USASK COLLEGE OF AGRICULTURE AND BIORESOURCES MAGAZINE 2024

AGKNOWLEDGE

A new way to farm: Precision agriculture redefines research and technology

UNIVERSITY OF SASKATCHEWAN
College of Agriculture and Bioresources
AGBIO.USASK.CA

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USask • College of Agriculture and Bioresources • 2024

Cover photo: Precision agriculture redefines research and technology. See page 15 for story.

Photography by Matt Braden Photo

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We acknowledge we are on Treaty 6 Territory and the Homeland of the Métis. We pay our respect to the First Nation and Métis ancestors of this place and reaffirm our relationship with one another.

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DEAN'S MESSAGE

This has been an exciting year for the College of Agriculture and Bioresources!

Although we have had many retirements over the past couple of years, we have welcomed a few new faces over the last year and have several new faculty searches underway, so our readers can look forward to learning more about how we are growing our expertise to better serve our community in the months and years to come.

The recruitments underway include a cluster hire in the area of sustainable and digital agriculture. To help pique your interest, check out the feature on some of our current work in the article on digital agriculture.

Digital agriculture is an area where interdisciplinarity is essential, bringing together strengths in agriculture, engineering and computer science. The bridging of these disciplines is increasingly important in crop breeding as well, by integrating genotyping, digital phenotyping, and data mining techniques together to develop new breeding strategies, like you'll read about in the article on ACTIVATE, a project funded by Genome Canada.

The college is also building on its interdisciplinary strengths in Food and Bioproducts Sciences, which has important crossovers into human health – check out the work of Morgan Fleming, one of our outstanding graduate students and recipient of the prestigious Vanier Scholarship, as well as the work looking at options for replacing animal fats with plant-based oils in processed meats.

Our scientists continue to push the boundaries of their disciplines, and are being recognized nationally and internationally, as you'll see when you read about the work happening in the Poultry Centre.

Dr. Angela Bedard-Haughn (PhD)

Photography by David Stobbe

Likewise, our alumni continue to impress and amaze us with the work they are doing in their communities, like Tyson Buyer (BSA, DVM) who has started a bovine reproduction centre, Hillary Kyplain (BSc RRM) who's a conservation coordinator at Métis-Nation Saskatchewan, and Mike Solohub (BSA, MSc) and Colleen Christensen (PhD) who have enjoyed successful careers with their AgBio backgrounds and are already planning on how they can give back to the college.

The AgBio community is filled with enthusiastic, passionate people – Agknowledge is a way for us to share the stories of our students, faculty, staff, and alumni and the impact they are having, locally and globally.

I sincerely hope that you enjoy reading these stories as much as we enjoy having all of you as part of our community!

– Dean Angela Bedard-Haughn

YEAR IN REVIEW 2023-24

Rooted in history since 1912, the College of Agriculture and Bioresources is growing the future.

1,738
Students

1,401
Undergrad

337
Graduate

326
Staff

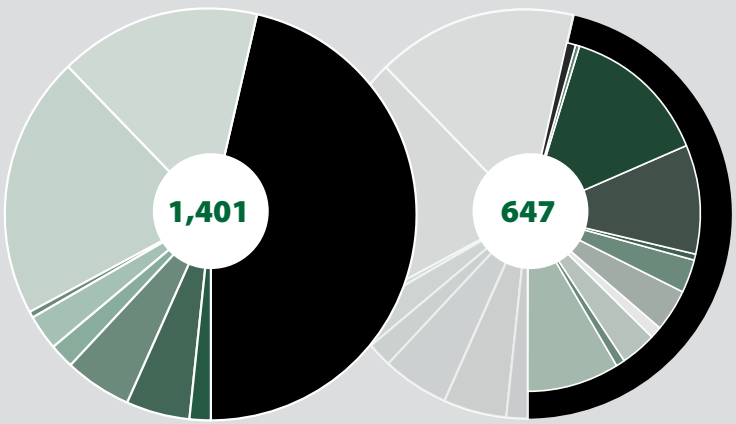
75
Faculty

$87.6 million
New awarded research funding

$1.6 million
Scholarships, bursaries, awards

Undergraduate students *by program*

- Bachelor of Science, Agriculture **647**
- Bachelor of Science, Agribusiness **224**
- Bachelor of Science, Animal Bioscience **290**
- Bachelor of Science, Food Industry Management **3**
- Bachelor of Science, Food and Nutrition **39**
- Bachelor of Science, Renewable Resource Management **29**
- Diploma in Agribusiness **73**
- Diploma in Agronomy **71**
- Kanawayihetaytan Askiy Program **25**



Bachelor of Science, Agriculture students *by major*

- Agricultural Biology **10**
- Agricultural Economics **6**
- Agronomy **193**
- Animal Science **140**
- Applied Plant Ecology **10**
- Crop Science **41**
- Environmental Science **54**
- Food and Bioproduct Sciences **14**
- Horticulture Science **47**
- Soil Science **14**
- Undeclared **118**

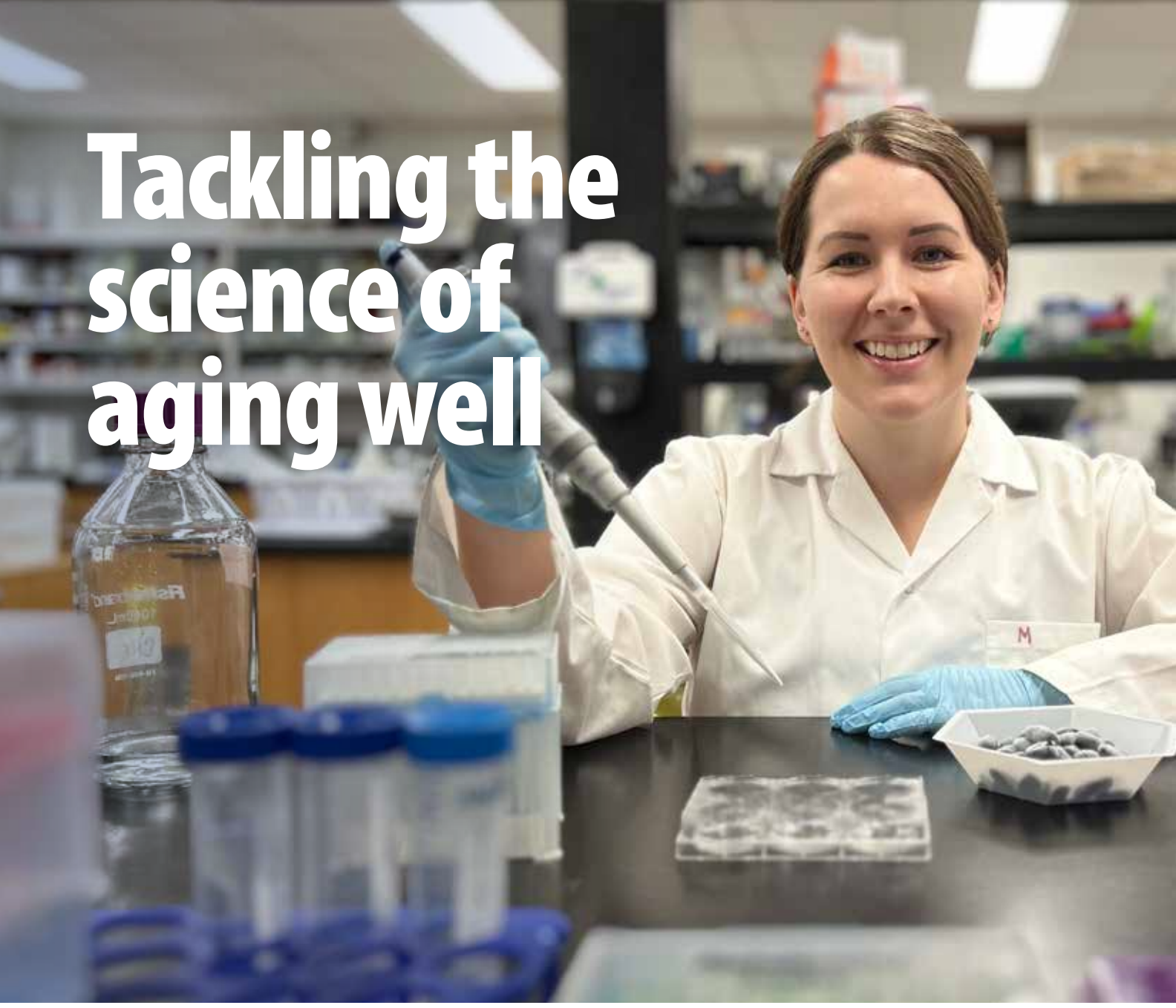
Prairie Horticulture Certificate

113
Students

November 2024 marks the 30th anniversary of the Prairie Horticulture Certificate! The certificate was created in response to student demand for a home-study program with plant and course material that more closely reflected the prairie environment.

30th
Anniversary

Tackling the science of aging well



JANE CAULFIELD

USask PhD student and Vanier Scholar Morgan Fleming is exploring how a component of plant-based foods might help you live longer.

Maintaining a balanced, healthy diet is one way to delay and manage age-related diseases, such as some cancers as well as cardiovascular and neurodegenerative diseases. But knowing exactly what kinds of foods to eat and, more importantly, how those foods can target specific issues at the cellular level, will help our overall ability to manage the challenges of aging.

"It seems like at least on a yearly basis we hear about friends or family being diagnosed with age-related diseases, and my work can contribute to a body of knowledge that can delay that for everyone," said Fleming, a graduate student in USask's College of Agriculture and Bioresources. Fleming is researching phenolic compounds – a well-known component of plant-based foods that can help people live longer, healthier lives.

