making More Food.

MAKING MORE FOOD

5 FACTS ABOUT MY RESEARCH ...

ON SEED OIL

with **Guanqun (Gavin) Chen**, plant lipid biotechnologist


Guanqun (Gavin) Chen

1. Why are you researching seed oil formation?

With a growing global population, the demand for vegetable oils is steadily increasing for both dietary consumption and as a resource, or feedstock, for sustainable industries. I am interested in increasing our understanding of seed oil formation (or plant lipid formation) and in developing and applying novel biotechnology to improve seed oil quality and yield.

2. What can you do with this knowledge?

Making better oil crops can benefit the Canadian economy. For instance, canola contributes almost $28 billion per year to our economy, and it is responsible for one fourth of total farm cash receipts, 250,000 jobs and $12.5 billion in wages and benefits. Just a one-per-cent increase of oil content in canola seeds can potentially contribute $90 million to the seed oil extraction and processing industry in Canada.

Simply improving oil content in canola seeds, however, may cause other problems in canola, such as low yield, low protein content or agronomic issues. New knowledge about lipid biosynthesis, its interaction with other pathways and canola seed development can help us properly improve canola seed yield and oil content, and seed protein content, which is an important parameter of canola meal quality.

3. What do you mean by "properly improving" canola?

While canola meal is relatively high in protein, the percentage remains lower than its major competitor, soybean meal. Canola meal also contains high levels of unfavourable fibre. We are working to simultaneously increase protein and oil content and decrease the fibre with the ultimate goal to develop an elite canola germplasm.

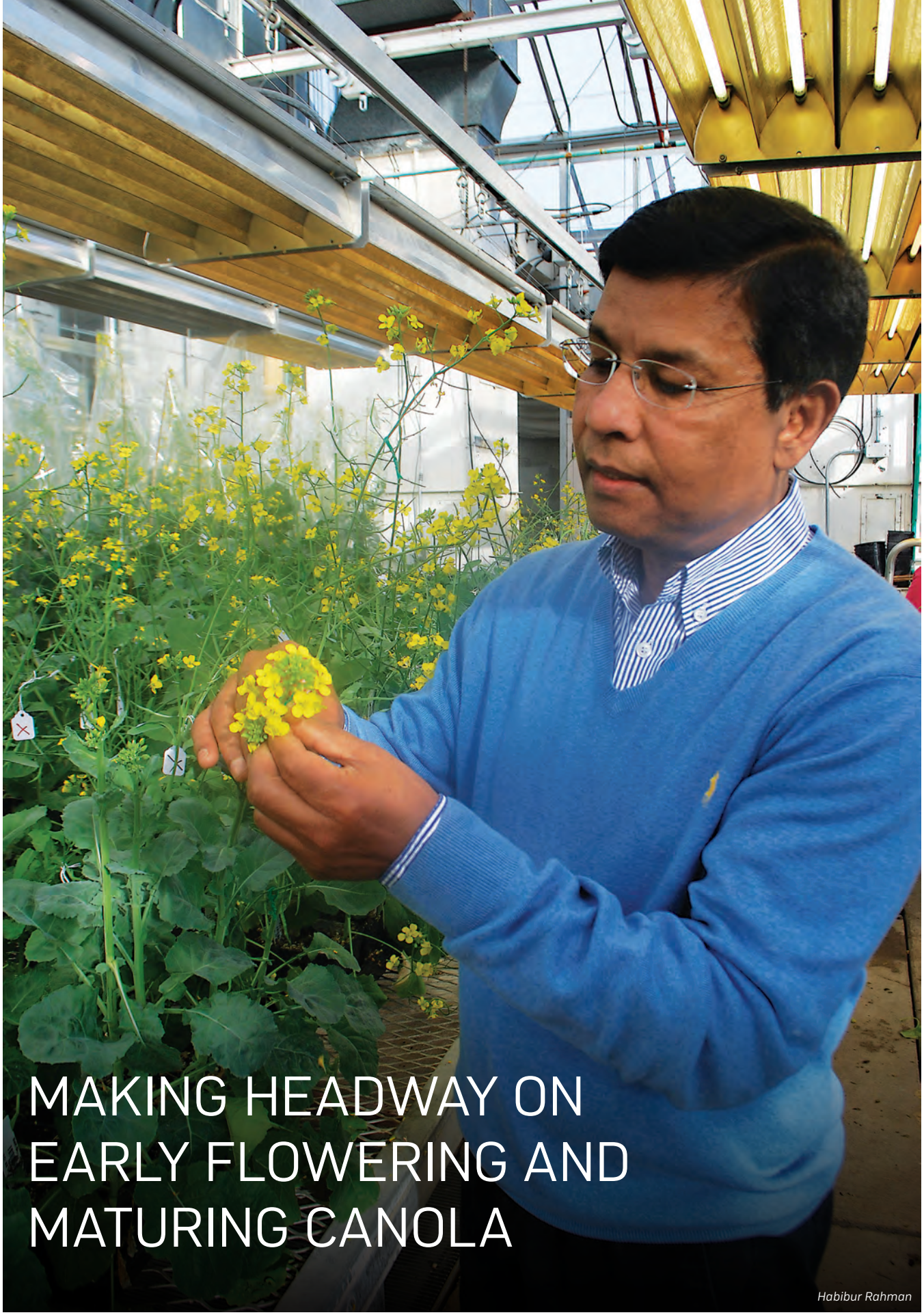
4. Where else can you apply your plant lipid research?

It can also help us create special high-value oils for nutraceutical and industrial applications, and our findings may be used to improve other important oilseed crops, including soybean and flax.

5. Tell us more about how high-value oils can help us.

Fatty acids are the major component of triacylglycerol, the vegetable oil. Some fatty acids have high value—for example, DHA and EPA, the two major omega-3 unsaturated fatty acids, which are plentiful in some fish oils. A few companies are almost ready to commercially grow canola cultivars that can produce DHA oil levels equal to that found in wild fish. This strategy can be used to produce other high-value fatty acids, too.

Another example is punicic acid, which is a major component of pomegranate seed oil. This conjugated fatty acid has strong anti-cancer, anti-inflammatory and anti-bacterial activities. We intend to increase punicic acid content in canola seed oil and develop yeast enriched in punicic acid to reduce the use of antibiotics in broiler chickens. ■



MAKING HEADWAY ON EARLY FLOWERING AND MATURING CANOLA

Habibur Rahman

The goal is to protect canola from early snowfall and stress of mid-summer heat

Habibur Rahman and student

By following a non-traditional line of thought, canola breeder **Habibur Rahman** has made significant progress in his goal to develop a canola line that flowers and matures a week early.

"I looked in the cabbage, cauliflower, broccoli and kale species, which mostly flower later than canola," says Rahman. "People think that there are no early flowering genes there. However, some of those do flower early compared to the others. So I wondered, 'What is the reason? There must be some early flowering genes.'"

He was right. Already, Rahman has located two genes that are proving useful. When introduced to canola, one causes it to flower one-and-a-half days earlier than *Brassica napus*, the spring canola that is grown the most in Canada. The other gene can induce earliness under short day-length conditions. More importantly, the time of flowering induced by these genes does not reduce seed yield.

Rahman is now on the hunt for four or five more genes that work in similar ways so that he can create a cultivar that flowers at least a full week earlier while maintaining seed yield.

Early flowering and maturing canola is highly desired by farmers for two reasons: it will be at less risk of damage from early snowfall or frost in fall, and the young flowers can avoid the stress from mid-summer heat, which also damages crops.

Despite these payoffs, few scientists are trying to breed early flowering and maturing canola, says Rahman, because the endeavour creates challenges beyond locating the right genes.

Introgression—the transfer of genetic information from one species to another—introduces many undesirable traits, along with the desired trait, which affect seed oil content and quality. So those traits must subsequently be bred out.

Also, while *B. napus* canola is itself a mix of Polish canola and the cauliflower/broccoli type plant species, crossing many cabbage or kale type species with canola creates plants that do not produce seed. Those traits must be improved, too. The two genes Rahman located were found in Chinese kale.

Rahman anticipates that finding the other genes and the characterization that will extend the early flowering may take up to eight to 10 years of discovery research, which he says takes longer than applied research and is more challenging as well.

This project is supported by the Natural Sciences and Engineering Research Council of Canada (NSERC). ■

ALUMNI PROFILE

"I really love working with landowners to promote these sustainable practices in ways that help them and the whole of Alberta."

AMANDA MILLER '13 MSc
Rangeland and Wildlife Resources

CURRENT POSITION

Provincial Range Specialist – Grasslands Region, Alberta Environment and Parks, Lethbridge

JOB DUTIES

We take the science of sustainable range management and find a way to apply it through the development of tools, policies and extension documents. The tools we use in the management of public lands (such as the range health assessment and plant community guides) help ensure that the range resource is being managed sustainably so that it provides us with all the ecological goods and services we expect, including wildlife habitat, carbon sequestration and healthy watersheds.

