Agknowledge

COLLEGE OF AGRICULTURE AND BIORESOURCES 04 | 15

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Inside this issue

On the cover: adapted from Food and Agriculture Organization of the United Nations

University of Saskatchewan
College of Agriculture and Bioresources

The Department of Soil Science celebrates

2015 International Year of Soils

2015 International Year of Soils

Agknowledge

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Dean's Message

Welcome to AgKnowledge 2015. Hard to believe another year has come and gone already.

A lot of exciting things have happened for AgBio over the past year, and in this edition of AgKnowledge you will see just how big an impact our college is making on the agri-resource environment and economy: provincially, nationally and globally.

In September, we announced a $5 million contribution from our friends at the Canadian Canola Growers' Association that will support ag-related policy research in our Bioresource Policy, Business and Economics department.

In October, we celebrated the grand opening of the Canadian Feed Research Centre in North Battleford. This $13.9 million facility is a major Canadian Foundation for Innovation funded project, with additional support from the provincial government, Cargill's Animal Nutrition program, Western Economic Diversification and the university. The facility, which has both industrial and pilot-scale production lines is one of the most advanced of its kind in the country and the continent, and will undoubtedly increase AgBio's impact on the global food economy, as it brings new and unique learning opportunities for researchers and students.

This issue highlights many of our faculty who have been recognized for their innovation, outstanding teaching and tireless efforts to engage students, and remain on the cusp of modern agriculture research and technologies, that are allowing this college to remain a leader in ag research in Canada.

As well, you will see undergraduate research initiatives that are providing invaluable, hands on learning opportunities for our undergraduate students. Our intuitive, passionate and well-rounded students hold the future of Canada's agriculture in their capable hands—and we couldn't be happier!

2014 brought tumult and change to our University, but it also brought growth and renewal and determined optimism. AgBio is stronger than ever; we MUST succeed in our mission for the university and the province to remain strong and focused on the future, and you only have to look at our accomplishments to know that we are doing that. It has been a hard time, and although our reputation suffered, our quality just continues to improve. Through all the ups and downs that faced the campus community this past year, our college's staff, students, researchers and faculty continued to impress me and everyone else with their commitment to innovation, their passion for learning and their willingness to push boundaries. There are so many reasons to celebrate our college, and I could not be more proud to call AgBio home.

Thank you for being a part of our AgBio community. It is a community with strong roots and a long history and we are always happy to hear from Agros, past, present and future.

Yours in Agro Spirit,
Dean Mary Buhr

Student Excellence

ENTRANCE AWARDS

AGBIO Renewable Entrance Scholarships
Gabrielle Achtymichuk, Outlook
Hannah Friesen, Laird
Alyssa Johnson, Canwood
Josh Myhr, Hudson Bay
Moria Petruic, Avonlea
Michelle Ross, Grenfell
Chelsey Schoepp, Grenfell

AGBIO Entrance Scholarships
Rebecca Blackburn, Estevan
Madison Boon, Maryfield
Shelby Capcara, Saskatoon
Jordan Dykema, Vanguard
Danean Edgar, Wolseley
Amanda Fedorchuk, Norquay
Curtis Frey, Young
Luke Jorgensen, Fort Vermilion AB
Liam Kelln, Duval
Nina Kucey, Saskatoon
Brendan Loewen, Radville
Kyra Mazer, Saskatoon
Kaylee Morris, Delisle
Bailey Ogilvie, Ardath
Phoebe Oudshoorn, Big River
Davlynn Pedrick, Wilcox
Arielle Sabourin, Saskatoon
Toveli Schmuland, Saskatoon
Kendall Scott, Nipawin
Andrea Sollosy, Saskatoon
Sarah Thomas, Calgary AB
Kelsey Woloschuk, Yorkton

Arnold and Emily Robinson Scholarship
Kimberly Williams, Blackie AB

Beatrice Murray Entrance Scholarship
Kiana Rieger, Imperial

Douglas Christie Ferguson Fund Scholarship
Stephanie Bieri, Progress BC
Chelsea Gruber, Wilkie
Annalise Hanson, Saskatoon

Jim Anderson Scholarship in Agriculture
Amy Prybylski, Willowbrook
Brandi Strieb, Gravelbourg
Danette Willford, Coronach

McConaghy Award
Jim Marten

Robert and Maude Hale
Robyn Kary, Vibank

CONTINUING STUDENT AWARDS

AGBIO Renewable Entrance Scholarships, Second Year
Devin Meijer, Saskatoon
Amy Pizzey, Binscarth, MB
Amanda Pufall, Saskatoon
Danielle Schlehahn, West Kelowna BC
Jacqueline Toews, Glaslyn
Bailey Wilson, Tugaske