Known to support heart health, decrease the negative impacts of diabetes, and have anti-inflammatory properties, there are more than 10,000 structurally different phenolic compounds identified in nature to date. Previous research has postulated that different phenolic compounds can work together synergistically to further

Morgan Fleming
Photography by Kira Glasscock

promote human health, but exactly how they do that is not well understood. That's where Fleming's research journey begins.

"We know that phenolic compounds are good for us. They are antioxidants, which means that they help protect us from damaging molecules," she said. "We have an opportunity to learn more about how phenolic compounds can do more for humans in regard to impacts on cellular processes and regulating health and disease."

Working under the supervision of professor emeritus Dr. Nicholas Low (PhD) and Dr. Christopher Eskiw (PhD) in the Department of Food and Bioproduct Sciences, Fleming is cultivating human skin cell samples and treating them with specific combinations of phenolic compounds derived from Haskap berries – bred and grown at USask – to analyse their potential benefit.

"I am really enjoying the process of being a PhD student," she said. "There is an abundance of resources that the college provides to ensure success. Not only with academic support but also with our mental health, finding balance between work and life, building community and much more."

Providing opportunities for future scientists

The 2024/25 academic year will be the second year in a row that Fleming has won the Natural Sciences and Engineering Research Council of Canada (NSERC) Indigenous Student Ambassador grant, which aims to promote interest and participation in the natural sciences and engineering within Indigenous communities and schools across Canada.

As a Métis citizen, Fleming said that being an Indigenous Student Ambassador is about finding ways to inspire Indigenous youth to think about a future career in science, technology, engineering and math (STEM) disciplines.

"I think it's really important to show young students what options are available to them in the sciences," Fleming said. "Food science is one of the lesser-known areas, but it's so cool and so relevant to everyone's everyday life."

Last year, in consultation with her lab mates and her supervisors, Fleming developed a day full of hands-on activities and experiments for Grade 7 and 8 students from Chief Whitecap School in Saskatoon. Throughout the day, students were able to learn about food science topics such as cross-contamination, the Maillard reaction, and vitamin C titration in the Agriculture Building in a food science undergraduate teaching laboratory.

"When I was in elementary and middle school, what really got me interested in the sciences were similar kinds of interactive activities, so that's what I am trying to do with the kids I work with," she said. "But when I started university and I learned more about the different kinds of careers available, I moved away from basic nutrition and immersed myself into the science of food."

Fleming said she first applied for the grant, which provides recipients with $5,000 to help fund various outreach initiatives, when she learned that there was a lack of Indigenous students in the Department of Food and Bioproduct Sciences.

"In Canada, only about two per cent of people employed in STEM are Indigenous. I want to try and change those numbers," she said.

A lifetime of learning ahead

Being a PhD student takes a lot of time and energy, much of which is fueled by coffee, Fleming confesses. But her dedication to her work is powered by more than that – she is driven by a desire to help improve the quality of life for as many people as possible. And it's that kind of passion that helped her win the prestigious Vanier Scholarship.

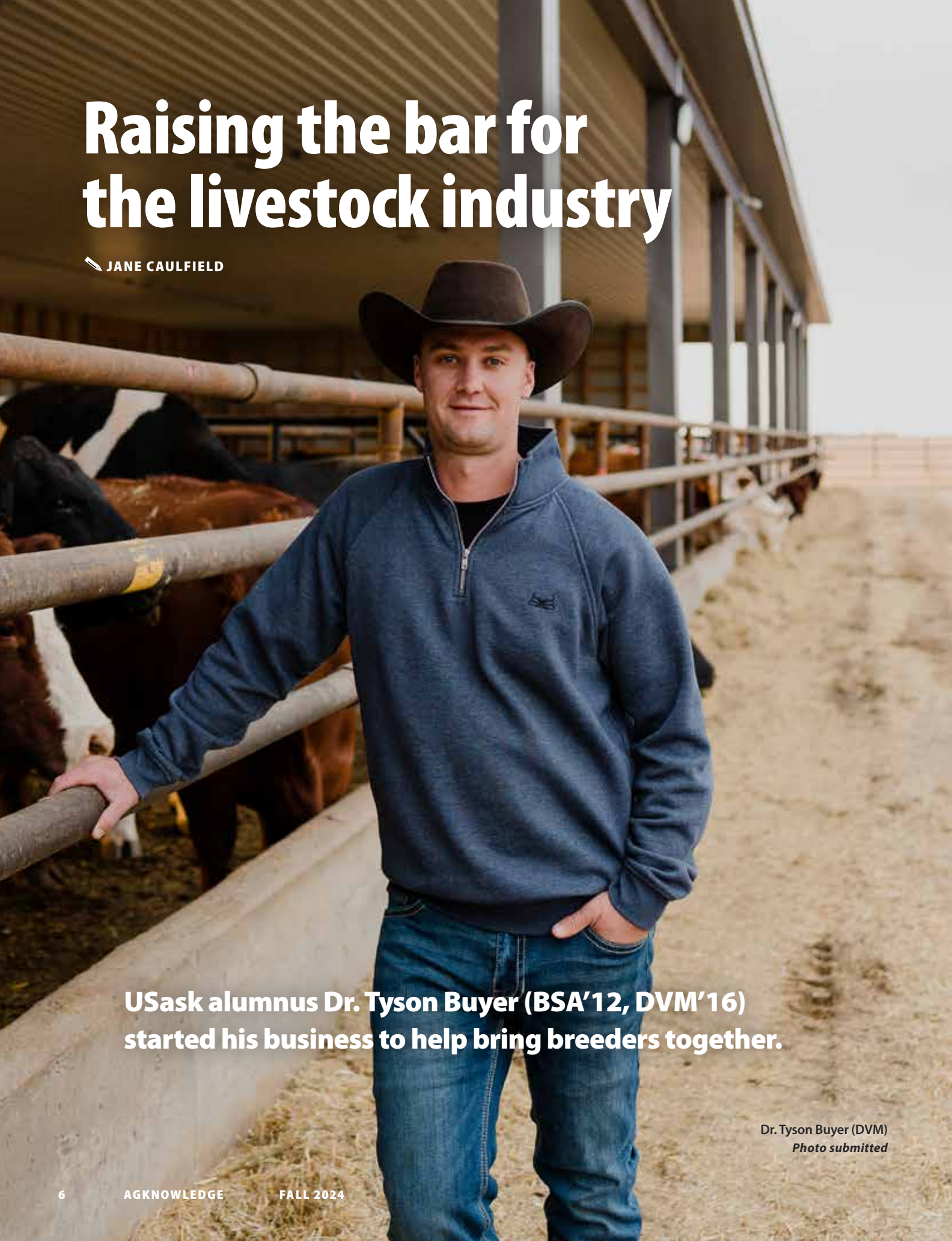
"It's very motivating to know that I have people believing in the research and outreach work I am doing," she said. "This means I will have an opportunity to engage with more high-quality research because the funding is not as limited."

Jointly administered by the Canadian Institutes of Health Research (CIHR), the Social Sciences and Humanities Research Council (SSHRC) and NSERC, the Vanier Scholarship provides recipients with $50,000 per year of doctoral-level study. It is awarded to a select few students across Canada who demonstrate academic excellence, research potential, and exceptional leadership in their chosen field of study.

Raising the bar for the livestock industry

JANE CAULFIELD

USask alumnus Dr. Tyson Buyer (BSA'12, DVM'16) started his business to help bring breeders together.



Dr. Tyson Buyer (DVM)
Photo submitted

The practice and concepts behind sustainable agriculture might conjure ideas and images of eco-friendly field management, farms running on solar power, or crops specifically bred to adapt to changing climates.

For those hard at work raising cattle and developing Canada's beef and dairy industries, sustainable practice is vital. And it's why Dr. Tyson Buyer (DVM) started a business to help producers advance their herds through assisted reproductive technologies.

"We focus on producing top quality animals that will ultimately perform better in their environment," Buyer said. "We focus on feed efficient animals that will gain more pounds of meat from fewer pounds of feed. Our goal is to produce these animals in conjunction with seed stock producers to then market to the commercial producer for a terminal cross to end up in the feedyard."

Raised on a beef farm in Carbon, Alta., and later in Carnduff, Sask., Buyer has always been interested in large animal sciences. He completed a Bachelor of Science in Agriculture from the College of Agriculture and Bioresources at the University of Saskatchewan (USask) in 2012, where he started to turn his interest into a career. In 2016 he earned a Doctor of Veterinary Medicine (DVM) from the Western College of Veterinary Medicine (WCVM) at USask, and shortly thereafter he started a large animal veterinary practice in Carnduff. In 2021, Buyer moved his practice and family from Carnduff to Moose Jaw where he became part owner of Peak Veterinary Health, specializing in herd medicine and farm animal reproduction.

Earlier this year, Buyer and his wife Ashley set out to turn their interest and knowledge about bovine reproduction into a business and opened BoviGen Genetic Services. The state-of-the-art facility, located just outside of Moose Jaw, provides a range of services designed to help ensure a robust industry and sets out to assist animal producers in both the buying and selling of genetics. The business offers producers with a range of services including, but not limited to, embryo transfer, invitro fertilization, and donor housing.

"We specialize in bovine in vitro fertilization and our goal is to help producers advance their herds through assisted reproductive technologies," he said. "Our business allows producers to propagate the genetics of their most valuable animals at a very rapid rate. Through in vitro fertilization we can vastly shorten the time needed to develop new traits, allowing producers to make genetic progress at a faster rate."