I'm on the road five or six weeks of the summer working in the field and with different stakeholders. I present to industry associations, and our program develops extension materials that can be used to assist in the management of private rangelands, as well.

BEST PARTS OF THE JOB

I really love working with landowners to promote these sustainable practices in ways that help them and the whole of Alberta. Also, there's nothing better than standing in a field of knee-high rough fescue, seeing these intact native landscapes that are protecting some of our most valuable assets—the water we drink, the air we breathe and the wildlife that lives on the land.

WHY I CHOSE ALES

The Faculty of Agricultural, Life and Environmental Sciences probably has the best range management program in Canada and possibly the best in North America, especially for graduate students. The resources and the variability of working landscapes we have at our disposal are unbelievable. The Kinsella Research Ranch in native Central Parkland Region, the Mattheis Research Ranch in the Dry Mixedgrass, and now the Stavely Research Ranch in the Foothills Fescue, and the Onefour Research Ranch for the very southern Dry Mixedgrass. All provide amazing research opportunities and resources that you would be hard-pressed to find at any other post-secondary institutions. ■

ANIMAL SCIENCE

FACULTY

JUDD AIKEN *Prion Disease* | **DIVAKAR AMBROSE** *Reproductive Physiology and Management* | **BURIM AMETAJ** *Ruminant Nutritional Immunology* | **LORNE BABIUK** *Immunology, Pathogenesis, Virology, Molecular virology and Vaccinology* | **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* | **RUURD ZIJLSTRA** *Ingredient Evaluation and Carbohydrate Nutrition* | **MARTIN ZUIDHOF** *Poultry Science/Bioeconomic Modeling*

MAKING MORE FOOD

GENOMICS RESEARCH HELPS PRODUCE ANIMALS THAT ARE MORE DISEASE RESILIENT AND FEED EFFICIENT

The Challenge

In a little more than 30 years, food production around the world needs to double in order to feed the world's exploding population.

To ensure there is enough food, researchers throughout the Department of Agricultural, Food and Nutritional Science are applying innovative genomic technologies.

"Genomics has already delivered tangible results, but the greatest gains have yet to be realized," says **Graham Plastow**, professor and CEO of Livestock Gentec, the Alberta Innovates Centre based in AFNS, where scientists are focused on better livestock breeding and management technologies, using genomics, genetics and bioinformatics. (For AFNS's Expertise in Informatics, see page 16).

Beef

The team at Livestock Gentec has been using genome-wide association studies in cattle since the organization helped develop the first tool able to do this work about 10 years ago.

Such studies can potentially reduce the cost of the production of high-quality beef as well as potentially help breed cattle that are more resilient against disease, says Plastow. The key is collecting enough information on the traits of interest.

Most recently the team is also looking for ways to reduce the amount of methane produced by beef cattle without decreasing the amount of beef produced, as well as developing tools to help manage the genetic potential of crossbred cattle.

"It is essentially as simple as selecting the best parents for the next generation," says Plastow. "You measure your traits you think are important and then you mate the best ones together and, on average, their progeny will perform better than the average of the population today because you are only breeding from the very best animals."

In traditional selection, scientists would have to grow an animal and then select the superior ones for breeding, says **Carolyn Fitzsimmons**, scientist at Agriculture and Agri-Food Canada and academic affiliate at the University of Alberta.

"For cattle in particular, you don't know which ones are superior until they are harvested for meat. Here genomics can help. For example, if you find which genetic markers are related to different traits of interest, you can test the animals when they're young, and keep them for breeding."

The main trait that Fitzsimmons is studying in cattle is feed efficiency. In a project at the Kinsella Research Ranch, supported by Agriculture and Agri-Food Canada, and Alberta Agriculture and Forestry, researchers are measuring traits related to production efficiency, including growth, birth weight, reproductive efficiency and carcass characteristics.

So far, they've made a significant finding—using genomic selection to improve feed efficiency has not negatively affected any of the other traits.

Another of Fitzsimmons's projects investigates prenatal maternal nutrition and epigenetics (the study of heritable changes in gene function that do not involve changes in the DNA sequence). In that study, she's discovered that prenatal maternal nutrition can have long-lasting effects on animal growth but negligible effects upon carcass quality.

Pigs

Nowhere else in the world have swine scientists used genomics tools to understand and improve disease resilience in pigs on the scale it is being done by the Department of Agricultural, Food and Nutritional Science and its partners, says AFNS animal scientist **Michael Dyck**.

Researchers here are testing more than 3,000 pigs (compared to much smaller previous studies elsewhere) for their response to various common bacteria and a number of respiratory diseases.

After identifying how each animal in a common environment responds to the pathogens introduced, researchers examine how those animals differ. What do the pigs' genomes, immunities and gut microbiomes contain that make some more resilient to disease? With that information, scientists can improve pig breeding programs and possibly use new technologies to induce beneficial mutations, says Dyck, the lead investigator on the Swine Health Genomics Project.

"Pigs that are less susceptible to disease are good for everyone," he says. "Pigs that aren't sick are more efficient. (Disease resilience) is beneficial to their welfare and it reduces the need for drugs and antibiotics."

So far, with about 2,000 animals assessed, the research is building on work done by the Swine Health Genomics Project team, which has already identified a genomic marker with promise for resisting a common disease that pigs are exposed to in production.

The project is also notable, says Dyck, because they have also involved social scientist **Ellen Goddard**, of the Department of Resource Economics and Environmental Sociology in the Faculty of Agricultural, Life and Environmental Sciences. She is looking at the perceptions of producers and consumers around developing and applying these techniques, and the consequences that follow.

"If we are able to use genomics to improve resilience, will the producers apply it, will the processors want it, and will the consumers buy it?" says Dyck. "She's doing those assessments and if there are questions they are addressed while the research in underway."

The project's partners are PigGen Canada and the Centre de Développement du porc du Québec (CDPQ). Funders include Genome Canada, Genome Alberta, Genome Prairie and the Ontario Genomics Institute. Other collaborators include researchers at the University of Saskatchewan, the University of Guelph and Iowa State University.

The Funders' Roles

The work AFNS researchers are doing in genomics requires close collaboration with partners outside the university.

Genome Canada, a not-for-profit organization funded by the Government of Canada, has demonstrated that it places high priority on agriculture research by granting nearly $40 million in funding to the Department of AFNS over the last few years.

In turn, Genome Canada asks researchers to secure co-funding from other sources, both government-related funders such as Agriculture and Agri-Food Canada, and Alberta Agriculture and Forestry, and industry.

These broad collaborations allow for a pooling of ideas and funds, resulting in projects that are both large scale and practical, says Michael Dyck.

"Part of Genome Canada's mandate is to develop and implement genomic research that benefits Canadians and various sectors of agriculture. We'll have a local impact but there's potential to have an international impact, as well," he says.

It is also enormously helpful when a funder, such as the Alberta Crop Industry Development Fund supports research early in the process, when scientists are still just proving the concept, says crop scientist **Jocelyn Ozga**.

"Usually funders don't want to do that, because it's a long time before [research] can be useful to the producers," she says. "Usually they want [to sponsor science] closer to commercialization." ■


Graham Plastow

MAKING MORE FOOD

BIOINFORMATICS

Making sense of DNA sequencing puts researcher at forefront of new science

Information overload is a growing problem in animal science, so researchers are developing tools to manage it—and a significant portion of that problem solving in Canada is happening in the Department of Agricultural, Food and Nutritional Science.

Thanks to recent advances in chemistry and molecular biology, scientists can now characterize the entire genome of an animal (its total DNA) in mere hours instead of years. Obtaining this sequence information is a key step towards understanding the hereditary instructions that control what cells do and contribute to differences between individuals.

However, when the genomes of many animals are sequenced—for example, 1,000 head of cattle—the amount of data generated can be overwhelming.

To organize and exploit it, a relatively new science called bioinformatics has gained importance in the past decade.

"We use computers and software to make genomic comparisons, to tell us where the differences exist, so we can relate that to other characteristics, such as milk production and feed efficiency," says **Paul Stothard**, a biologist specializing in bioinformatics and genomics in the Department of AFNS.

Knowing the connections between genomic traits and animal characteristics then allows scientists to develop specific DNA tests that allow producers to breed animals efficiently and inexpensively, he says.

"Before the use of DNA testing, selective breeding was done on the basis of the observable characteristics of an animal or its close relatives."