AGBIO Renewable Entrance Scholarships, Third Year
Benjamin Dietrich, Moosomin
Logan Pizzey, Binscarth MB
Jasmine Tenkink, Prince Albert
Sara Wist, Central Butte
Brianna Zoerb, Delisle

AGBIO Renewable Entrance Scholarships, Fourth Year
Tracy Fehr, Rosthern
Sarah Johnson, Saskatoon
Shannon Palmer, Port Alberni BC
Lukas Smith, Saskatoon

AGBIO Transfer Scholarships
Josie LeDuc, Okotoks AB
Shayla Hertz, Edenwold

Adeline and William Haberman Memorial Scholarship
Jesse Bond, Marengo

Agrium Aboriginal Students Award
Charlene Swain, Saskatoon
Akaysha Duchek, Esterhazy

Albert and Beatrice Trew Memorial Scholarship
Lukas Smith, Saskatoon

Animal Nutrition Association of Canada (Alberta Division) Scholarship
Jolet Kohler, Glenavon

Animal Nutrition Association of Canada (Saskatchewan Division) Scholarship
Maria Epp, Clavet

BASF Canada Scholarship in Plant Sciences
Alanna Orsak, Russell MB
Amy Pizzey, Binscarth MB

Bert Hargrave Scholarship
Ella Fulmes, Saskatoon

Bert Salloum Scholarship in Agriculture Economics
Amanda Gabruch, Saskatoon

Canadian Prairie Lily Society John Bond Scholarship
Rachelle Hofmeister, Saskatoon

Canadian Prairie Lily Society T.A. (Andy) Dingwall Scholarship
Jennifer Grexton, Saskatoon

Canadian Society of Animal Science Book Prize
Karen Scott, Maple Ridge BC

Carlson Scholarship in Renewable Resource Management
Rebekah Esau, Saskatoon

Charles C. Cook Student Leadership Award
Andrew Reddekop, Hepburn
Keaton Schmidt, Saskatoon

Chicken Farmers of Saskatchewan Award in Agriculture
Charlotte Corbett, Bruno
Jade Paley, Tuffnell

David J. Welch Memorial Prize
Andrew Reddekop, Hepburn

Douglas L. Gibson Memorial Award
Cassandra Sondershausen, Saskatoon

STUDENT EXCELLENCE

- **Dow Agrosciences Scholarship in Agriculture**
  Lukas Smith, Saskatoon
  Christina Tollett, Saskatoon

- **Early's Farm and Garden Centre Student Prize in Horticulture**
  Sarah Wist, Central Butte
  Harold Geist, Saskatoon

- **Elmer Laird Memorial Scholarship for Organic Agriculture**
  Jorge Cordero Elvia, Saskatoon
  Jaden Wood-Sparrow, Vanscoy

- **Ernest Winn McKenzie Scholarship**
  Amanda Schurman, Saskatoon

- **Ewald M. & Donna I. Kitsch Scholarship in Crop Science**
  Taryn Heidecker, Saskatoon

- **F.J. Fear Scholarship in Soil Science**
  Tracy Fehr, Rosthern

- **Grow Community of Independents Class Prize**
  Kerrie Andreas, Saskatoon
  Alica Olson, Archerwill
  Dane Oram, Central Butte
  Paige Pister, Rhein
  Alecia Remmen, Hanley
  Justin Serhan Saskatoon

- **Harvey Scholarship**
  Brittany Davis, Saskatoon
  Sara Doerksen, Saskatoon
  Amanda Gabruch, Saskatoon
  Jessa Hughes, Eston
  An Gel Liew, Saskatoon
  Moria Petruic, Avonlea
  Karen Scott, Maple Ridge BC
  Karl Wilkins, Shaunavon
  Rongrong Xiang, Saskatoon

- **Howard Lindberg Memorial Award**
  Cody Gabruch, Consul

- **James Donald Hardin Scholarship**
  Jaden Jamieson, Battleford
  Kendall McArthur, Watrous
  Jenny Walls, Saskatoon

- **Jickling Agricultural Scholarship**
  Jesse Bond, Marengo

- **Jim Anderson Entrance Scholarship**
  Amy Prybylski, Willowbrook
  Brandi Strieb, Gravelbourg
  Danette Willford, Coronach