BoviGen offers producers with the ability to sell genetics through an exclusive online marketplace. It also carefully selects genetic materials to enhance fertility, improve calving ease, and improve feed efficiency – all of which help increase overall producer profits. Their team of experts is comprised of skilled technicians, reproduction specialists, and herdsmen to ensure that each animal is well cared for.

"Our goals are to expand into the international semen distribution market," said Buyer. "We are currently shipping worldwide but we'd like to expand that market into more countries. Our goals are to start using more technologies to develop animals that have better feed efficiency, which we can then market."

Getting a start at USask

Buyer is driven to ensure that the future of the industry that he loves so much is bright. From keenly understanding the specific needs and demands to watching market trends, Buyer said his motivation to succeed first started when he was attending classes at the College of Agriculture and Bioresources.

"I took an animal science degree in which I enjoyed the upper-level classes the most, including cow calf management and feedlot management," he said. "The area I'm in is fairly niche, and wasn't exposed to it a lot in university but my experience and the entire environment at USask put the drive in me to do more or expect more out of myself. It also gave me the background knowledge and foundation to start a career with a solid base."

While his area of expertise is not something many students consider as a career option, Buyer said that his journey could have been very different if he didn't first earn his BSA.

"Being in such a niche market there has been a lot of self-learning over the years, but my education gave me the foundation to start with and build on," he said. "The professors at the university have been instrumental in my learning post-university. They also still make themselves available for questions, or debate, even after all these years of being out."

Dr. Tyson Buyer with his family.
Photo submitted

" ...my experience and the entire environment at USask put the drive in me to do more or expect more out of myself."

DR. TYSON BUYER (DVM)

Buyer also made some lifelong friendships and connections that continue to help elevate him in his career.

"The connections that I made at university are lifelong and I still to this day have colleagues and friends that I attended university with," he said. "I really enjoyed my time at USask. The networking and social atmosphere is one you'll never be able to find anywhere else."

An outsider's perspective

USask professor brings fresh approach to economics research and teaching.

DELANEY SEIFERLING

Dr. Peter Slade (PhD) is surprised at where he ended up in life.

"If you told me at age 20 that I'd be an agricultural economist in Saskatchewan, I probably wouldn't even know what that was," said Slade, an associate professor in the College of Agriculture and Bioresources at the University of Saskatchewan (USask).

But here he is – not only teaching the next generation of producers and industry stakeholders the importance of economics to agricultural operations, but also leading research to help industry participants and governments make better decisions for their policies, programs and business activities.

How did he get here? A simple shift.

After completing his undergraduate degree in business and economics at Memorial University in Newfoundland, where he grew up, Slade went on to study agricultural economics and international development, thinking he would work in international development.

But through his thesis research, comparing the productivity and efficiency of dairy farms in Canada and the United States, he became enthralled with agricultural economics and the world of academia.

"Through the coursework and interacting with faculty and others in the profession, I just really came to enjoy research, economics and working in the agricultural industry," he said.

And now, after almost 10 years in his current position in the Department of Agricultural and Resource Economics at USask, he has found his 'outsider' status to be valuable, offering new perspectives within a rapidly changing industry aiming to position itself for sustainable growth.

One of these perspectives has particularly informed his approach to teaching; positioning economics as a central tool for decision-making and strategy.

"The students here are really engaged in agricultural issues, very motivated to learn things that they think are going to be relevant to their careers," he said.

"The trick of teaching is to make everything practical and very relevant to what students think that they're going to be doing as farm managers or as people working in the agricultural industry."

He has also carried out this approach in one of the main focuses of his research, aimed at understanding the effect of the Canadian government's long-standing suite of business risk management (BRM) programs, including the crop insurance program (AgriInsurance), on farm efficiency, profitability and decision-making.

Given the importance of these billion-dollar programs, designed to safeguard farmers against income and production losses, this work has garnered much attention and has been used to inform many industry opinions on the topic.

In 2020, Slade presented to the federal Standing Committee on Agriculture and Agri-Food on the outcomes of his research looking at the effectiveness of BRMs in meeting their set objectives, making recommendations for improvements.

The following year, Slade was part of a task force to examine how BRMs can be optimized to help Canada meet its climate change goals.

He has also been appointed as the Canadian Canola Growers Association Agricultural Policy Chair, which aims to generate more research on agricultural policy of relevance to the canola sector.

Slade believes that BRMs are a valuable tool for carrying out policy changes, which means this type of work will only increase in importance.

Apart from policy, Slade's research has also aimed to help producers become more efficient and profitable in their farming operations.

Some of his ongoing work in this area is testing the wider effects of crop rotations across the province using field-level data and

Dr. Peter Slade (PhD)
Photography by Matt Braden Photo

satellite-derived yield estimates. Although it's early in the study, he says takeaways to date have driven home the idea that diversity is important to rotations and that pulse crops can be very beneficial.

"Pulse crops fix nitrogen in the soil, so in theory, you could get away with using less nitrogen in your subsequent crops."

The final focus of Slade's research is on helping the agriculture industry position itself to anticipate and meet emerging and growing consumer demands. Specifically, he has been involved in research aiming to understand just how much demand there is, and will be, for plant-based food products and ingredients, and how much of an impact this could have on meat and dairy industries.

For example, one study he was involved in a couple years ago found that, for every litre of plant-based milk sold, it reduced sales of dairy milk by half of a litre.

"So, half of the people who are buying it either didn't buy dairy milk before or they're using it in a different context, and half of it is a direct one-to-one replacement for dairy milk," he said.

Another of Slade's ongoing projects, examining consumer acceptance of cell-based meat (meat grown from animal cells rather than whole animals) and plant-based proteins, has yielded some interesting results.

"We found that women were more likely to prefer plant-based meat substitutes, but men were more likely to prefer lab-grown meats," he said.

Overall, Slade hopes that his work in this area will help the industry position itself to capitalize on the plant protein market, by understanding what is driving demand and consumer priorities.

"From the context of producers, the big opportunity for plant-based protein is still largely in export markets. But this is a growing area, and a lot of its success will come down to taste and price, by far the most important things to consumers. So, building a better burger, or whatever the product is, will certainly increase market share."

Going forward, he hopes his teaching and research work will help drive the sustainable growth of Saskatchewan's agriculture industry through effective policies, informed management practices, and sound economic projections and data.

And he plans to continue to use his outsider's perspective to inform his approaches.

"People who have spent their whole life in the industry have a lot of knowledge that I don't," he said. "But at the same time, poking around, asking some unexpected questions and approaching things from a slightly different lens provides you with a different perspective.

"I think that kind of outsider's point of view can be helpful."

Dr. Colleen Christensen (PhD) and Mike Solohub
Photography by Carey Shaw

COLLEEN MACPHERSON

Although still in the prime of their lives, Mike Solohub (BSc'88, BSA'92, MSc'97) and Dr. Colleen Christensen (BSc'93, PhD'99) have laid the groundwork to ensure they can support future generations of graduate students in the College of Agriculture and Bioresources at the University of Saskatchewan (USask).

The college alumni have arranged planned gifts in their wills that will establish annual scholarships in their names for domestic and international MSc and PhD students. The future awards, to be aligned with the annual domestic tuition fees of the day, are a nod to both their experiences at and connections to the college over the years, but also to the successful careers they've built from their university education.

"This planned gift is all kind of new for us," said Christensen. "We just put this together in the last few months, but we've been talking about it for a long time."

Solohub added they were both lucky to have benefited from scholarships while doing their graduate studies, and they both also know the financial pressures students face.

"When you're going through grad school, you're just so poor," said Christensen. "A scholarship could mean a student won't have to get a part-time job and can really focus on school."

The business of science

Christensen and Solohub, who met at a grad student mixer at the Kernen Crop Research Farm, are specific about the eligibility requirements for each scholarship. The Christensen award will go to a student in the Department of Animal and Poultry Science whose thesis work is directly relevant to the agricultural producers of Western Canada, a reflection of her own studies and career path.

Planned gift with deep roots in AgBio

"I was a farm kid from Young," she said. "My parents had a mixed farm, then moved to just dry-land agriculture so driving grain trucks became my specialty, but I really loved science."

Christensen's first degree was a BSc majoring in physiology. After a year teaching English in Japan, she secured a job as a technician at the Vaccine and Infectious Disease Organization (VIDO) on the USask campus "where I realized I really loved lab work."

Her experience at VIDO led her to the Department of Animal and Poultry Science where, after one year in a master's program, she was elevated to a PhD in animal physiology doing research on a vaccine for pigs designed to increase litter size. While the results were promising, the vaccine ultimately proved to be impractical for producers, "and I realized there are all kinds of science that never make it into the real world. I loved doing that PhD, but I wasn't sure how to put it all together to get a job."

It all came together while she was working at the college's Virtual College of Biotechnology and also taking classes for a business certificate.

"I realized science could be business," she said.

Christensen went on to serve as general manager of the Saskatchewan Colostrum Company, a spinoff from the Western College of Veterinary Medicine that collected and freeze-dried dairy colostrum for sale around the world.

From there, she moved to the Canadian Light Source (CLS) to help establish the Biomedical Imaging and Therapy Beamline before joining its business development unit to introduce agriculture companies to the possibilities of synchrotron science.

She returned to the college, to the Feeds Innovation Institute, to work on by-products from processes like biofuel production and oilseed crushing, which again made use of both her science and business skills. It was satisfying "to work with dozens of companies producing products out of our own western Canadian grains," she said.

Christensen again combines her scientific and business background in her current position as a research grant administrator working with agriculture companies in Saskatchewan.

From the ground up

For Solohub, soil has been at the heart of his studies and his career, so the scholarship in his name will go to a graduate student in the Department of Soil Science whose research is relevant to mapping, genesis, or fertility of soil.