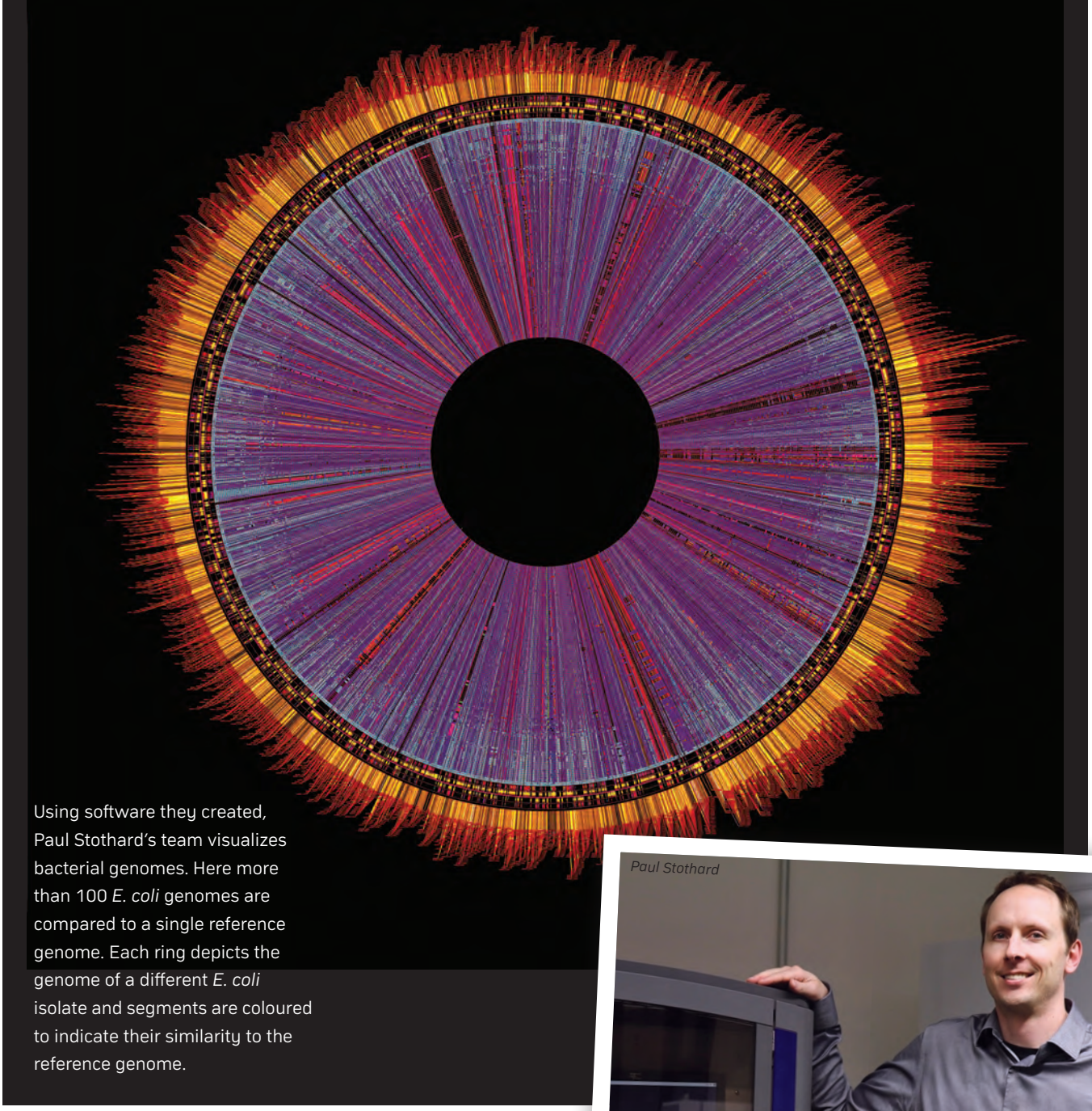
"But sometimes the physical characteristics of an animal can't tell you everything you want to know, or it's a trait that's difficult to observe, such as milk production—dairy bulls carry those genes but they are only expressed in their daughters."

The development of a DNA test begins with collecting DNA samples from enough animals with information on the trait of interest recorded. Genome sequencing is then performed, and the resulting data analyzed to first find the differences in the DNA sequences, and then to correlate those differences with the trait. Additional work can then be done to verify the influence of specific DNA sites on phenotype (observable characteristics).

Livestock production creates tremendous opportunities for identifying the genes and DNA differences that affect traits because a great deal of information on animal phenotypes has been collected, says Stothard.

"A lot of other researchers in AFNS have embarked on large-scale projects involving the use of DNA sequencing. Bioinformatics is an important part of all of these studies, and we contribute in any way we can."

Already, in collaboration with Stothard,



Using software they created, Paul Stothard's team visualizes bacterial genomes. Here more than 100 *E. coli* genomes are compared to a single reference genome. Each ring depicts the genome of a different *E. coli* isolate and segments are coloured to indicate their similarity to the reference genome.

Paul Stothard

the department's researchers have created genetic tests to increase hybrid vigour in cattle, and have identified new genes that govern immune response and feed processing.

Stothard's skills in bioinformatics are also in demand elsewhere. Collaborating with a researcher in biological sciences, he is characterizing the genomes of bacteriophages (viruses that infect bacteria). With researchers in the School of Public Health, he is identifying microorganisms present in treated waste water, to understand the risks associated with waste water reuse.

The software tools he and his team create are also shared with the world's research community.

"They are used by hundreds of people daily and have been cited in thousands of studies. So that's another impact of our work. DNA is the common thread across all these studies and it applies to everything, from viruses to bacteria, invertebrates to mammals to plants." ■

DNA: the molecules that make up the genes found inside the cells of an organism

Genome: an organism's total set of genes

Genome sequencing: reading the order of the DNA's building blocks (called nucleotides) in order to learn about the specific functions of individual genes or to identify faulty genes

DAIRY RESEARCHER TAKES LEAD IN 'NEW ERA OF BIOLOGICAL SCIENCE'

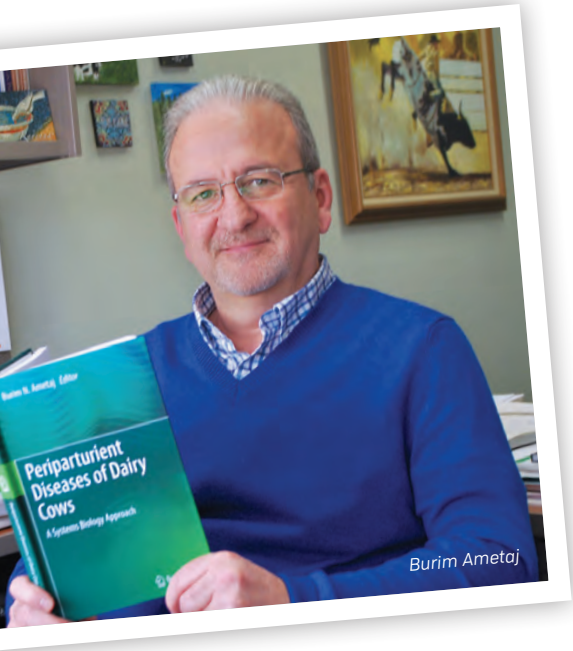
Book is first to apply systems biology to animal health

Half of all dairy cows in the world are culled from their herds each year because they are prone to several diseases just after they calve.

But an AFNS dairy researcher believes a relatively new multi-pronged approach in science—called systems biology—could help solve these health issues.

In his new book, he uses a systems biology approach to summarize current knowledge about diseases in dairy cows.

Systems biology looks at the interactions among many different elements of a system, such as those related to genes, proteins or metabolites. The approach is ideal for dairy cow research because there is so much new knowledge available about post-calving diseases that scientists need a new method to study and interpret how it all fits together, says **Burim Ametaj**, a professor of animal physiology and immunology.



"There is a new group of sciences called the 'omic' sciences, as well as bioinformatics and even math and physics, which we need to use in our research approach to better understand those diseases," says Ametaj.

The "omics" sciences include genomics, transcriptomics, proteomics and metabolomics—the study of genes, RNA molecules, proteins and metabolites, respectively. Each of these sciences has benefited in the last decade from more advanced instrumentation that allows researchers to study the "big picture" instead of just focusing on one isolated element, says Ametaj.

Yet, he says, a systems biology approach requires even more than just 'omics' sciences, which are an inventory of all genes, mRNA molecules, proteins and metabolites of a cell or an entire animal body.

That inventory does not help understand disease, he says. Instead, scientists need to look at interactions among all those elements to go to the roots of causes and develop new prevention strategies. A systems biology approach to disease is quite different than a traditional approach, he says.

"Until now, in biological science we have used a reductionist approach or philosophy to studying disease process, taking a few components (a gene, protein or metabolite) of a cell or an organ and studying them in isolation from the entire organism.

"But today, with more sophisticated instruments, we can measure, for example, more than 4,000 metabolites, 25,000 genes and the same number of proteins. If we can measure their interactions with each other, we will be able to unfold the reason why cows become sick, and develop early treatments that can prevent the disease from occurring."

Ametaj says there needs to be a more sophisticated way of studying diseases. "We need to create teams of scientists that include biologists, animal health scientists, biostatisticians, computer scientists, physicists, mathematicians and others. We need a new approach, from multiple angles, multiple layers, multiple sciences and instruments."