- **John Mitchell Memorial Scholarship**
  Ian Andvaag, Regina

- **Kelly Aulie Memorial Scholarship**
  Breanna Anderson, Saskatoon

- **Larry Janzen Memorial Scholarship**
  Zachary Kurtenbach, Deloraine MB

- **Major Alfred Frank Mantle Memorial Scholarship**
  Jade Marshall, Red Deer County AB

- **Molson Canada Book Prize**
  Lauren McDonald, Saskatoon
  Cassandra Sondershausen, Saskatoon

- **Pat Toderian Scholarship**
  Brittany Davis, Saskatoon
  Karen Scott, Maple Ridge BC

- **Port Metro Vancouver Scholarship**
  Joshua Moats, Riceton

- **R.K. Baker Prize for Excellence in Poultry Science**
  Lisa Johnson,

- **Robert T. Armstrong Scholarship**
  Sara Wist, Central Butte

- **Roderick Alan McLean Memorial Award**
  Kiela Caudillo Ruiz, Saskatoon

- **Ron Gallaway Memorial Scholarship**
  Justin Dering, Kinistino

- **Ross Johnson Memorial Scholarship**
  Katelyn Stehr, Swan River MB

- **Rossnagel Scholarship for Academic Improvement**
  Koryn Hare, Saskatoon

- **Russell Fisher Scholarship**
  Alyssa Cruikshank, Aberdeen

- **Saskatchewan Institute of Agrologists Scholarships**
  Abraham de Vries, Sturgis
  Jill Martens, Fiske
  Logan Pizzey, Binscarth MB

- **Saskatchewan Institue of Agrologists Diploma Scholarship**
  Andrew Reddekop, Hepburn

- **SaskMilk Undergraduate Scholarship**
  Jasmine Paulson, Hodgeville

- **Shand Greenhouse Education Prize**
  Amanda Schurman, Saskatoon

- **Syngenta Achievement Award**
  Torbjorn Lokken, Saskatoon

- **University of Saskatchewan Scholarships**
  Ian Andvaag, Regina
  Krista Davis, Saskatoon
  Rebekah Esau, Saskatoon
  Danica Lucyshyn, Saskatoon
  Shannon Palmer, Port Alberni BC
  Logan Pizzey, Binscarth MB
  Laci Schmidt, Saskatoon

- **University of Saskatchewan Diploma Scholarship**
  Harold Geist, Saskatoon

- **University Undergraduate Scholarships**
  Dhawala Abeywickrama, Saskatoon
  Colton Allan, Davidson
  Angela Howell, Swift Current
  Kristin McIntosh, Saskatoon
  Carolyn Murray, Saskatoon
  Christine Mysak, Saskatoon
  Peter Olsen, Saskatoon
  Janessa Paetkau, Saskatoon
  Seanna Pashulka, St Paul AB
  Amanda Pufall, Saskatoon
  Kelsey Richardson, Delisle
  Keaton Schmidt, Saskatoon
  Amie Vowles, Saskatoon
  Shannon Walker, Langham

- **W.J. Copeland Scholarship in Crop Science**
  Zachary Kurtenbach, Deloraine MB

- **Walter Scott Scholarship**
  Christine Young, Bredenbury

- **William G. Barclay Scholarship**
  Vaun Genik, Elgin MN

- **William M. Farley Memorial Scholarship**
  Everett Boots, Saskatoon
  Brittney Goruick, Wood Mountain
  Jade Marshall, Red Deer County AB
  Dana Tkatchuk, North Battleford
  Kent Walters, Saskatoon
  Charlotte Tyson, Dysart

GRADUATION AWARDS

- **Saskatchewan Institute of Agrologists Gold Medal to the Most Outstanding Degree Graduate**
  Kerrie Andreas, Melfort
- **Fulton Family and Saskatchewan Institute of Agrologists Prize to the Most Outstanding Diploma Graduate**
  Michelle Hildebrand, Boissevain MB
- **Agribusiness Top Graduate Award**
  Jordan Gottinger, Neudorf
  Emmy Boersma, Portage La Prairie MB
- **Distinguished Undergraduate Award in Animal Bioscience**
  Scott MacMahon, Saskatoon
- **Elaine Partington Equine Thesis Award**
  Rae-Leigh Pederzolli, Saskatoon
- **Frank Sosulski Graduation Prize in Plant Sciences**
  Kerrie Andreas, Melfort
- **Molson Canada Award of Excellence**
  Erin Hopkins, Saskatoon
- **Norman H. Pearce Prize in Animal Science**
  Carmelle Huberdeau, St Lazare MB
  Kirstie Rissling, Denzil
- **P.M. and Y.Y. Huang Distinguished Award in Soil Science**
  Kelsey Henderson, Assiniboia
- **R.K. Baker Prize for Excellence in Poultry Science**
  Lisa Johnson
- **Saskatchewan Horticulture Association Prize**
  Coral Stang, Saskatoon
- **William Allen Prize in Agricultural Economics**
  Amy Carduner, Saskatoon