Even as a young man growing up in Wynyard, Solohub knew he wanted a career that would take him outdoors. To that end, he completed his first undergraduate degree at USask in physical geography. After "bouncing around for a couple of years," he headed back to university, this time majoring in soil science, a discipline that complimented his geography training.

With his BSA in hand, Solohub spent a year in Calgary doing soil surveys as a contractor. It was there he learned two things: "I liked the college, and Calgary was too big." He returned to the university for a master's in precision agriculture at the Department of Soil Science, and stayed on to work in the department for six years. He spent another six years with the Centre for Hydrology in the Department of Geography before taking a position as a soil scientist with the consulting company contracted to undertake the pre-disturbance environmental impact assessment for the BHP Potash mine at Jansen, Sask.

It was then time "to strike out on my own" as a contractor. One of his main clients is Wood Buffalo Environmental Association in northern Alberta's Athabasca Basin. The organization is a non-profit coalition of communities, environmental groups, industry, government, Indigenous partners, and public stakeholders that, among other projects, monitors the effects of pollution on jack pine forests. Solohub brings his soils and hydrology skills to the work in the areas of environmental compliance and forest health.

Furthering his love of the outdoors, he has also worked for a couple of years doing high-elevation grasslands soil surveys for coal companies in British Columbia. It's a job with helicopters being the only way in and out.

Most of Solohub's work involves sophisticated instrumentation "but I also like digging holes and looking at soil." In fact, there's a photo in their home of him standing knee deep in a hole in an open field, decked out in hard hat and high-visibility vest, and being keenly observed by a semi-circle of cattle. His smile says it all about Solohub's love of soil and the outdoors.

Solohub and Christensen have deep roots in the college, having both spent about a dozen years there as students and employees, and their planned gift is a very personal way to give back. Solohub acknowledged that donations come in many forms "but the idea of being able to help out a student was most important to me."

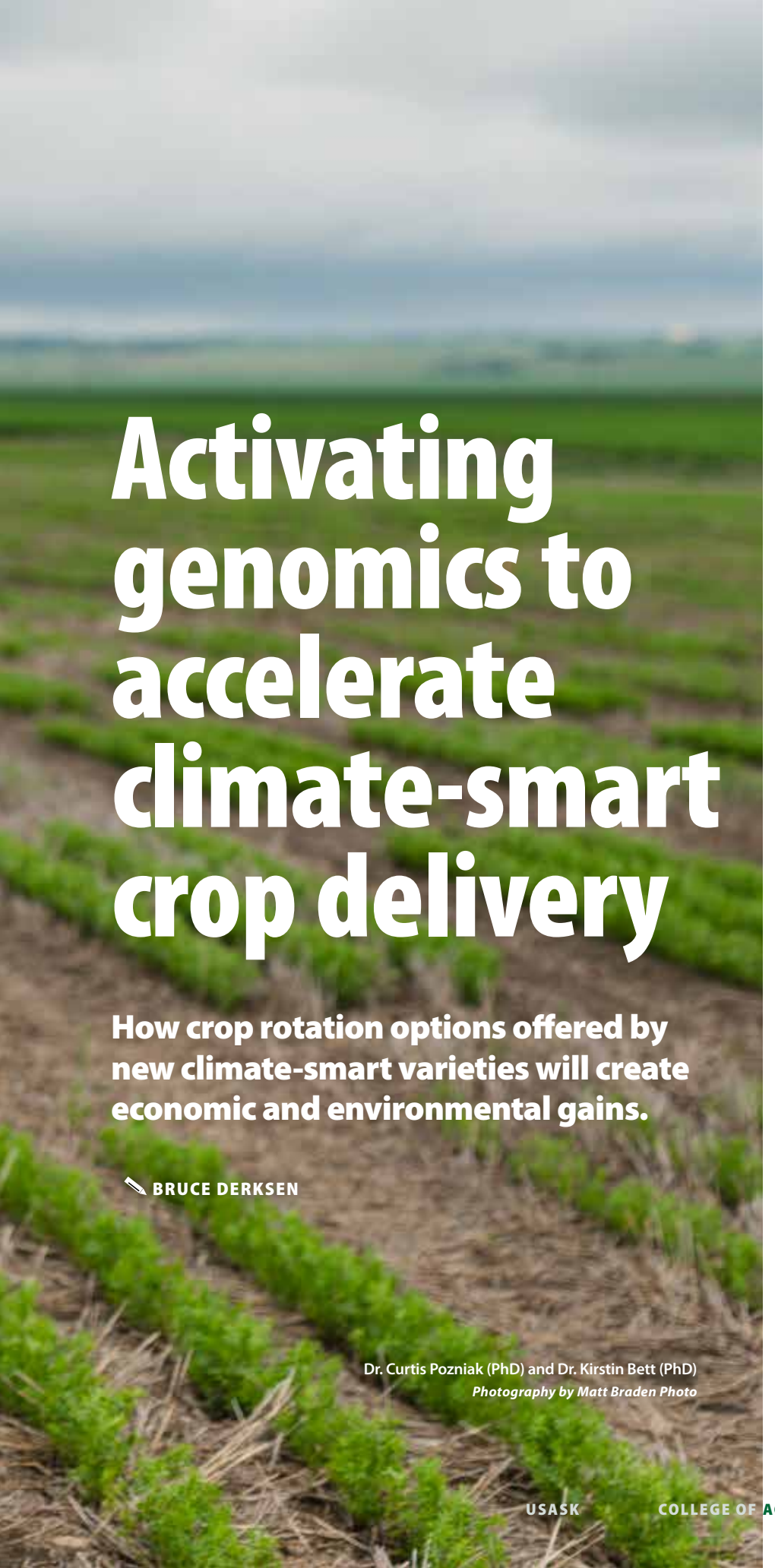
Christensen agreed.

"It was most important to me too," she said. "This could change someone's life."

Activating genomics to accelerate climate-smart crop delivery

How crop rotation options offered by new climate-smart varieties will create economic and environmental gains.

BRUCE DERKSEN



Dr. Curtis Pozniak (PhD) and Dr. Kirstin Bett (PhD)
Photography by Matt Braden Photo

The four-year (2023–2026) University of Saskatchewan (USask) ACTIVATE project was designed to contribute to Canada's greenhouse gas (GHG) reduction targets and develop new and improved climate-smart wheat and lentil cultivars and microbiomes. In combination, it also aims to improve on-farm crop-rotation management options.

New genomics-assisted plant crosses and the genomic strategies used to manage them will assist in reducing synthetic fertilizer use and provide substantial economic benefits to farmers when combined with optimized crop rotations.

The project's multi-species breeding strategy targets crosses to plant lines carrying genes, reducing losses resulting from soil nitrogen cycling and microbiome interactions. Their integration, especially in lentil-wheat crop rotations, ensures less nitrogen is lost and more remains available.

The ACTIVATE team of GHG, microbiome, and socio-economic experts, plus numerous graduate students, are led by USask researchers in the College of Agriculture and Bioresources (AgBio), Dr. Kirstin Bett (PhD) in the Department of Plant Sciences, and Dr. Curtis Pozniak (PhD), director of the Crop Development Centre (CDC). Both researchers offer extensive experience and expertise in pulse and cereal crop research.

Nearly half the $6.15-million project value is coming from Genome Canada with matching funds contributed by the Saskatchewan Pulse Growers, Saskatchewan Wheat Development Commission, Manitoba Crop Alliance, Alberta's Results Driven Agricultural Research, Western Grains Research Foundation, and Saskatchewan's Agriculture Development Fund.

Field trials are being meticulously managed, a prerequisite for the delicate experiment's success.

The nitrogen fixation premise

Bett and Pozniak focused on nitrogen and crop rotations designed to confirm a lentils-to-wheat transition gain.

"The real premise behind the project is to determine how to maximize producer productivity and yield while reducing nitrogen losses from production systems," said Pozniak. "We're verifying what lentil varieties do well in producing nitrogen for durum and which durum varieties take optimal advantage."

"Pulses are known for their nitrogen-fixing abilities so we're confident of reducing synthetic nitrogen while letting inoculants

Dr. Kirstin Bett (PhD) inspects crop with students involved with the ACTIVATE project.
Photography by Matt Braden Photo

work to their capacity," said Bett. "We want to access the underlying genetics to assess how nitrogen is transferred from a pulse to a cereal, plus manage it efficiently along with the soil microbiome."

The pattern of specific durum varieties benefiting from nitrogen fixation in the previous pulse crop is inherent to individual plant genetics. Using current genomic technologies, genome sequencing can begin with precise experiments identifying the genome parts responsible for improved fixation and uptake.

"Once we gain this genomic fingerprint, we can start selecting more efficiently for this signature in our breeding programs," Pozniak said.

Hitting the ground running for a larger proof-of-concept

The project's intent is early proof of concept regarding breeding for crop rotations. Using lentils and durum wheat made sense as plenty of genomic information representing 20 years of work was already available.

Traditionally, plant breeders tend to focus on individual crops in isolation, and challenges such as enhancing climate resiliency and adaptation, yields, and productivity through crop rotation make the proof of concept an exciting and novel idea for the team.

"In Western Canada, the rotation isn't only lentil and durum wheat but a variety of other combinations," Pozniak said. "Before we dive into those complicated layers, we wanted to tackle something with more background information. Plant variety interaction is real. We need to detect and confirm these genetic fingerprints to verify which ones will do well in rotation."

Bett explained their plant breeding and rotation results should offer crop-agnostic tools displaying broad applications outside the two designated crops.

"The beauty of this project is we're hitting the ground running using existing breeding material. Once we show how it's accomplished, we'll be able to point to new, already superior varieties," she said.