The book brings together current knowledge about the most common diseases that affect dairy cows after birth. These include metritis, mastitis, laminitis, ketosis, retained placenta, rumen acidosis, milk fever (infections of the metabolism, the uterus, mammary glands, hooves, placenta, stomachs and vaginal tract) as well as gastrointestinal microbiota and immunity. It also discusses several myths that have been established during the last century in the animal health sciences, and the need to revisit those and develop new paradigms.

Additionally, every one of the book's authors (drawn from AFNS' dairy group, elsewhere in Canada, the United States, the United Kingdom and Italy) pose important questions designed to trigger new research that would involve multiple sciences.

"We cannot solve dairy cow problems with just one or two sciences," says Ametaj. "The entire biological sciences are changing. It's a new era."

Periparturient Diseases of Dairy Cows: A Systems Biology Approach is published as a hardcover and an ebook by Springer International Publishing. ■

DID YOU KNOW ...

The Banff Pork Seminar and Western Canadian Dairy Seminar each carry international cachet

Two of the world's largest agriculture seminars—one about pork, the other about dairy—were founded by the University of Alberta's Department of Agricultural, Food and Nutritional Science, together with Alberta industry and government. Both have been built into the premier global gatherings for producers, researchers, government and industry representatives.

Banff Pork Seminar

The Banff Pork Seminar, which has taken place every January since 1972, is a not-to-be-missed information exchange that attracts more than 700 attendees from North America, South America, Europe and Asia. It attracts the pork value chain's top players, and is renowned for its comprehensive coverage of topical research and news.

"A good example of that happened in 2014, when there was a major outbreak of porcine epidemic diarrhea that took place just as the conference was happening," says **Michael Dyck**, one of the event's co-organizers and an animal science professor in the department of AFNS.

"Because we had all the experts there already, we held a roundtable discussion where anyone could ask questions. As a result, during a major crisis we were able to get ahead of, and on top of, the issue right away. It demonstrates that we have all the right expertise there—essentially all the industry represented—and it speaks to the networking and transfer of knowledge that we do."

Two on-site awards place innovation in the spotlight. The Dr. F.X. Aherne Prize for Innovative Pork Production is an opportunity for anyone who has developed a relevant technology innovation to present it and vie for a prize valued at $2,000.

The R.O. Ball Young Scientist Award invites abstracts from both undergraduate and graduate students, with the top four selected to present their work during a breakout session. The top two are chosen for their overall combination of good and relevant science, a well-written abstract and excellent presentation, and are awarded prizes of $500 and $250 each.

Western Canadian Dairy Seminar

The Western Canadian Dairy Seminar, which has occurred each March since 1983 in Red Deer, hosts discussions on the most current research and compelling issues of the Canadian dairy industry.

It draws more than 800 delegates from around the world who are keen to improve their decision-making abilities in dairy production and management. Each year, topics presented range from nutrition and reproduction to dairy policy and other challenges.

In addition to four days of seminars from international researchers focused on solutions, there are ample openings for one-on-one discussions between speakers and participants, and for informal contact with sponsors at the 75-booth trade show.

For 47 and 37 years respectively, the conferences have increased and fostered the connections between the Department of Agricultural, Food and Nutritional Science and its community, says **Ruurd Zijlstra**, chair of the department.

"Each conference has an advisory committee with rotating external members who keep the program fresh, an excellent conference co-ordinator to organize the event, and sponsorship to keep registration fees down for our stakeholders. We're proud to be involved in these flagship events." ■

ALUMNI PROFILE

"I use the scientific knowledge I have to explain why technicians are, or are not, seeing results, so they aren't relying on trial and error."

PAULO ROBERTO DE OLIVEIRA CARNEIRO '16 MSc Animal Science

CURRENT POSITION

Breeder and hatchery analyst, Maple Leaf Foods, Wetaskawin

JOB DESCRIPTION

I am the link between the hatchery and the Alberta egg-hatching producers for Maple Leaf. I help the producers achieve more production and performance out of their birds, while also providing them with answers whenever they have any problems with the flock, like poor hatching, hairline cracks in eggs or dirty eggs.

JOB DUTIES

I work closely with the quality assurance technician and then report back to the producer. I offer advice on when to add new males to the barn, on the light schedule (how to photo-stimulate the birds and bring them into production) and how to decrease the number of defective eggs. I use the scientific knowledge I have to explain why technicians are, or are not, seeing results, so they aren't relying on trial and error.

THE VALUE OF MY EDUCATION IN AFNS

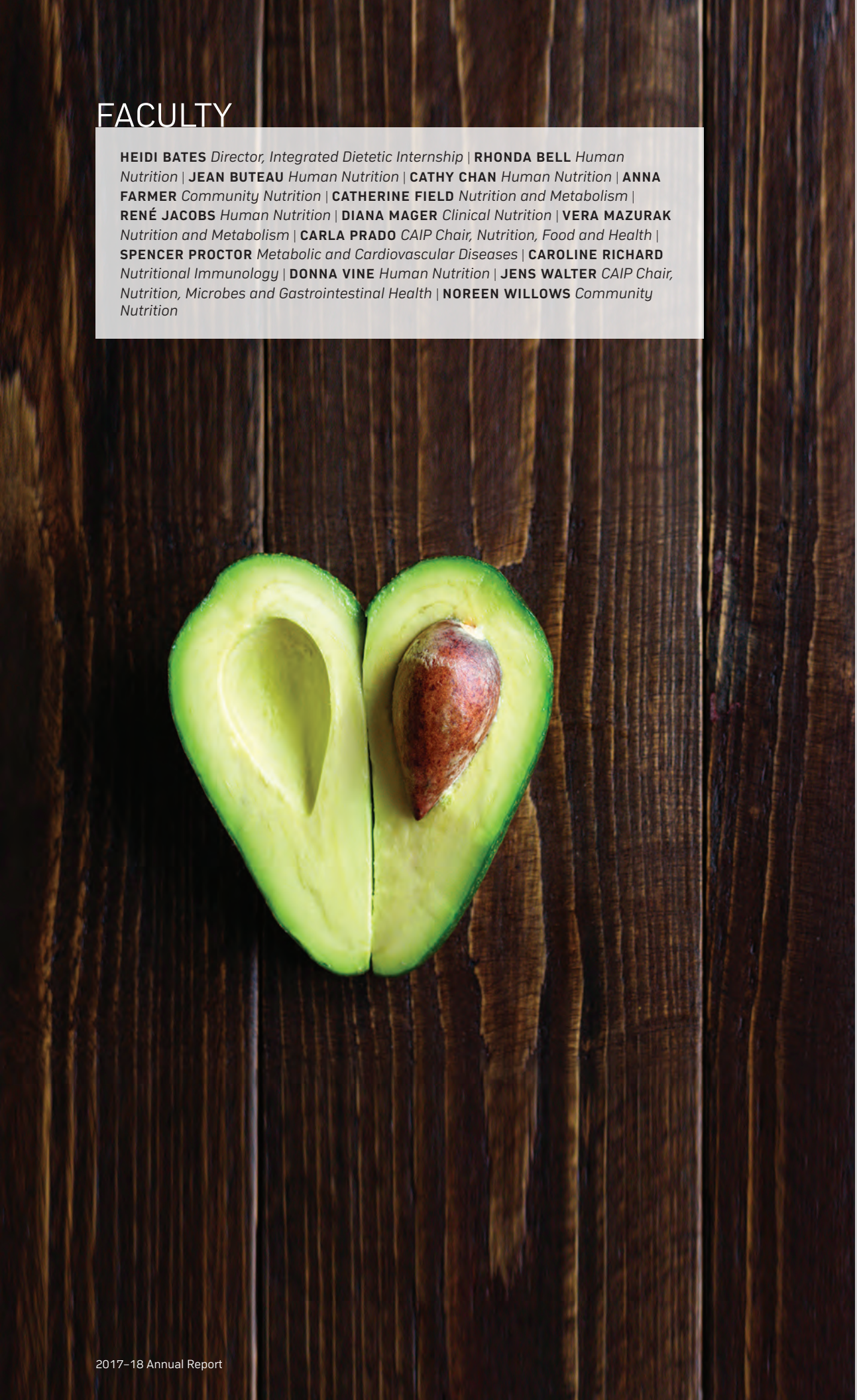
I learned a lot about bird behaviour and data management. Poultry expert Martin Zuidhof is exceptional in data management, especially in working with very large data sets. Usually, as a student, one does a small trial, working with about 100 entries. His precision feeding system inputs data every 15 seconds, so one ends up with more than one or two million entries.