POSTGRADUATE AWARDS

- **Ajinomoto Heartland/Halchemix Scholarship**
  Megan DeVisser
- **Alexander and Jean Auckland Post-graduate Award in Agriculture**
  Md. Nazrul Islam
- **Barbara and Frank Pavelich Post-graduate Scholarship**
  Amanda Guy
- **C. Paul W. and Marianne M. Ziehlke Post-graduate Award**
  Robin Brown
  David Bulmer
- **Class of '43 60th Anniversary Award**
  Dilshan Benaragama
- **Dr. Alfred E. Slinkard Post-graduate Scholarship**
  Maya Subedi
- **Dr. Robert E. Redmann Memorial Graduate Scholarship in Plant Sciences**
  Anjika Attanayake
- **Earl David Mallough Scholarship**
  Kirby Nilsen
  Katherine Stanley
  Konstantinos Xyntaris
- **F.V. MacHardy Graduate Fellowship in Grasslands Management**
  Anjika Attanayake
- **Gerhard Rakow Legacy Award**
  Jennara Field
- **Haris and Lauretta and Raymond Earl Parr Memorial Scholarship in Agriculture**
  Seyed Pozveh
- **J.D. MacFarlane Scholarship**
  Ian Willick
- **John Baerg Award**
  Mark Sigouin
- **John Wickhorst Memorial Scholarship**
  Mark Sigouin
- **L.H. Hantelman Post-graduate Scholarship**
  Xiaoyue Wang
- **Martin Pedersen and Family Post-graduate Scholarship**
  Mark Sigouin
- **Maurice Hanson Sr. Post-graduate Award in Soil Research**
  Mark Sigouin
- **Molson Canada Post-graduate Scholarship**
  Oarabile Kgosisejo
- **Norman and Kathleen Lean Post-graduate Scholarship in Agriculture**
  Ian Willick
- **O.M. Elviss Post-graduate Scholarship**
  Angie Lam
- **Paulden F. and Dorathea I. Knowles Post-graduate Scholarship in Crop Science**
  Ti Zhang
- **Purdy Post-graduate Scholarship**
  Ian Willick
- **Putnam Family Memorial Award**
  Amanda Guy
- **R.P. Knowles Scholarship**
  Kirby Nilsen
- **Rene Vandeveld Post-graduate Scholarship in Crop Science**
  Parminderjit Bangar
  Gurcharn Brar
  Kendra Meier
  Rushikesh Warale
  Jessica Weber
- **S.N. Horner Scholarship**
  Mark Sigouin
- **Saskatchewan Pulse Crop Development Board Don Jaques Memorial Fellowship**
  Sarah Anderson
- **SaskMilk Graduate Scholarship**
  Janna Moats
- **Syngenta Graduate Research Award in Pulse Production**
  Yunfei Jiang
  Vladimir Pajic
- **Syngenta Scholarship in Sustainable Agriculture**
  Alexis Adams
- **Townley-Smith Scholarships**
  Eugenia Herwig
  Timothy Howdeshell
  Blake Weiseth
  Yang Yang
- **Western Grains Research Foundation**
  Andrea De Roo
  Dustin MacLean

GRADUATE STUDENT SPOTLIGHT

A Long Road

MOHAMMAD TORSHIZI DECIDED EARLY IN HIS ACADEMIC CAREER THAT THE U OF S WAS THE PLACE TO BE — AND HIS STUDENTS ARE GLAD HE DID

Mohammad Torshizi leads a class discussion

By Glenn Cheater

Mohammad Torshizi has revived an old practice — only this time, it's the teacher who gives apples to his students.

And while it's not the precise reason the PhD candidate won a prestigious teaching award, it's part of a story that veers as far from the ordinary as you can get.

It starts in the 31-year-old's home town of Gorgan, a city of 270,000 in northern Iran. The country may conjure up images of arid, austere landscapes, but that's not Torshizi's Iran.