Balancing long-term gains and incentives while managing data

Of course, a farmer's concern typically revolves around yield and profitability.

"Producers want, and understandably need high-yielding varieties," Bett stressed. "Selections must be high-performing and contribute to multi-season profitability. Paying a premium to grow and rotate these new reduced-emissions products needs incentivization, which is an issue AgBio assistant professor (Dr.) Nicholas Tyack (PhD) is addressing."

One year into the project, the initial seeds have been produced, and the first 100 lentil lines are currently established with 100 durum lines designated for the next growing season providing the equivalent of 1,000 combinations.

Pozniak believes the project's extensive data management, cross-cutting, and crop-agnostic decision support systems will be a key to the project's legacy.

"Data management is a huge component of today's science as so much is being generated," he said. "When we think of a single wheat genome sequence, it's 16 billion base pairs of information."

Information must be stored, accessed, analyzed, and necessary portions extracted to help plant breeders and producers make climate-smart decisions. These resources will ensure genomic data, developed germplasm, microbial samples, analyses, and decision support tools are available and accessible to other research projects and diverse end-users, an aspect database developer Lacey Sanderson in the Department of Plant Sciences at USask is overseeing.

"We're excited about expanding the work from lentils to barley, oats, canary seed, flax, and all other crops we work on at the CDC," Pozniak said. "Taking advantage of this support is paramount as often it's a lost piece of the puzzle."

Promise for the future

Even though it is early in the project's experiments, the team is pleasantly surprised to discover a high level of plant genetic variabilities, essential for progressive plant breeding.

The future hope sparked by the project is once improved genomic signatures are in place, breeders will voluntarily begin selecting for them, leading to a variety of development programs.

"Like any strong research, when we answer one question, it creates 10 more."

DR. KIRSTIN BETT (PHD)

"Like any strong research, when we answer one question, it creates 10 more," Bett said. "We're already starting to see this in our data. Experiments interconnected with breeding systems cause knowledge to flow and our connections will continue this curiosity-driven research around the interesting data and questions we're starting to see."

The team believes its climate-smart cultivars and microbiomes could reduce fertilizer use, creating cost savings of more than $1.2 billion over the next 20 years (2024–2043) while lowering fertilizer-related emissions between 2-3 metric tons. Additionally, productivity gains from improved crop rotations and varietal improvements could yield another $1 billion in benefits to farmers over the same period.

A new way to farm: Precision agriculture redefines research and technology

From using satellites thousands of kilometres above the Earth's surface to examining chemical compositions in soils and plants, the goal of precision agriculture boils down to one word: efficiency.

MATT OLSON, USASK RESEARCH PROFILE AND IMPACT

Students and drone technician set up a drone.
Photography by Matt Braden Photo

Dr. Greg Penner (PhD)
Photography by Matt Braden Photo

Agricultural researchers are pushing beyond the boundaries of the exceedingly important but still "traditional" areas of crop and livestock study. Just as today's sports science gives modern athletes an edge at every stage of preparation down to the molecular level, precision agriculture gives modern producers a never-before-seen edge when it comes to growing and raising plants and animals in an ever-changing environment.

Scientists at the University of Saskatchewan (USask) are casting their view beyond the field, to the edges of the atmosphere down to the most infinitesimal, to learn and understand more about what they can do to improve outcomes for farms and farmers, no matter their specialization.

"We're getting more granular data, which we can use to guide more precise land management decisions – hence, precision agriculture," said Dr. Preston Sorenson (PhD) of USask's College of Agriculture and Bioresources. "But also with more granular data, we're able to get much more accurate, scaled-up estimates."

It's not a new idea, or even a new term, but time leads to evolution and revolution – especially in the world of technology.

Precision agriculture means different areas of study to different scientists, but the overall goal is clear: using new technology to find new efficiencies in agricultural production.

Precision nutrition a tool of the future for livestock

Dr. Greg Penner (PhD) cares about what cows eat.

The idea of nutritional biology certainly isn't new – humans have been developing various diets to best fit their lifestyles for a very long time – but putting it into play for dairy cows is becoming a much more refined process because the knowledge for nutrient requirements of cattle is more detailed than for humans.

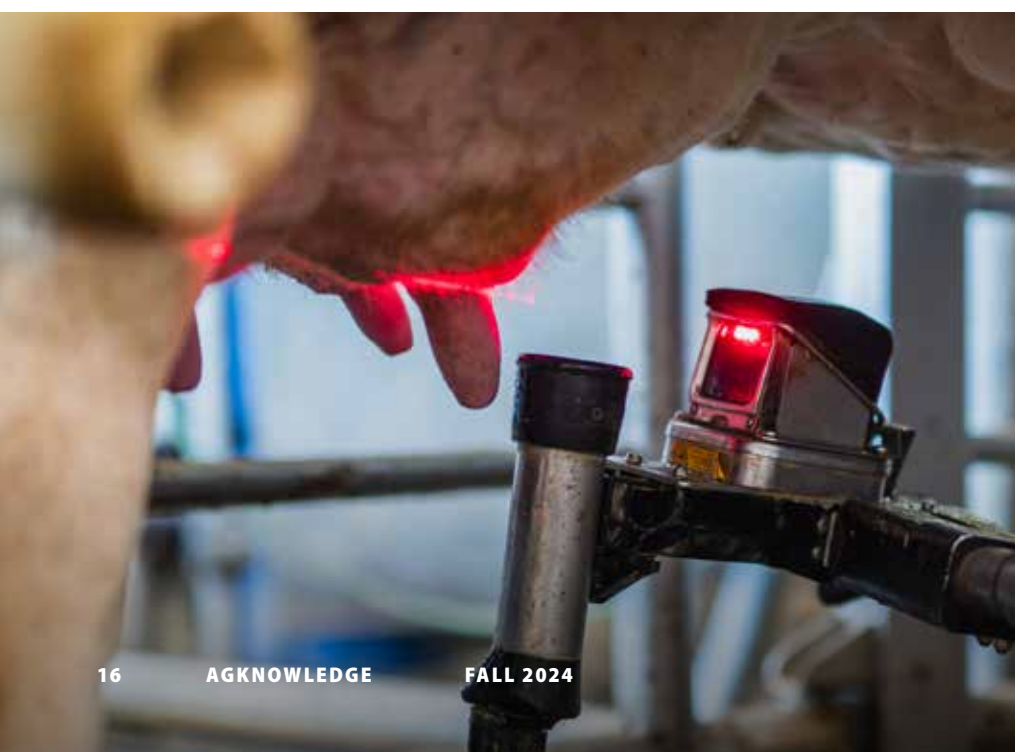
A professor in the Department of Animal and Poultry Science, much of Penner's research revolves around the idea of "precision nutrition" – meaning finding the most ideal and efficient amount of nutritional inputs to maximize animal health and outputs while minimizing waste products.

"We're really focused on minimizing environmental losses while ensuring we're delivering the right balance of nutrients to livestock to meet their nutritional requirements," he said.

As the dairy industry continues to move towards more automated systems and individual cow data collection, there are more opportunities to gather data and provide optimized nutrition to individual animals.

As an example, robotic milking systems can precisely measure and predict a cow's milking routine and milk production. Some of these robotic milking systems also measure body weight, milk quality, and the amount of fat and protein in the milk. All these factors can be used in early alert systems to identify sick cows and to help predict nutrient requirements. Those same machines can also dispense feed to the cow in a mixture that is specially formulated for that animal's needs.

Robotic milking in the Rayner Dairy Research and Teaching Facility; Drone being assembled in a lab; Roughage intake control systems in Rayner Dairy Research and Teaching Facility allow researchers to measure feeding behaviour of cows. ***Photography by Matt Braden Photo***



With steadily improving technology, Penner and researchers like him can draw more and more detailed info from the robotic systems and design feeding programs that target individual nutrition programs for each cow while minimizing the environmental impact.

"The robotic milking system knows who that cow is, it knows her predicted milk yield and it measures her actual milk yield," Penner said. "Based on her seven-day average, it can predict how much milk she will deliver, and we tell the computer how to use that information to determine how much and what kind of extra supplement should be provided."

As researchers find new avenues and new data sources to explore precision agriculture, Penner said one of the difficulties is determining which data is important. This will be an ongoing task as new devices are developed and marketed.

USask is not only at the cutting edge for agricultural research and technology, but as far as Penner is concerned it's also the kind of institution that will help future researchers understand not only how to gather this kind of precise data, but how to best use it.

"We have a population of future producers that is a lot more comfortable with technology, and we're giving them the opportunity to be aware of what type of data is available and to help guide the process for how they use that information to hopefully improve the sustainability of livestock agriculture," Penner said.

"I wish we had many of these tools when I was still a livestock producer," he added with a laugh.

Specific sciences in the soil

Deep in the soil, Dr. Sorenson is constantly discovering new ways to make life easier for producers.

"I do see soil as the foundation of human civilization," he said. "So how we can better manage our soils is very important. We have increasing expectations of what we want our soils to do, in terms of sequestering carbon, having less greenhouse gas emissions, and ensuring our food security."

As Penner's work takes him deep into the biology of livestock, Sorenson's research – as a research associate in the Department of Soil Sciences – delves down into the Earth. Sorenson's definition of precision agriculture comes down to the myriad factors that affect soil, from nutritional components and outputs to crop rotations to chemical compositions and everything in between.

Dr. Preston Sorenson (PhD)
Photo submitted

"I very much see precision agriculture being about trying to tailor your soil management and inputs to the variations in the landscape and soils within your fields, which can let us do a whole bunch of things," he said.

One of Sorenson's areas of research involves soil spectroscopy – analyzing the composition of soil using light-based tools.