My education is helping me on an industry level to provide feedback on how to collect data in the hatchery, how to filter it and analyze it, to make sure we have a bank of data that is good, so we can compare producers. How to manage big data sets was the most helpful thing I got from my master's here. ■

HUMAN NUTRITION

FACULTY

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** *Nutritional Immunology* | **DONNA VINE** *Human Nutrition* | **JENS WALTER** *CAIP Chair, Nutrition, Microbes and Gastrointestinal Health* | **NOREEN WILLOWS** *Community Nutrition*



NO MAGIC PILL FOR POSTPARTUM WEIGHT LOSS

Breastfeeding to aid weight loss is a myth, nutrition researchers find


Rhonda Bell

Women lose weight and experience changes to their body composition in highly individual ways after giving birth, and breastfeeding does not correlate to weight loss, nutritional science researchers have found.

In a study that tracked postpartum weight loss, body composition and energy expenditure postpartum in 50 women, participants experienced one of four body composition changes in the nine months postpartum:

- Gained fat, gained lean muscle
- Gained fat, lost lean muscle
- Lost fat, gained lean muscle
- Lost fat, lost lean muscle

"The findings suggest losing baby weight will occur differently for every woman and she will need to adapt her weight loss strategy as needed," says **Rhonda Bell**, who conducted the study with department of AFNS colleagues **Carla Prado** and professor emerita **Linda McCargar**.

A common misconception is that breastfeeding mobilizes fat to return to a pre-pregnancy fat distribution and body weight. This was not borne out, says Bell.

"Our research shows weight loss and fat loss aren't as simple as just breastfeeding after giving birth. All the women lost weight, but their body compositions were all over the map," she says.

Previous studies have found that roughly half of all women in developed countries gain weight in excess of Health Canada's recommended total weight gain for women during their pregnancy, which for women of average weight is between 25 and 35 pounds. Those who start pregnancy with a body mass index over 25 are more likely to experience high weight gain.

"The excess weight increases the risk of health complications for baby and mom, and makes it more likely that women will keep some of that weight after they deliver," says Bell.

Strategies she recommends include, "cutting out unnecessary calories, adding in physical activity and taking a view toward an extended timeline."

The study is one of many under UAlberta's ENRICH research program looking at how to support healthy pregnancy across diverse groups of women. ■

5 FACTS ABOUT MY RESEARCH ...

ON DIET AND IMMUNE SYSTEMS

with **Caroline Richard**, nutritional immunologist

1. What is your research about?

I want to understand how certain diets or food components can improve the immune system impairment associated with obesity.

2. Why does obesity impair the immune system?

Inflammation is now recognized as an emerging cardiovascular risk factor. We measure inflammation by the body's levels of C-reactive protein, or CRP. A higher CRP increases the risk of mortality by cardiovascular disease.

When one gains weight, cells produce more of the inflammatory molecules that increase CRP. With obesity, there is an increase in inflammation and when one looks at the immune systems of these individuals, they have impaired immune function. Plus, they have metabolic complications (such as Type 2 diabetes or insulin resistance), which further impair the immune system.

3. Isn't the easiest fix just to lose weight?

Past research has focused on weight loss. But weight loss is hard—and hard to sustain. So we need other alternatives. It's better to focus on changing small things in diet, things you can maintain, that will improve the immune system.

4. What are you proposing?

There are specific components found in food that we know improve the immune system in animal models, but haven't been proven in humans yet. For instance, choline, an essential nutrient found in high concentration in eggs, has some beneficial effect on the animal immune system.

But when a patient has Type 2 diabetes and is overweight, there has been a concern about the cholesterol in eggs. We just published a systematic review on the impact of egg consumption on cardiovascular disease risk factors in individuals with Type 2 diabetes. We showed that there is basically no effect when you consume eggs as part of a healthy diet. So if my hypothesis is right, and eggs can actually improve the immune system in humans as well, then maybe we were wrong all along about restricting egg intake in individuals with Type 2 diabetes. Maybe eating eggs can improve or normalize their immune system.

5. Why is it so important to improve our immune system function?

If you look at the death rate in Canada, one third of people will die from cardiovascular disease and one third will die from cancer. When we think of the immune system, the most obvious connection is to infectious diseases. But most people don't know that the immune system is involved in cardiovascular disease, too. In all three of these diseases—cancer, cardiovascular and infectious diseases—the immune system is involved. ■

ALUMNI PROFILE

"I had so many opportunities to learn beyond the classroom. "

KAREEMA BATAL '14 BSc
Nutrition and Food Science

CURRENT POSITIONS

Employment case manager at Lives in Transition and co-founder of Neo Juicery, an organic juicing company.

HOW HER EDUCATION APPLIES

Lives in Transition helps clients who have fled domestic violence and are preparing themselves for employment. I do teaching and mentoring, but I also started a collective kitchen and a food literacy program in which we cook, learn about food and have in-class workshops about nutrition.

WHY IS NUTRITION KNOWLEDGE SO USEFUL IN THIS JOB?

It's important for the clients to learn to sustain themselves and their families as they move into situations where they are single moms, often with more than one child. Being well-nourished is part of being healthy. So how can they get the best bang for their buck, and how can they make healthy lunches for school and for work?

The community kitchen draws their attention in a different way. First, they learn to make foods that they sell to fundraise. They learn kitchen skills, teamwork and delegation. Then they use the funds for a second collective kitchen to make food for themselves. And food really does bring people together. We can get them talking about all kinds of topics, so we are looking at their healing, not only financially, but in managing stress and coping with challenges.

WHAT IS YOUR SIDE-BUSINESS ABOUT?

We make cold-pressed juice and deliver it to customers' doors. So many people navigate directly to supplements. I want to provide something easy and convenient and bio-available (the ease and predictability of a substance to be absorbed and used by the body.) Cold-pressed juice is one of the easiest ways to consume something that's fresh, delicious and full of vitamins and nutrients.

HOW DID AFNS HELP YOU BUILD THESE CAREERS?

I had so many opportunities to learn beyond the classroom. I was the president of the Nutrition and Food Science Student Association, and that gave me the opportunity to take on a leadership role, to learn about setting goals as well as teamwork and problem solving. ■

FOOD SCIENCE AND BIORESOURCE TECHNOLOGY

FACULTY

MARLENY ARANDA-SALDAÑA *Food/Bio Engineering Processing* | **MIRKO BETTI** *Muscle Food Science and Processing* | **DAVID BRESSLER** *Fermentation and Bio/Food Engineering* | **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 Engneering* | **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*

CATTLE DELAYED A WEEKEND BEFORE SLAUGHTER PRODUCE LOWER GRADE MEAT


Heather Bruce

Stress of multiple loading and unloading events may be to blame

When cattle arrive at a slaughterhouse on a Friday but are held for processing until Monday, they have an increased incidence of tough, low-grade meat, new research says.

"It can happen if there are too many cattle and there's a backup, or if there's a plant breakdown," says **Heather Bruce**, an associate professor of carcass and meat science in the Department of Agricultural, Food and Nutritional Science.

"They are held over the weekend at a strange feedlot and are stressed by repeatedly being loaded and unloaded into a truck and by eating strange feed. The sustained stress of as many as six loadings and unloadings depletes the glycogen in the muscle—they run out of gas."

The result is "dark cutting beef," which is a blackish-purple colour instead of bright red. It is less appealing to consumers, is less flavourful and subsequently reduces the price of the meat by as much as 30 per cent, says Bruce.

Instead of becoming high-priced cuts of beef, it is ground into hamburger or sold to institutional kitchens.

Bruce and fellow researchers found that while only one-to-two per cent of slaughtered cattle in Western Canada produce dark cutting beef, as much as 40 per cent of a load can be affected.

"So it's not a large or expensive problem for the whole industry, but it is when it's your truckload of cattle; 40 per cent of your cattle can lose 30 per cent of their value," she says.

The issue is more acute in the West than the East because transportation distances are longer on the Prairies, the winters are harsher (which depletes the cattle's energy) and the abattoirs in the West tend to handle larger volumes, creating bigger backups when delays occur.

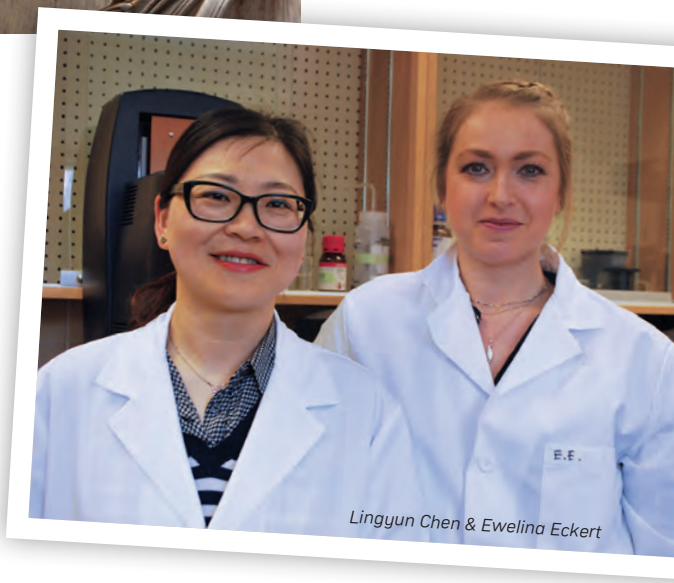
While the practice of weekend delays is overwhelmingly associated with dark cutting beef, the researchers found that an array of other factors also contribute.