"It's not very far from the Caspian Sea and it's a beautiful place, always green," he says. "Actually it's very similar to Vancouver." The next twist is the career choice of a city kid whose father is a dentist and whose favourite subjects in grade school were physics and math.

"Although I grew up in the city, my uncle has a small hobby farm and I always helped him in the summertime," says Torshizi. "That got me interested in agriculture, but I didn't want to farm for a living because I knew just how hard it is. Since I was also interested in physics and math, I thought I

should find something that had some of both. So that is how I came to agricultural economics."

In fact, it was a very specific branch that caught his interest: ag policy. Again, it was a choice influenced by his time on his uncle's farm. Like many small-scale farmers, his uncle had no tractor, much less a combine, and so Torshizi and his cousins would harvest wheat with a scythe.

Iran is actually a major wheat producer, harvesting (with combines) about 13 million tonnes annually. But the challenges faced by small-scale farmers remained with Torshizi when he went to university. It's one of many issues where sound ag policy can make a huge difference, he says.

"I was interested in many issues, such as inefficient irrigation systems and overuse of subsidized fertilizers," he says. "I guess I was a naïve 19-year-old, but I was sure that if I learned ag policy, I could find ways to resolve them."

And the young Iranian undergrad knew exactly where he could find that training — Saskatoon.

"I applied for a couple of other universities, but I knew I had to be at U of S," says Torshizi. "There are not many people who are really good at ag policy. I had heard of Hartley Furtan and others, and I really liked the stuff that Richard Gray was doing, so this is where I wanted to come."

Getting to Saskatchewan was the next challenge.

"One of my teachers did his PhD under this other person and that guy did his PhD at the University of Saskatchewan," he says. "I thought that if I made a good impression on this guy and got really good marks, he would introduce me to the other guy, and eventually I could maybe get introduced to people at U of S."

It was not an easy process, and among the challenges was earning a top score in nationwide exams to get into the Masters program at the University of Tehran, which only accepts three candidates a year. But, in the end, it worked out and in August 2009, Torshizi stepped off a plane in Saskatoon.

But there was one more big hurdle to overcome.

Ever the diligent student, Torshizi took English classes five days a week for a year and a half before coming to Canada. He was far from proficient, but figured his English would quickly improve once here.

"Then a very strange thing happened — after a while, I realized that I was understanding less and less," he says. "I wondered how this could be, and then I realized that I was scared of not understanding people. So I was avoiding conversations — or running away from them — because I was afraid that I might not understand. It was a vicious cycle."

So he forced himself to talk to people, even though it was uncomfortable and he frequently felt embarrassed. Today, he's perfectly fluent but that experience had a lasting effect. In Torshizi's classes, not participating is not an option.

"I know some people are shy and don't want to talk because they don't want to be out of their comfort zone," he says. "But I just knew I had to find a way to get them to talk."

This is where giving out apples comes in (and how Torshizi garnered a 2014 North American Colleges and Teachers of Agriculture teaching award for graduate students).

"I have ways to break the ice and get them talking. For example, I might give them a protein bar or an apple if they ask a good question, give a good answer to a question, or make a good comment. And if I make a mistake and someone says, 'Hey, you did this wrong,' then they get a protein bar. I want them to be comfortable in my course, not just sitting there and wishing the class was over."

And even at the end of the class, students may not be able to slip quietly away.

"If a student gets a bad mark, I'll ask them to come to my office and I will say, 'I know you're smart. I know you can do this. What went wrong here?'"

> **"IF A STUDENT GETS A BAD MARK, I'LL ASK THEM TO COME TO MY OFFICE AND I WILL SAY, 'I KNOW YOU'RE SMART. I KNOW YOU CAN DO THIS. WHAT WENT WRONG HERE?'"**

Torshizi laughs as he tells this story, adding, "Maybe they study harder in my course because they don't want to come to my office and have this awkward conversation with me again."

The economist also charts his students' progress with graphs of their marks.

"Some who had the worst marks at the beginning ended up with some of the highest marks," he says.

And no one ever falls off Torshizi's radar. Miss a few classes and you can expect an email asking if everything is OK.

"I don't see them as a class or a bunch of students," he says. "No, I see them as individuals and every one of them matters. Once they realize that, it can change their life." ■

Reimagining Food Aid

Michael Nickerson from the college, and Shannon Hood-Niefer of the Food Centre pose in front of the extruder

IT'S A FAR-REACHING AND HUGELY AMBITIOUS PROJECT, BUT A NEW U OF S INITIATIVE COULD ONE DAY SUBSTANTIALLY REDUCE THE TERRIBLE TOLL OF MALNUTRITION

By Glenn Cheater

Think of food aid and images of sacks of grain and other basic foodstuffs spring to mind.