Different compounds in the soil will absorb and reflect wavelengths of light to varying degrees, allowing for a snapshot of the most prevalent chemicals based on measurements of those wavelengths. While the technique may not be as exact as a chemical analysis in a lab, soil spectroscopy is weeks quicker than the "wet chemistry" process.

"It's speed, but it's also huge potential cost savings," he said. "What looks feasible with this technology is bulk soil properties,

Dr. Steve Shirtliffe (PhD)
Photography by Matt Braden Photo

like carbon and clay content, because there's enough of it there."

But the biggest advantages in modern soil analysis come from using machine learning tools to combine all the different variables. By inputting data from in the field, in the lab, historical yield information and other observational sources like satellite imaging, an accurate picture of the field can be mapped.

If researchers put a limited number of soil sensors into the ground out in a field and get information of the chemicals present at each sensor, new predictive mapping technology can combine that on-the-ground data – or in this case, in-the-ground data – with those broader observations. Sorenson said they can create machine learning models to accurately interpolate the chemical composition in all the areas between the sensors.

Precision agriculture is an excellent tool for the future of agriculture – but as Sorenson puts it, it's important to know how these tools fit into other tools and techniques to give producers the best advantages.

"It's very much like a puzzle to be solved when it comes to data analysis," he said. "How can I figure out how to work with this data and try to get a map that's both useful and accurate?"

Precision agriculture from satellite technology

Stretching from farmers' fields to the upper atmosphere and back again, Dr. Steve Shirtliffe (PhD) has taken to space to find agricultural answers.

Or at least, the data he's using comes from space – satellites scattered above Canadian farm fields gathering advanced imagery for Shirtliffe to process and analyze.

"People say to me 'this is really cool, I want to know how I can get involved,'" Shirtliffe said. "We're just starting to scratch the surface of what we can do."

Shirtliffe is a professor in the Department of Plant Sciences who specializes in the field of agronomy – a science that finds more efficient crop production solutions while also protecting the environment.

Shirtliffe is using satellite imaging to explore multifaceted field projects: to map and estimate greenhouse gas emissions like nitrous oxide from crop production; to chart the spatial variability of farm fields and how their yields differ over time; and the economic impacts of these types of projects.

But at the heart of all this research is a tremendous goal: "wall-to-wall" mapping of Prairie farm fields. Shirtliffe's aim is to map long-term spatial variability in every single farm field in Western Canada, and then use artificial intelligence to determine the causes for that variability in fields.

"It's crazy ambitious," he said. "But we have this huge land mass of Western Canada, but we really don't know that much about it. The best analogy I can use is it's like sequencing a genome of a plant. This is the first step to really understanding, and it's a huge undertaking in terms of the computational requirements of doing it."

Thanks to geolocation devices on modern grain harvesters, producers can generate "yield maps" to measure how much is produced in different sections of the field. By combining that data with known environmental information and satellite imagery, Shirtliffe can use machine learning models to predict yield variability in a field.

And through using satellite imagery from multiple spectral bands and topographic analysis, Shirtliffe can map greenhouse gas emission hot spots in fields to better plan nitrogen fertilizer use and emission mitigation strategies.

"We're just starting to scratch the surface of what we can do."

DR. STEVE SHIRTLIFFE (PHD)

"We can tell what fields, or what areas in the fields, should be prioritized to reduce nitrous oxide emissions and help Canada meet its greenhouse gas goals while still maintaining the ability to produce high-yielding crops," he said.

These technologies and strategies are the future for those learning at USask as well. Shirtliffe is part of a group that has developed a brand-new Certificate in Precision Agriculture program at USask, passing this knowledge on to the next generation.

"In decades past, universities and colleges would teach agriculture students techniques like welding and hydraulics and … we had the emergence of some of the best no-till seeder companies that designed and built the tools farmers use today," Shirtliffe said. "I'm hoping that this process of giving students and people in the agriculture community precision agriculture tools can do the same thing to catalyze this industry."

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Meet the new meat

Surveys say novel hybrid products created at USask taste great.

Dr. Supratim Ghosh (PhD), Oluwafemi Coker, Dr. Phyllis Shand (PhD)
Photography by Matt Braden Photo

JOANNE PAULSON

Meat, packed with protein, is generally good for you. Processed meat, somewhat less so.

But what if you could replace "bad" fat in, say, deli meat, sausages and burgers, with a healthier option — and without sacrificing taste and texture?

University of Saskatchewan (USask) researchers Dr. Supratim Ghosh (PhD) and Dr. Phyllis Shand (PhD) are on it.

Ghosh, a professor in the Department of Food and Bioproduct Sciences (FABS) in the College of Agriculture and Bioresources, came up with the idea of keeping the protein part of meat products while removing the animal fat and replacing it with plant-based material.

"The animal fats are high in saturated fat and cholesterol, so that's why I'm developing the saturated fat replacer using canola oil and pulse protein," Ghosh explained.

Shand, a professor emerita in FABS, brought her expertise to the project along with the invaluable help of their PhD student, Oluwafemi Coker, and their former post-doctoral fellow, Dr. Fatemeh Keivaninahr (PhD).

"There's a large group of meat products that can take advantage of this," she said. "We're able to reduce the overall amount of fat in the product; plus, this fat replacer we're hoping replaces those sensory properties, the flavour, the mouth feel of the fat.

"The bonus is we're getting some extra protein from the plant-based protein we're adding."

Granted funding by Saskatchewan's Agriculture Development Fund and SaskCanola, they are now nearing the end of the project with the last of a series of taste tests, which have proved very popular.

"We've evaluated it now in several different types of meat products," said Shand.

In the first test, they used it in a bologna-style, finely chopped sausage, similar to a hot dog or a deli meat. Subsequently, they tried it in a breakfast sausage, and Coker has just run a consumer panel, comparing

hybrid burgers to full-fat and low-fat beef burgers.

He has had no trouble generating interest.

"One asked, can I come again next week and do it again?" Shand said with a chuckle.

From lab bench to production

The project, which began before and was delayed by the COVID-19 pandemic, began on a small scale on the lab bench using faba bean protein donated by AGT Food and Ingredients.

"We made something called an emulsion; an oil droplet coated by protein. The droplets are tiny at 500 nanometres, coated by the protein," Ghosh said. "We processed them in a way that the protein acts as a glue and binds the oil droplet together.

"The pulse protein emulsifies the oil into smaller droplets and then converts that emulsion into a gel. That gelling process is happening due to the faba bean protein property."

Next, the emulsion-based fat replacer was scaled up to the amounts needed for pilot-scale meat processing at the Saskatchewan Food Industry Development Centre Inc., using the college's equipment. Then, the hybrid meat products were made at the college's food processing pilot plant.

Part of the process was also to study the product at the Canadian Light Source (CLS) at the molecular level.

"It was pretty cool to use the CLS technology to visualize the microstructure of the product and the original gel," Ghosh said.

Many scientists are trying similar things, but this project is the first to be successful with faba bean protein. The taste-testing is also rare, if not unique.

"When we go to conferences and talk about it, people always ask, did you test it? How does it taste?" Ghosh said.

"Normally, we don't do that. We make things in lab. But that's the novel part with our pilot plant, that we could make a food-grade product, and we have the approval of the University of Saskatchewan Behavioural Ethics Board to do the human testing. That was pretty cool. It's really exciting."

And it's good for you

The new hybrid meats contain half the amount of traditional fat in processed meat products, reducing calories but also the type of fatty acids: canola oil contains only about seven per cent saturated fat and no cholesterol.

"With the making of a processed meat product, we always have to have at least some salt or sodium chloride in there, so we're not changing that," Shand said.

"It's really the fat composition that's changing. People are now more concerned about saturated fat."

When the project concludes by year-end, the scientists should have a complete picture of the fatty-acid profile. Meanwhile, positive feedback is coming in. The products hold moisture well and are reported to have good texture.

The only thing they've noticed is that the bologna-style product is a paler colour, but otherwise the sensory attributes have been declared similar to the full-fat and low-fat bolognas they used as controls.

"For overall acceptability on a nine-point scale, they were all equally accepted, so they were accepted as much as the traditional product," Shand said. "That's a positive outcome."

In addition, unlike many meat replacement products on the market, "the ingredient statement is pretty clean," Shand said. "There aren't unusual-sounding chemical products in it."

Ghosh noted that meat replacement products often contain nearly 20 different chemicals and ingredients needed to create the meat structure.

"Here, we are keeping the meat product," he said. "This is not a veggie burger.

"There's nothing wrong with meat protein. We are improving the nutritional quality of what is there in the meat."

As far as the market for the product goes, while it will be more expensive to make, Shand said she thinks it will be easily incorporated by meat processors.

"The burgers or the sausages are made in a traditional way, so it's really not going to change the way processors need to work with it," she said. "It will appeal to the audiences looking for the health benefits of changing the fatty acid profile together with less fat and calories in general."

Groundbreaking research with global impact

USask Poultry Centre has helped improve industry standards across the world.

JOANNE PAULSON

All creatures on Earth — not just human beings — need to sleep, preferably in darkness.

While it seems a common-sense concept, empirical proof of this was lacking until relatively recently in the case of commercial poultry. It wasn't until just a little more than a decade ago when Dr. Karen Schwean-Lardner (PhD) took up the case during her PhD project with Dr. Hank Classen (PhD).

Schwean-Lardner is now a professor and poultry scientist with a primary research focus on management and bird welfare at the Poultry Teaching and Research Unit at the University of Saskatchewan (USask) — usually referred to as the Poultry Centre. Her work (and that of others) has influenced global industry processes and policy in fundamental ways.

Schwean-Lardner's PhD research began at a time when most

Turkey hens under green lighting.
Photography by Tory Shynkaruk

chicken producers around the world provided their birds with 23 or 24 hours of light every day.