Animals' energies can be depleted through steroid use because the glycogen is directed to muscle growth instead of held in reserve, and certain diets can give animals upset stomachs that cause them to eat less. As well, female cattle seem more prone than steers to cut dark, although why is not clear. Yet heifers (young female cows) weighing more than 550 kg had a reduced incidence.

"What has confounded solving this problem is that different populations of cattle are at risk under different circumstances," says Bruce.

"There are many points at which the animals can be stressed, which means monitoring has to occur at the farm, on the truck and at the abattoir. It's an industry problem, not just a producer problem."

The research was funded by Agriculture and Agri-Food Canada, the Beef Cattle Research Council and the Alberta Beef Producers. ■



Lingyun Chen & Ewelina Eckert

LENTILS CAN REPLACE EGGS AND MILK IN BAKING

Plant-based protein is low in fat and cholesterol

Researchers in the AFNS kitchen have whipped up angel food cake and muffins as light and fluffy as bakers expect, using lentil protein powder instead of eggs and milk.

The trial goodies were a hit with taste-testers.

"They liked it, especially the muffins," says food scientist **Lingyun Chen**, a professor and Canada Research Chair in the Department of Agricultural, Food and Nutritional Science. In multiple tests that featured angel food cake and muffins containing either eggs and milk or varying amounts of lentil protein, tasters reported that there was little to no difference in taste and texture.

Chen and her team were able to bake muffins using nothing but lentil protein, and cut egg and milk content to half in angel food cake—the fussiest of cakes to bake from scratch. They chose it deliberately for its difficulty factor, to give the lentil product a tough test.

"If this can make an angel food cake successful, it can make many other products too," says Chen.

The study revealed that powdered lentil—resembling flour—produces the same foaming reaction and air bubbles in batter as eggs and milk, which is what gives good baking a soft, springy texture.

The discovery—resulting from Chen's ongoing research program with plant-based proteins—means that the food-processing industry can now start using the ingredient. She predicts home bakers will be able to reach for lentil protein on store shelves within two to three years, adding to choices such as chickpea flour.

Lentils and other pulse plants appeal to health-conscious shoppers by providing high-protein foods low in fat and cholesterol. The crops also offer more stable pricing for processors than animal-based commodities like eggs, which tend to fluctuate in price, Chen says.

The findings were published in the *International Journal of Food Science and Technology*. ■

5 FACTS ABOUT MY RESEARCH ...

TO ENHANCE FOOD SAFETY AND SUSTAINABILITY

with **Roopesh Mohandas Syamaladevi**, food safety engineering researcher


Roopesh Mohandas Syamaladevi

1. What is your research focused on?

My research lab is testing the potential of advanced, sustainable technologies to improve food and water quality, and safety. Two of those technologies are atmospheric non-thermal plasma and high-intensity pulsed LED treatments.

2. In layman's language, what do each of those technologies do?

Atmospheric non-thermal plasma is a highly energized form of any gas, containing a number of reactive components at low temperature and atmospheric pressure. These reactive components can kill microorganisms. We utilize this quality of non-thermal plasma to kill bad bacteria and mould in food, water, and on surfaces.

In high-intensity pulsed LED treatments we basically use light energy to kill microorganisms in food, water and food-contact surfaces. We use specialized high-power LEDs to produce light of certain wavelengths.

3. What are the main challenges with these technologies?

We are exploring possibilities to use these technologies for a variety of applications including dry food processing, meat product safety and water treatment. These technologies are new and more research is required to take them to the next level, i.e., scale-up. There is much to understand on the efficiency of these technologies for different applications and the various factors affecting the treatment efficiency, so it will take time to determine optimized industrial solutions.

4. What will this research allow us to do immediately, and where could it potentially lead in the future?

We anticipate that our research and the research around the world will eventually lead to scale-up of these technologies. We are focusing on a few applications of these technologies, such as for dry food safety (pet foods, nuts, flours, spices, etc.), water treatment and meat product safety. We hope our research will be useful to identify important factors determining the efficacy of these technologies, so the food industry in Canada can eventually use these technologies to treat their products.

5. Why is improved food safety so important?

In Alberta, the agri-food industry is the second-largest manufacturing sector and very competitive. Ensuring food safety and sustainability is very important to the advancement of agri-food industries in the development of value-added products and in providing safe and nutritious food for consumers. To improve food safety and sustainability—food production that uses techniques that protect human and animal health, as well as the environment—development of advanced, green and sustainable technologies is essential. ■

ALUMNI PROFILE

ASHLEY MICHIELIN ’16 BSc
Food Science and Technology

CURRENT POSITION

Quality microbiology specialist, Labatt Breweries of Canada (Edmonton).

JOB DUTIES

I am responsible for testing everything from the water to the finished packaged beer for microbial contamination. So, from the starting point through the whole brewing process: the fermented beer, the yeast, the filter and then the packaged beer that goes into cans and bottles. I run anywhere from 20 to 40 different samples a day. It is a really good mix of being out on my feet and problem solving.

HOW I LANDED THIS JOB

Prior to being in ALES, I was in the Faculty of Science where I earned a degree in microbiology. But there are not many entry-level jobs you can get with that; it’s mostly research. My decision to pair that with a food science and technology degree is what really allowed me to get this job. In ALES, I was in the internship program, and through that I got an internship as an entry-level lab technician at Labatt, testing the overall beer for a summer, then staying on part time during my last year of school and working again the following the summer. Then this opportunity opened up.

THE CHALLENGES

I’m not an engineer, but I’m working with many kinds of equipment—cleaning devices, tanks, industrial-sized packaging lines—because you have to understand it to be able to fix it.

HOW MY ALES EDUCATION PREPARED ME

We learned a lot around food quality and HACCP (Hazard Analysis Critical Control Points), and that’s stuff I use everyday.

We learned where any kind of food hazards could arise and what is done to control them. As part of the course, we also went out to food producers to talk to them, to see their plants and then write up a plan for them. There were two of those visits that were term-long projects and you learn so much there that is good to have as base knowledge. I know what all the acronyms mean, and when people are talking about them quickly I don’t have to stop and think about it. ■

“In ALES, I was in the internship program, and through that I got an internship as an entry-level lab technician at Labatt. ”

DEPARTMENT HIGHLIGHTS

Sasha van der Klein

POULTRY PHD STUDENT EARNS PRESTIGIOUS VANIER SCHOLARSHIP

As a child, poultry researcher **Sasha van der Klein** didn't beg her parents for a puppy, but for pet chickens. By eventually fulfilling her request, her parents put her solidly on the path that has led to a Vanier Scholarship, Canada's most prestigious award for PhD students.

Van der Klein's award is one of 10 Vaniers earned by University of Alberta students for 2017, and the only one for the Department of Agricultural, Food and Nutritional Science, where she is studying under the supervision of **Martin Zuidhof**, an expert in poultry precision feeding.

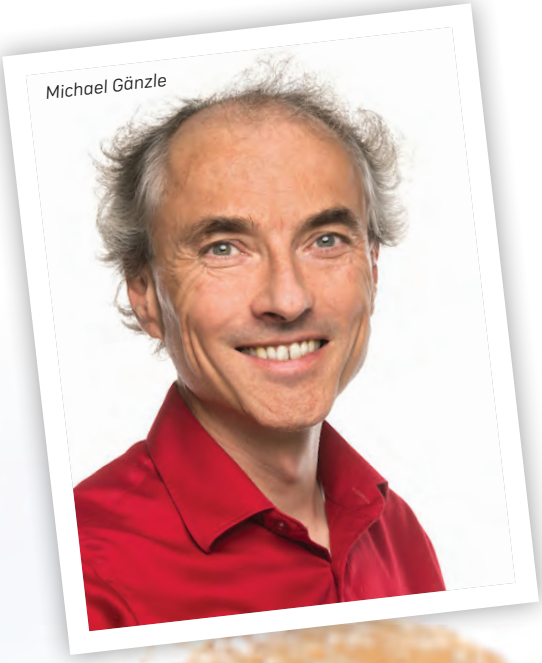
Her thesis is investigating how day length during the rearing period of broiler breeders and controlling their body weight affects their reproductive success and nesting behaviour.

Vanier Scholarships are worth $50,000 per year for three years and are difficult to attain because selection criteria includes not just a student's academic excellence and the research potential of their project, but also the leadership the students demonstrate in their community or academic life.