But Mike Nickerson thinks of very different things — a high-caloric paste, a cereal that can also be ground into flour, 'just add water' porridge, and an emergency ration food bar that can be ground up to fortify other foods.

"Our goal is to develop food-aid products with enhanced nutritional properties with the right blend of amino acids, but also things like omega-3 oils to help with brain development and antioxidants in concentrated forms to provide additional health benefits," says the associate professor of food and bioproduct sciences.

A protein expert who speaks enthusiastically about "opening up" proteins via micronization and "fermenting" them with enzymes, Nickerson is one member of a large and eclectic group of researchers and collaborators in Canada and Ethiopia. There are other food scientists; specialists in agri-business, policy, nutrition and food processing; and food-aid experts on the team. It will eventually include professors and students from Ethiopia's Mekelle University and local residents who will ultimately benefit from these fortified protein-based food products.

"I've worked on big projects, but nothing this big," says Nickerson.

"Bringing all these people together is challenging, but it's also really rewarding. We look at this as a foundation for something bigger."

Big is an apt word. Worldwide, it's estimated that poor nutrition accounts for almost half of all deaths of children under age five — more than 2.5 million every year. Countless millions more suffer lifetime afflictions from malnutrition, including stunted growth because of poor bone development; impaired organ function ranging from weakened hearts to kidney and brain disfunction; compromised immune systems; and micronutrient deficiencies that can lead to anaemia, rickets, scurvy, and other ailments.

"There are a whole bunch of malnutrition-related diseases," says Nickerson. "They all have a long-term impact on human health."

Major funding for the $1.7-million project came from the Global Institute for Food Security at the U of S.

"The primary mission of the institute is to increase crop productivity and resiliency," says Bob Tyler, the institute's managing director. "However, food security is a very complex issue, and can be achieved only by ensuring access for all to affordable, safe, and nutritious food. This project addresses some of the non-production challenges related to food security — improving the nutritional status of at-risk populations in particular."

Those challenges go far beyond food chemistry and encompass economics, supply chains, consumer marketing, and even politics. Which is why, right from the get-go, this initiative has been designed to function from the ground up.

Despite all their differences, Ethiopia and the Canadian prairies are both farm country, with wheat, barley, pulses, and flax among their key crops. Increasingly, food aid agencies such as the UN's World Food Program view local food production and processing as critical to Third World food security.

So the first step is how to use locally grown foods to make more nutritional products.

"We're starting by looking at what is the best blend of pulses and cereals," says Nickerson. "Is it chickpeas and oats? Lentils and barley?

"For instance, pulses are high in lysine but have low levels of methionine, whereas it's the opposite for cereals. A population that only had access to wheat or rice wouldn't have the right levels of nutrition going into their bodies and would start experiencing malnutrition because they wouldn't be getting the right micronutrients needed for good health."

Diseases associated with malnutrition can also affect the body's ability to absorb nutrients, so researchers at the University of Manitoba are conducting animal trials to look at how easily various protein blends can be digested. Other researchers will work with Saskatoon company InfraReady Products that uses a heat treatment called micronization. The process not only makes proteins more digestible, but reduces microbial loads and extends the shelf life of products.

"Once we have a good handle on the ingredient profile, then we'll move into the product development phase," says Nickerson. "We'll be working with the Saskatchewan Food Industry Development Centre and looking at the impact of extrusion cooking (a high-heat process that simultaneously cooks and dries a product) on the digestibility and formulation of these products."

Adding omega-3 oils from flax is also on the list. Canadian stores have many products with this healthy fatty acid. But for food aid purposes, you have to store them "for one or two years without refrigeration," he notes. When it comes to fruit phenolics (aka antioxidants), the challenge is ensuring they remain bioactive.

There are also the intertwined issues of technology transfer, economics, supply chains, and logistics. While these fortified foods could be manufactured here and shipped overseas, the researchers want to use processing technology suitable for a country like Ethiopia. Having local production would bolster both food security and development of a local food manufacturing sector which could, in turn, lead to these fortified ingredients being used in other Ethiopian food products. (The country has a small but growing food-processing sector, with flour, biscuits, and baked goods among its leading products.)

And then there's the matter of taste.

"Ultimately, it doesn't matter how healthy the product is — if people don't like it, they won't want to eat it," says Nickerson. "Even in these hard-hit regions, people have to like the way a product tastes."