"Producers did not mean to mistreat the bird; there was a purpose," Schwean-Lardner said. "The birds could feed, drink, move about and perform positive behaviours when they wanted to. I think they did it for very good reason."

Yet perpetual light seemed questionable. And so, in conjunction with Aviagen, the largest broiler genetics company on earth, Schwean-Lardner dove in to investigate.

Using the Poultry Centre's research barns, she provided various hours of darkness to different flocks and noted the effect on production, feed intake, bird welfare, meat yield, and other parameters.

"We think it all goes back to that biological cycling, that circadian rhythm, in birds," she said. "They need to have a dark period. They need to sleep in a dark environment. We actually get better growth while significantly improving all aspects of bird welfare."

Additional research done by Tory Shynkaruk, a research technician and Schwean-Lardner's right arm, showed why the birds became more efficient.

"She's worked on trying to figure out why feed efficiency is better, how feed transfers through the gut when we have different photoperiods. That helped us to explain what I saw in some of my PhD data."

Dr. Karen Schwean- Lardner (PhD) and Tory Shynkaruk
Photography by Matt Braden Photo

When you give the birds a dark period at the same time each day, they learn to anticipate it, Shynkaruk explained.

"They have an organ called a crop that can store feed. They'll eat a lot before the onset of that dark period and fill that organ," said Shynkaruk.

"During the dark period, there will be a slow release of food throughout. Their gastrointestinal tract never empties. My longest dark period was 10 hours, and yet their tracts were never empty because the birds anticipated that dark period, and ate more prior to lights going off."

The lighting research has been adopted into practice by Aviagen and today, "their recommendations for every broiler they produce in the world is to include a dark period to allow birds to sleep," said Schwean-Lardner.

"Approximately sixteen billion broilers are produced every single year world-wide and we've changed their well-being by the work that's been done here.

"It's also in our Canadian code of practice. We're getting lots of interest in even further changing that. I think that would be our biggest influence."

Where and why the work is done

The Poultry Centre's research facility is made up of three separate buildings. The first contains the small hatchery used for research and for hatching the unit's heritage stock. The other half of the building is the gnotobiotic unit used for germ-free research.

Further down the road are two long buildings. The nearest one is the brooding and rearing barn, which has nine mini-barns wherein the environments can be controlled and changed.

Across the way is another long barn, mainly a laying hen facility, with another smaller facility attached. When full, there are 16,000 birds on campus.

Schwean-Lardner points out that poultry is a massively important industry in this province.

"It's an important component of our provincial as well as our national industry, because it's very much locally produced," she said.

"In Saskatchewan, the chances are very, very high that you will consume what is produced in our province. That's different than the other industries (such as beef cattle), and I think that's pretty cool."

And more research

The Poultry Centre has also investigated other light-related elements of raising birds, including colour, intensity and flickering. Colour seems to make a difference in how chickens feel.

"How birds get light to the brain is different for them than it is for us. For a human, the light goes through the eyes and so it does with a chicken; but light also penetrates through the skull in birds. That activates components of the brain differently," Schwean-Lardner said.

Red, for example, penetrates quite well; blue does not.

"But in broiler chickens (meat birds), blue light actually reduces fear and stress.

"The other project that's interesting is our work with Dr. Trever Crowe (PhD) in transportation in Canadian environments. That's another thing that's unique to our university. Those are the two areas of research that have had the most important influences."

Other research projects — among many — are being done by PhD students looking into commercial hatcheries as well as heat stress and how to mitigate it with feed composition.

The researchers are continuing the light colour work in other species.

"We're just finishing up experiments studying leghorn pullets and commercial turkeys with respect to light wavelengths, and it appears to have different impacts in different species," said Schwean-Lardner.

"We're lucky, our group. We get to work with a lot of different species," Shynkaruk said. "Other research groups tend to focus on one."

There is less research occurring on turkeys generally, for example.

"It's really exciting to be able to provide evidence on how to manage turkeys," she said. "They're a different breed."

Raising turkeys is hard work, said Schwean-Lardner.

"They're big strong birds, they're curious birds, so they wreck things. They're a whole different ballgame and we absolutely love them."

Organizing all of this is by no means an easy feat, and as Schwean-Lardner said, "I wouldn't get to do 90 per cent of the things I do if it weren't for Tory."

Shynkaruk is very busy juggling a myriad of tasks including writing grants, getting animal care approvals, managing the lab, overseeing student research, training students on procedures, and knowledge transfer.

"Sometimes we'll get industry interest in doing projects and they don't want to wait the two years that it can take a master's student to finish and get that data through, so I'll lead those projects to be able to get them the results they need at a faster pace," she said.

Clearly, the Poultry Centre is always hopping; Schwean-Lardner alone has 11 graduate students.

And there are birds everywhere, always.

"June 1 was for me 10 years as a faculty member and those barns have been full with research all the time," said Schwean-Lardner.

Consumer, producer and bird benefits

Benefits from the research have accrued across the board. For example, producers use and therefore pay for less electricity than in the past when proper lighting programs (including a dark period) are used.

"Canadian producers are amazing. They care about their animals. I'm very proud of our Canadian producers," Schwean-Lardner said.

Pullets under blue lighting.
Photography by Tory Shynkaruk

"With use of a dark period for broilers, producers can actually market more birds, heavier birds, and they eat less. Their welfare is so much better. They have a better life while they're here."

From a consumer perspective, in Canada, "you know the meat you are eating and the eggs you are consuming are coming from birds that have been treated well and have had a good life."

And because better practices can help keep production costs down, that can help keep grocery store prices down.

"It's really nice for us knowing there is work that can be directly applied on farm and can be benefiting producers or processors, and directly benefiting consumers," Shynkaruk said.

As their research continues, so do advancements at the centre, which is in the planning and fundraising stages for a new laying hen facility.

"One of the very cool things that we want to do in that facility is have a glassed-in hallway that runs the length of the barn," Schwean-Lardner said, "so that consumers, without risking biosecurity, without risking disease, can come in and walk through that hallway and see how those birds are being raised, and gain an understanding of where their food comes from."

Among the centre's primary focus is teaching and giving students the hands-on experience they can't get elsewhere, she added.

"We are teaching the future leaders in the poultry industry. We have an incredibly strong link with our industry in Canada and internationally, and so much of our research applies to industry issues. It applies to farms all around the world. I love my job!"

Fish, canola, and the future of aquaculture

USask graduate student research investigates canola meal as sustainable fish meal alternative.

IAN GOODWILLIE

Success in the world of agriculture is continually evolving via ongoing attempts to make it more effective and more efficient. This is incredibly important in a changing world with growing nutritional needs.

The same is true in aquaculture where sustainably farming fish is a viable path to food security. The worldwide need for healthy proteins is only becoming greater, and meeting those needs through the most environmentally friendly and economically efficient ways possible is paramount.

It turns out that the solution could be yeast-fermented canola meal, something that agriculture already produces in spades. Putting it to good use solves two problems with one clever solution.

Doing the research

Chuyuan Zhang is a graduate student with the College of Agriculture and Bioresources (AgBio), whose research at the University of Saskatchewan (USask) has the potential to change the future of aquaculture.

"The primary goal of my research is to determine whether yeast-fermented canola meal can serve as a sustainable and effective alternative to traditional fish meal in aquafeeds," said Zhang. "The big research question is whether fermentation can improve the nutrient profile and reduce anti-nutritional factors (ANFs) of canola meal while improving nutrient digestibility, growth, and health in fish."

Current aquaculture practices often use plant-derived protein sources in aquafeed. That does create issues as those aquafeeds have been known to contain a variety of ANFs which can in turn restrict raising the best quality fish.

Under the supervision of Dr. Murray Drew (PhD), professor emeritus of the Department of Animal and Poultry Science, AgBio, and Dr. Lynn Weber (PhD), Department of Veterinary Biomedical Sciences, Western College of Veterinary Medicine, Zhang compared the impact of feeding raw canola meal and candida utilis-fermented canola meal (CFCM) to farmed fish. Specifically, she conducted two eight-week-long trials with Nile tilapia and rainbow trout using various inclusion levels of the meals.

She found that CFCM both reduced ANFs and improved the crude protein and amino acid content. CFCM could be

Chuyuan Zhang
Photography by Kira Glasscock

integrated up to 600 g/kg in the diet of Nile tilapia without any detrimental effects on growth performance. During her research, this practice even showed better growth performance in rainbow trout.

Zhang explained why these two species of fish were chosen.

"Nile tilapia represents an omnivorous, warm-water species, which is reputed to be less sensitive to the effects of canola ANFs. Rainbow trout represents a carnivorous, cold-water species that is known to be sensitive to ANFs present in canola meal," said Zhang.

The impact on you

The research is compelling and provides multiple benefits to producers as well as consumers by potentially increasing the size and health of the fish. But there's more to it than that.

"The animal feed sector is currently experiencing a significant shift toward the use of fermented feed, driven by its potential benefits for animal health, production efficiency, and sustainability," said Zhang. "My research aligns with the growing trend towards solid-state fermentation in the global animal production field. Microbes used in the fermentation process might have immunostimulant benefits, further enhancing fish health."

The population on Earth is rising quickly, and with it, a demand for sustainable, reliable sources of protein. This has left producers searching for feed ingredients that bring more to the table.

Potentially replacing traditional fish meal with more sustainable options like fermented plant ingredients, featuring increased protein and reduced ANFs, means that aquaculture will become an increasingly viable way of feeding the world. In turn, that will decrease the stress humanity places on wild fish populations and their environments.

There's one more sustainability angle to consider, according to Zhang, and that's the fact existing agricultural practices are already producing the plant ingredients needed to pull this off.