Although van der Klein is an international student who moved from the Netherlands to pursue her PhD at the University of Alberta, she quickly became immersed in assisting with complex student affairs on campus. She is currently the president of the Graduate Students' Association, which is negotiating a new collective agreement for graduate students with the institution. For two years previously she was its vice-president of labour, assisting graduate students with compliance issues in their research or teaching assistant contracts. ■

MAKING FOOD SAFE AND TASTY WITH FEWER CHEMICALS

Canada Research Chair's goals align with consumers' desires


Michael Gänzle

Michael Gänzle studies food fermentations—how they affect the quality and nutritional properties of food, as well as its safety.

"You could call that hamburger science," says Gänzle, a food microbiologist in the Department of Agricultural, Food and Nutritional Science, "because my research relates to the quality of the bun as well as the safety of the patty."

To satisfy today's consumers, the food industry faces the problem of replacing food additives and antibiotics that have been working extremely well for decades, says Gänzle. "And it's not so easy to replace them."

As the Canada Research Chair in Food Microbiology and Probiotics, Gänzle will tackle those challenges by focusing on two core areas.

One area of study involves replacing additives and antibiotics in food production through food fermentation and intestinal lactic acid bacteria. For instance, fermentation with lactic acid bacteria allows salt to be replaced in bread, while still maintaining bread's popular taste and freshness.

Gänzle is also researching the conversion of phenolic acids by lactobacilli. Phenolic acids are found naturally in plants as a defense compound. Gänzle's goal is to understand how fermentation with lactic acid bacteria can increase the availability and activity of these compounds, and then to use the compounds to replace chemical preservatives in ready-to-eat foods without negatively affecting taste.

"The answer to that will lead to applications for food safety," he says. "Subsequently, I plan to extend the area to understand how bacterial metabolism of phenolic compounds impacts human health." ■

TWO ALES RESEARCHERS RECEIVE TEC INNOVATION AWARDS FOR THEIR PATENTS


Clover Bench

Clover Bench, an animal behaviouralist, and **Feral Temelli**, a food engineer renowned for her work in supercritical fluid technology, have each been honoured by business accelerator TEC Edmonton for ingenious technologies they invented that have been transferred from the lab to the world.

Bench created, along with adjunct professor **Al Schaefer**, an apparatus and method that automatically collects and interprets non-invasive infrared images from one or more animals at a time, to predict their health, growth or reproductive state using both thermal and behavioural biometrics.

The technology simultaneously enables scientists to gather large amounts of radiated heat and behaviour information from animals in short periods of time, for a variety of applications that can be customized for the species and the setting, says Bench.

"From a behaviour science standpoint it has opened up a whole new way of approaching animal behaviour, by using the unique attributes of the infrared camera to capture the subtle movements of an animal that cannot be observed easily using standard visual-based methods," Bench says.

Temelli's patent is for generating micro- and nano-sized particles and fibres from biopolymers (biodegradable molecular structures) so that they can be used to impregnate a bioactive component and/or encapsulate a bioactive component with biopolymers.

"Our new technology overcomes the challenges associated with conventional techniques for drying of high molecular weight biopolymers and creates new opportunities for ingredients to deliver bioactive components, targeting a variety of applications," says Temelli. ■


Feral Temelli

Masahito Oba

DAIRY RESEARCHER HONOURED INTERNATIONALLY

In 2017, animal science researcher **Masahito Oba** won two international awards from his peers for his work on the nutritional management of dairy cattle.

Oba's research program studies how to combat subacute ruminal acidosis (which can reduce the weights, milk production and health of herds), how to manage calf nutrition during weaning and calving transitions, and how to evaluate barley grain, silage and byproduct feedstuffs.

The American Dairy Science Association awarded him the "Nutrition Professionals Inc. Applied Dairy Nutrition Award", and the Canadian and American Societies of Animal Science jointly bestowed their award for "Excellence in Nutrition and Meat Sciences".

"Awards from international scientific societies such as the ADSA are an important recognition for the excellence of professors in the areas of teaching, research and/or service," says **Ruurd Zijlstra**, chair of Oba's home department, the Department of Agricultural, Food and Nutritional Science. ■

NUTRITION AND FOOD SCIENCE STUDENTS HELP PREP ASTRONAUTS' FOOD

Canadian Space Agency picks ALES students for prestigious internship, two years running

For the second year in a row, a top nutrition and food science student trained at the University of Alberta is the intern developing the foods eaten by Canadian astronauts on the International Space Station.

Tanya Mireault, who is in her last year of nutrition and food science in the Faculty of Agricultural, Life and Environmental Sciences, has completed a one-year post as space food and nutrition intern at the Canadian Space Agency. **Hope Kurylo**, a fellow undergrad in the same program, started her one-year internship at the agency's headquarters outside of Montreal in September 2017.

The agency chose two ALES students over those from several other institutions because of their broad education plus the work experience in food science and nutrition they accumulated while earning their degrees, says **Natalie Hirsch**, a project officer in operational space medicine at the Canadian Space Agency.

"They had completed a range of courses in nutrition and food science, with both theoretical and practical and laboratory components, that are relevant to providing food in space—in particular food safety and quality assurance, and fundamentals of nutrition," says Hirsch.

For Mireault, the internship was a one-of-a-kind job experience.

"You don't realize how many different moving components are involved in such a large project as sending astronauts up to the ISS, so it's been incredible to see all the small details and the collaboration going on," she says.

"That will benefit me greatly in terms of future employment, having a handle on working on such a massive project."

For Kurylo, "it's hard to express how exciting this is. It's amazing to be part of this experience, and I'm looking forward to continuing the work that Tanya started."

Mireault started by setting up a testing lab to prepare a "crew-specific" menu for Canadian astronaut David Saint-Jacques, whose flight is scheduled for November 2018. Crew-specific menus are one of three categories of food eaten aboard the space station, and consist of a limited quantity of items requested by the astronauts themselves.

The other two categories include the basic menu of breakfast, lunch and dinner supplied by NASA (the National Aeronautics and Space Administration, one of five participating space agencies at the space station), and crew packages. The latter are put together by the astronauts' families, who often insert favourite snacks or sentimental items.

Mireault sourced commercially produced versions of the items Saint-Jacques requested, and then ensured they met all the criteria for going into space.

"They have to have a shelf life of 18 months because there isn't any refrigeration on the ISS," she says. "They can't be fragile or crumbly or too liquidy, because that can cause quite an issue in micro-gravity. They have to have a relatively low sodium factor, because they eat a lot of dehydrated food and high sodium can cause issues with calcium absorption and increases the risk of kidney stones."

Astronauts must be able to consume the food right out of its container, and because human sense of taste is weakened in space, Mireault chose foods that are extra flavourful here on Earth.

"With no gravity, a lot of fluid builds up that can plug the nostrils and that ultimately leads to decreased taste," says Mireault.

She also tested how plastic or hydrofoil packs are warmed in a conductive oven, as is done on the space station.

Another important responsibility Mireault held was sitting in for her supervisor a number of times, as the Canadian Space Agency's representative during teleconference calls with the European Space Agency, and those of Russia and Japan. In those calls, team members discuss food nutrition and update each other on their project's progress.