This is where researchers at Mekelle University in northern Ethiopia come in — they will assist in product development and work with community groups to conduct taste testing.

"We've already had a couple of people go over on fact-finding missions and one of the surprises was that in Ethiopia, there's a widespread belief that food sold in packages is healthier than a fresh product sold in the marketplace. It's sort of a reverse mentality to here."

All in all, it is a massively ambitious undertaking, which is why Nickerson talks of this project being just the start of a long journey. But he also hopes it will be a model for an entirely new way to approach big and complex issues.

"You often hear of a science cluster, but we're bringing together academics, food companies, processors, NGOs, and community groups," he says. "I see this leaving a legacy that shows how to bring different sectors together, work collaboratively, and tackle more ambitious projects than researchers could ever do on their own." ■

> "I SEE THIS LEAVING A LEGACY THAT SHOWS HOW TO BRING DIFFERENT SECTORS TOGETHER, WORK COLLABORATIVELY, AND TACKLE MORE AMBITIOUS PROJECTS THAN RESEARCHERS COULD EVER DO ON THEIR OWN."

AgBio at a glance

2014 STATS

1,329 STUDENTS

- 976 UNDERGRADUATE
- 295 GRADUATE
- 58 NON-DEGREE PROGRAM

80 FACULTY

390 STAFF

RESEARCH FUNDING

$50,748,645

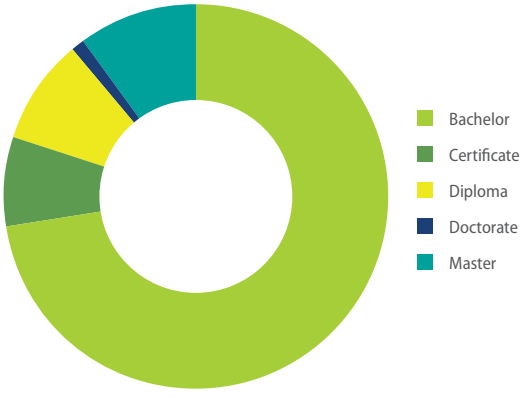
SCHOLARSHIPS, BURSARIES AND AWARDS

217 FOR UNDERGRADUATE STUDENTS

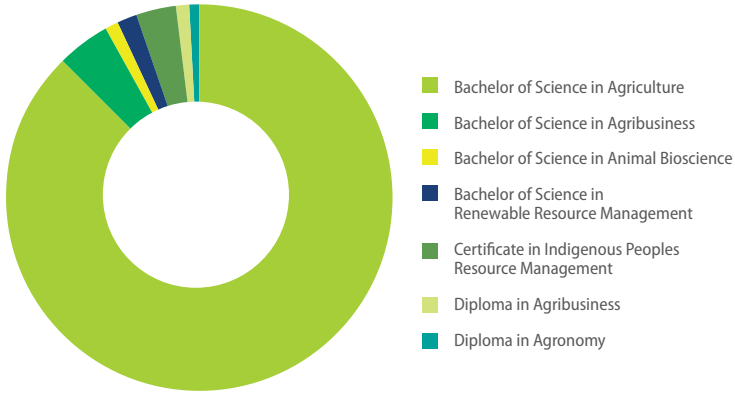
123 FOR GRADUATE STUDENTS

STUDENT SUPPORT: **$1,798,092**

2014 GRADUATES



DEGREES TO DATE



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Hatching Good Ideas

SOME CONSIDER THEM SIMPLE BIRDS, BUT HANK CLASSEN KNOWS BETTER— AND HE'S CONTINUING TO FIND BETTER WAYS TO RAISE THEM

By Glenn Cheater

It was one thing when a young Hank Classen started raising bantam chickens as a hobby on the family's grain and pig operation near Nipawin.

It was another matter entirely when he decided studying poultry would be his life's work.

"My dad was not very happy with this," recalls the NSERC Industrial Research Chair in Poultry Nutrition. "First of all, I went into agriculture when he thought I should go into business or something like that. Then when I went into animals, he couldn't understand that because he liked plants more.

And when I told him I was going into poultry science, he thought I had totally lost my mind."

He also wondered if his son would have much to do.

"He said chickens were simple animals and wondered how much more there was to know."

As it turns out, there was an awful lot. And despite a host of major advances during his four-decade-plus career, the list of research questions continues to grow, says Classen.