"Canola meal is a by-product of canola oil production and is not used for human consumption. Utilizing it in aquafeeds enhances sustainability by repurposing an otherwise underutilized resource. This sustainable approach can potentially reduce the industry's carbon footprint and contribute to global food security," Zhang explained.

Next steps

The research project, funded by SaskCanola and the Natural Sciences and Engineering Research Council, is complete with the successful defense of Zhang's thesis. That is, of course, not the end of the research on this topic. Zhang has a vision for the future.

"The next steps could involve further optimizing the fermentation process to enhance the nutrient profile of canola meal even more and conducting long-term feeding trials to assess the overall growth and health of fish fed with CFCM," said Zhang. "Additionally, exploring the economic feasibility and scalability of producing CFCM for commercial aquaculture operations would be essential."

On top of that, Zhang can see the process expanding beyond canola.

"This fermentation technology can potentially be applied to other unconventional feed ingredients such as barley, oat, cottonseed meal, and straw. The process provides the dual benefits of enhancing the economic and environmental viability of aquaculture."

Repurposing canola meal for use as feed in aquaculture through this fermentation process has the potential to improve food chain viability and sustainability, a core goal of the College of Agriculture and Bioresources. Zhang's research is right at the centre of it, bringing the future of aquaculture into focus.

Giving care to Saskatchewan's most ancient landscapes

For alumna Hillary Kyplain (BScRRM'22), a conservation co-ordinator for Métis Nation-Saskatchewan, protecting the Muskeg is more than just a job.

✎ JANE CAULFIELD

Northern Saskatchewan is blanketed with Muskeg, the name Indigenous people give to what is also known as peatland or wetland. They are vital ecosystems, providing food and sustenance to animals and traditional medicines to Indigenous communities. They also have an important role in mitigating the effects of climate change – they absorb run-off, filter water, and are where the Woodland Caribou goes during calving season.

"They are an important carbon sink and not a lot of people know about that," said

Hillary Kyplain
Photography by Kira Glasscock

Kyplain, who works as part of the Métis Nation–Saskatchewan Ministry of Lands and Environment on the Li Muskeg Ni Pishkaapahtaynaan (Protect Our Muskegs) project. "It's really important to take care of them."

A carbon sink is the name scientists give to the natural process where more carbon dioxide is absorbed from the atmosphere than it releases. When plants, trees, and animals decompose in the Muskeg, they break down in a thick layer of mud. The mud – the peat – holds on to the carbon from the decomposed materials, conserving it in the ground.

Part of the work Kyplain does is working with local communities and organizations to help ensure the Muskeg is protected so that it can continue to provide sustenance for future generations.

"We are the only province that doesn't have any policy to support and protect peatlands," she said. "We have partnered with a group called For Peat's Sake, who originally formed in response to a peat mining proposal in 2018 to help advocate for the continued protection of the peatlands."

Kyplain also works to improve education about the benefits and importance of peatlands with school divisions and organizations across the province.

"Not a lot of people know about peatlands and why they are important. Lots of people think it's just viable land for development," she said. "We've worked with the school divisions to develop a middle school unit on the benefits of peatlands."

Some of her educational work includes Muskeg Conservation Workshops, which focus on educating participants about the importance of conserving Muskegs and about the lack of protection policies in place. Most recently, she held one in August during the Métis Nation-Saskatchewan-sponsored Women's Protecting the Land Camp in La Ronge at the Lac La Ronge Indian Band Youth Haven-Little Hills. The three-day camp aimed to reconnect women and children with nature and engage in land-based activities, including medicine gathering in the nearby Muskegs.

"It's a great way to highlight how vital peatlands are to the ecosystem and to Indigenous people," she said.

Finding a career path that makes sense at USask

When Kyplain first started her educational journey, she thought she was going in a particular direction.

"I was always interested in learning biology and environmental sciences. I was obsessed with animals," she said. "So, when I started at USask, that's what I took."

But after realizing that she wasn't a fan of some aspects of the course load, she started looking at what else the university had to offer. That's when she discovered the Renewable Resource Management Program in the College of Agriculture and Bioresources.

"It was the program you take when you're interested in becoming a conservation officer, which is what I thought I wanted to do," she said. "But once I was in there, I realized that I could do a lot of things with this kind of degree."

After switching programs, Kyplain said that a whole new world of opportunities presented themselves – many of which she tried. When she was still a student, she spent her summers working as an environmental technician at companies such as Cameco. After graduation, she landed a job working for the Lac La Ronge Indian Band as a community energy co-ordinator, helping the band adopt more renewable energy solutions and identify ways to conserve energy throughout the community.

Kyplain credits her ability to move into different roles with ease to the diversity of courses taken during her time at USask. Even when they are roles she didn't think she wanted.

"I can adapt to the different roles I get put into," she said. "I didn't necessarily want a career where I would have to deal with the public, but that's what I am doing a lot of now and it's not so bad. Having several different kinds of classes across different areas really helped me learn how to adapt to new situations."

"During my time at USask, I did a lot of science and a lot of economics," she said. "I learned a lot about many things," she said. "I got to try out a lot of different kinds of career opportunities until I found one that fit."

The Saskatchewan Agriculture Graduates Association (SAGA) proudly represents the interests and accomplishments of graduates from the college and school.

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90th Annual SAGA Reunion Weekend and Banquet – January 10 and 11, 2025

Our next reunion weekend and banquet will be a celebration of 90 years of University of Saskatchewan (USask) agriculture grads gathering together. SAGA is planning a special weekend and what better place to hold this auspicious celebration than at one of the preeminent places of Saskatchewan agricultural history – the Saskatoon branch of the Western Development Museum (WDM).

Jan. 10, 4 – 7 pm: Friday Night Social at USask Agriculture Building Atrium, guided tours and Gabfest in ASA Lounge

Jan.11, 7 am – 5:30 pm: SAGA Hockey Tournament in Waldheim

Jan. 11, 4 – 9 pm: Reunion: Banquet at WDM, followed by Mixer, 9 pm – 1 am

Recognition of years 1945, 1950, 1955, 1960, 1970, 1985, 1995, 2005, 2015, 2020

Honorary life members for 2024

Dr. Fran Walley '93 PhD is the recently retired associate dean (academic) in the College of Agriculture and Bioresources (AgBio), and a professor emerita in the Department of Soil Science at USask. Fran grew up dreaming of becoming a vet. As luck would have it, the University of Manitoba (U of M) required pre-vets to take a soil science class taught by Bob Soper, distinguished USask graduate. She was entirely hooked on soils from that point on. Dr. Walley obtained her BSc and MSc from the U of M; then earned her PhD in soil microbiology from USask. She began her career as an assistant professor and extension specialist, when pulse crops were becoming widely adopted on the prairies. Her extension experience with farmers sparked an active research program in soil nitrogen dynamics and pulse crop agronomy. Fran is the author or co-author of more than 65 peer reviewed journal articles and book chapters and has supervised/co-supervised more than 30 graduate students and post docs. Dr. Walley has long been involved in teaching introductory soil science and was particularly proud to share her love of soil science and the College of AgBio with her students.

Janice Tranberg '94 C has been the dual president and CEO of the National and Alberta Cattle Feeders Association based in Calgary, Alberta since 2018. Janice's career path began in rural Saskatchewan where she was raised, first around Balgonie and then Big River. She was drawn to plants and obtained a horticulture diploma from Olds College. Eventually, her love of science led her "back home" to USask, where she received her BSA degree, followed by a MSc ('98) in molecular biology and plant pathology. Janice started working in the "new and really cool" biotechnology sector with Performance Plants, then moved to Ag-West Bio, CropLife Canada, and finally as Executive Director of SaskCanola. Her broad-reaching career has always involved the ag sector where her interests expanded to policy development, regulatory affairs and government relations. Her focus has been on supporting beef producers and advocating for the cattle industry as it dealt with the many unforeseen impacts of COVID.

2024 highlights

Henry de Gooijer '83 C is the 2024 President and Terry Grajczyk '83 C is the Vice-President.

Gabrielle Ayles and John Paul Wasan were recognized as the SAGA Scholarship recipients for 2023-24. Most recently, Ella Grimeau was awarded the SAGA Scholarship for the 2024-2025 academic year.

SAGA and the Saskatchewan agriculture community lost two leaders this year, with the passing of Bob McKercher '54 C in January and Les Henry '64 C in June.

The June SAGA newsletter (available online at saskaggrads.com and to members by email or by mail) contained class photos of the 2024 Reunion, which was a great success.

The Saskatchewan Agricultural Hall of Fame inducted six individuals at a ceremony in April. Among the inductees were ag grads Bruce Coulman '71 C and Leslie Johnson '00 S. Congratulations, Bruce and Les! Also inducted to the Sask. Hall of Fame were Abdul Jalil, Brian Olsen, Grant Carlson and Stewart Stone. Bruce Coulman was also inducted into the Canadian Agricultural Hall of Fame this year!

Stay in touch

If you're a SAGA member and have changed your contact information (email address, mailing address) – please reach out to us, to make sure we have your most up-to-date information:

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General inquiries
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SAGA reunion and chairperson
reunion@saskaggrads.com

SAGA Treasurer
treasurer@saskaggrads.com

Submit news to The SAGA editors
newsletter@saskaggrads.com

Call for volunteers

SAGA is a volunteer-led organization dedicated to creating community for Sask. agricultural graduates. Each year we need volunteers to be chairpersons to organize their classmates for the annual reunion. Are you interested?

SAGA invites all degree, diploma and certificate graduates of the College of AgBio to join our alumni association. Please see **saskaggrads.com** for more information.

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