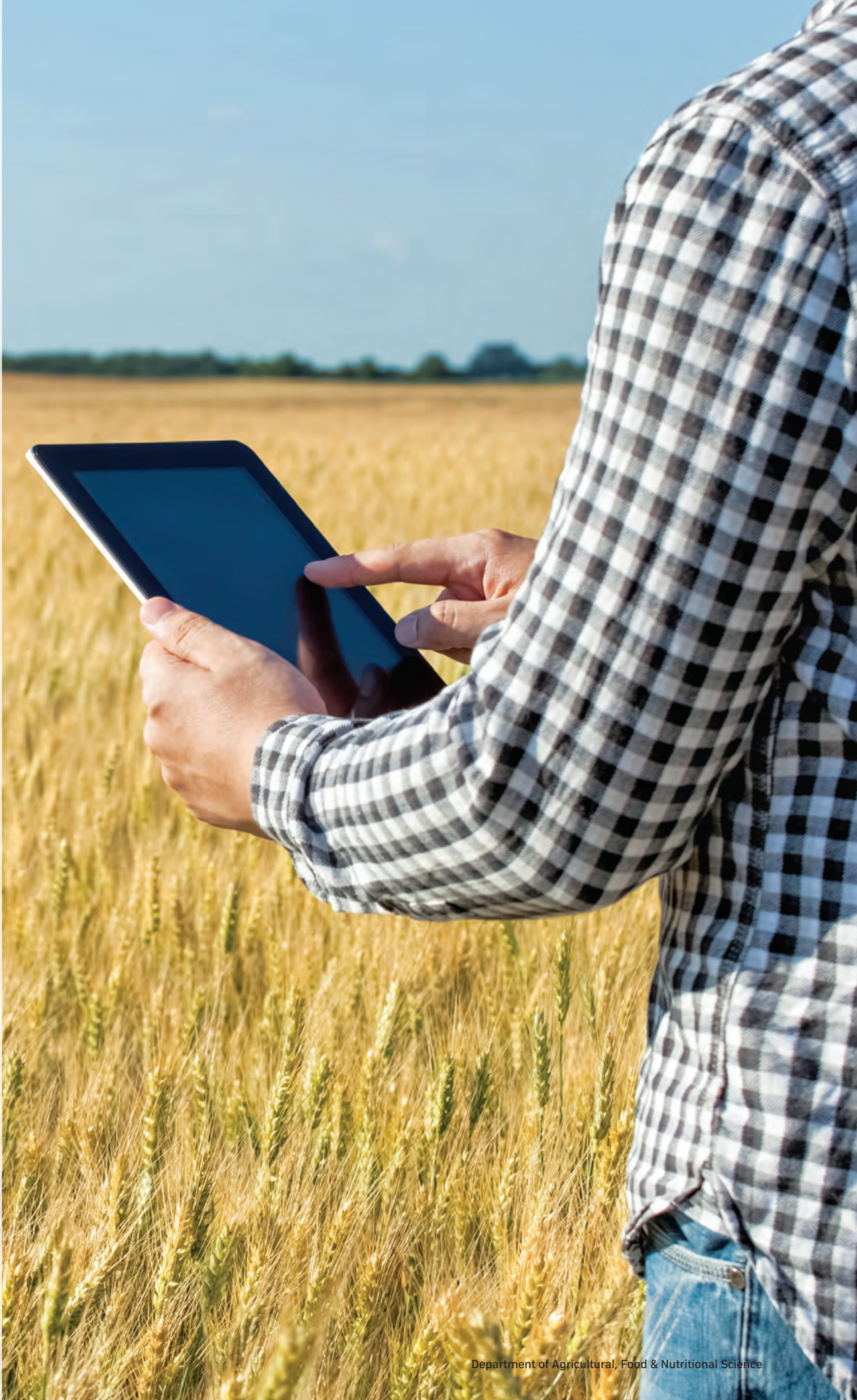
Now that Mireault has finished prepping Saint-Jacques' menu (which included requests for smoked salmon and maple syrup, and special patés meant to be shared with astronauts from other countries), Kurylo will be responsible for the paperwork.

She will document that all of the Canadian Space Agency supplementary foods meet NASA guidelines and can pass through customs without issue, and flag those that are problematic. In the lab, she will be optimizing the water-to-dehydration ratio of foods.

"Our program was tailored for these kinds of jobs," says Kurylo. ■

> "Our program was tailored for these kinds of jobs."
>
> *– Hope Kurylo, nutrition and food science student and current intern at the Canadian Space Agency*

FACTS & FIGURES



PARTNERS AND FUNDERS 2017–18

Acadian Seaplants Limited

Agriculture and Agri-Food Canada

Agriculture Funding Consortium:

- Alberta Barley Commission
- Alberta Canola Producers Commission
- Alberta Chicken Producers
- Alberta Crop Industry Development Fund
- Alberta Innovates-Bio Solutions
- Alberta Agriculture and Forestry
- Alberta Milk
- Alberta Pulse Growers Commission
- Alberta Wheat Commission
- Egg Farmers of Alberta
- Western Grains Research Foundation

Alberta Biodiversity Monitoring Institute

Alberta Hatching Egg Producers

Alberta Health Services

Alberta Innovate

Alberta Pork

Alberta Turkey Producers

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BC Dairy Association

Beef Cattle Research Council

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Saskatchewan Milk Marketing Board

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Saskatchewan Wheat Development Commission

Saskatoon Colostrum Company Ltd

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Syngenta Canada Inc.

Teagasc – Agriculture and Food Development Authority

The State of Queensland - DSITI

University of Calgary

University - Dalhousie

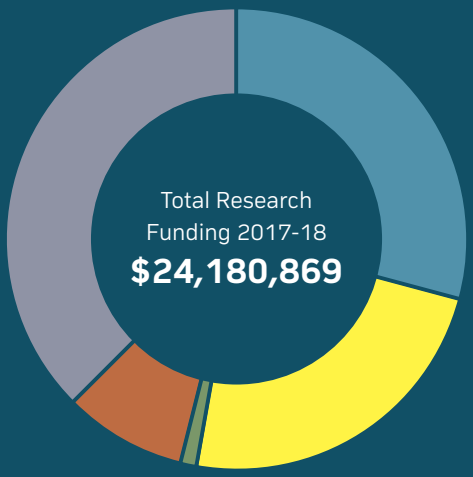
University - Iowa State

Western Economic Diversification

Westgen

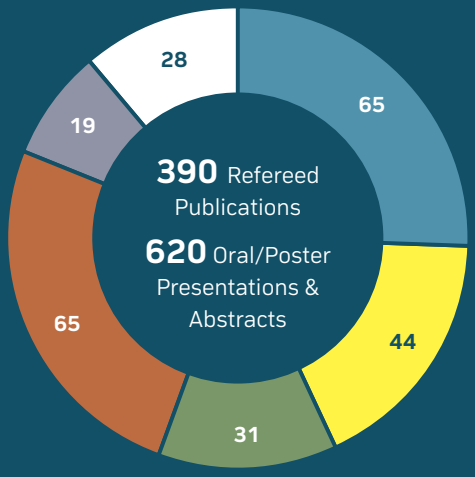
BY THE NUMBERS

RESEARCH FUNDING



Alberta Provincial Government	$	7,076,209
Federal Government	$	5,743,068
Other Government	$	277,350
Industry	$	2,061,357
Other	$	9,022,884

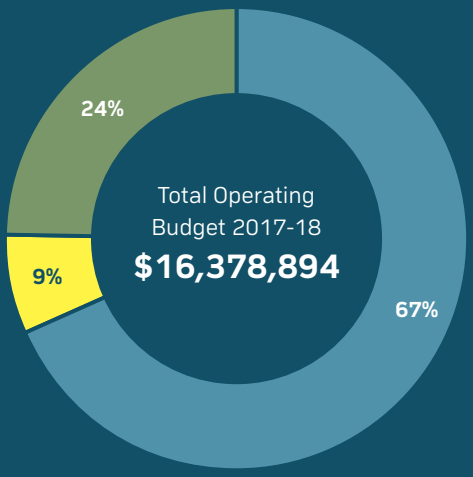
ACADEMIC STAFF



- Professors*
- Adjunct Professors
- Professor Emeriti
- Post-Doctoral Fellows
- Research Associates
- Visiting Scientists/Students

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

OPERATING BUDGET

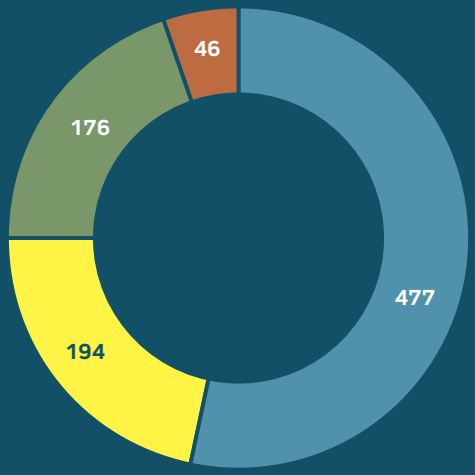


- Academic, Administrative and Teaching Support
- Central Laboratories
- Research Stations

TECHNOLOGY TRANSFER

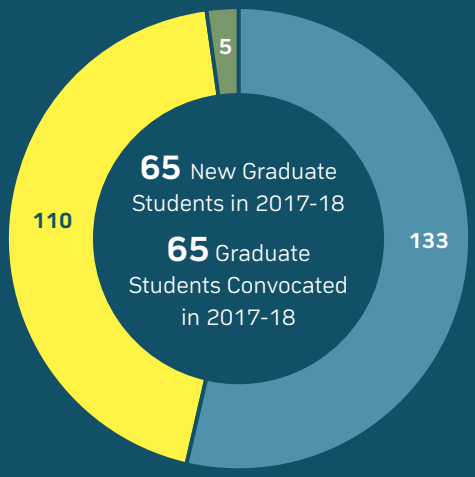
09	Commercial Agreements (Licenses and Options)
02	Technologies with Patent Protection Initiated
05	Report of Inventions Reported
17	Technologies Received Investment by TEC Edmonton, Inventors, etc.
24	Material Transfer Agreements

UNDERGRADUATE STUDENT ENROLLMENT



- BSc in Nutrition and Food Science
- BSc in Animal Health
- BSc in Agriculture
- BSc in Agriculture/Food Business Management

GRADUATE STUDENT ENROLLMENT



- Doctoral Students
- Masters Students
- Visiting Students

CENTRAL LABORATORIES

- Agri-Food Material Science Unit
- Agriculture Genomics and Proteomics Unit
- Food Science Facilities
- Nutrition & Metabolism Facilities
- Human Nutrition Research Unit
- Plant Growth 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 & 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 Ranch

UNIVERSITY OF ALBERTA
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FOOD & NUTRITIONAL SCIENCE

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