Poultry is on pace to surpass pork and become the world's favourite meat by 2020, but there are key challenges, including dealing with higher feed costs and reassuring consumers who are increasingly concerned about animal welfare and food safety.

Classen is a leading figure in nutrition and welfare research, although he is quick to credit his many collaborators and research partners.

"I think one of my strengths is that when a research idea is raised, I recognize where there are issues — and I recognize that I can't do it all,"

Hank Classen

he says. "Multi-disciplinary research is not only much better, it's much more exciting to do."

And the science is increasingly complex. Take, for example, the simple question of how long to leave on the lights in a chicken barn.

The broiler chicken industry thought it had this one figured out decades ago. Chickens really do eat like birds, feeding a bit at a time and then taking 30- to 60-minute breaks. So, the theory went, keep the lights on longer — 23 hours a day in some barns — and they'll eat more often and grow faster.

"I'm sure I even taught this in my classes at one time," says Classen. "But my graduate student, Karen Schwean-Lardner, found the most rapid growth never came from 23 hours of light. Having longer periods of darkness was beneficial."

This discovery didn't come from just fiddling with the light timer.

First, there's a behavioural aspect.

"With the use of video cameras, we discovered sleep-deprived chickens were lethargic and the constant up-and-down feeding disturbed other birds trying to nap. Their comfort behaviours – such as preening or foraging – also decreased in frequency."

Other studies looked at physiological changes resulting in higher mortality (notably, heart problems), more skeletal problems, and reduced feed efficiency. Researchers are now looking more closely at the metabolic changes that occur during deep sleep (such as a slight drop in body temperature) and how that affects heart and bone development.

Research from Classen's team has not only prompted shorter 'days' in poultry barns; it has had an impact in other areas of poultry welfare and nutrition. Thanks to the $3.6 million in funding from NSERC and industry that came with the research chair, additional studies will build on the latter work by examining the impact of nutrition on bird performance, welfare and health, as well as food safety.

Today's chickens can reach two or more kilograms during their five- to six-week production cycle, but as with barn lighting, "the more we understand, the more we realize how much there is to know about poultry nutrition," he says.

"We started from a fairly crude basis," says Classen. "We knew we needed protein in the diet, and we realized amino acids are the building blocks of proteins. But we needed to know if the amino acids were digestible or not, in order to know whether the bird is getting use from them. We now have a good knowledge of amino acid digestibility, so our future research will focus on where the digestion occurs. Our hypothesis is that characteristic has an important impact on a number of criteria, including growth and performance."

'Where' is far from a simple question. Just as famed astrophysicist Carl Sagan used to rhapsodize about the "billions and billions" of stars in the cosmos, Classen and his collaborators are delving into the equally vast and complex world of an animal's digestive system.

"Billions and billions says it well," he says with a laugh. "There are more bacteria than cells in the body of a chicken, and the interactions are so complex. There are some 'positive' bacteria and when we see those bacterial populations go up, we seem to see healthier birds. But they're sitting in an ecosystem with a large number of other bacteria, so when you change the population of one bacteria, it has a phase-shift on other populations."

It's research tailor-made for Classen's multi-disciplinary, collaborative approach.

For example, one of the areas he and his team will be looking at is the digestibility of peas, which are widely grown on the Prairies and could be a lower-cost ration. But they are also more slowly digested, and the research will look beyond just feed efficiency and examine how this changes what is happening in a chicken's gut and how it affects its metabolism.

"The digestive tract is an amazingly important tissue," notes Classen. "It doesn't just digest and absorb, it also has to prevent infection by blocking pathogens."

In this vast but microscopic world, all sorts of things are happening – from the rate of glucose release as starches are digested, to the health effects of "fermentation products." The macro picture is complex, too, with issues ranging from using nutrition to reduce antibiotic use to feeding the world's growing population.

"We're not talking about 10 chickens in someone's yard, which was what I thought about when I was a kid," he says. "Chicken production is massively important, and will have a very large impact on feeding the billions of people who will be here by 2050." So more than four decades after Classen broke the bad news to his dad, there remains much to do, and the NSERC and industry funding will only be a start.

"I'M GUESSING A BIG CHUNK OF WHAT WE'RE DOING WILL PROVIDE AMMUNITION, SO TO SPEAK, FOR ANOTHER GENERATION OF SCIENTISTS TO TAKE FURTHER."

"We've planned some research that will have immediate benefits and can be put in practice in one or two years. But I'm guessing a big chunk of what we're doing will provide ammunition, so to speak, for another generation of scientists to take further."

Taking the Leap

THE ROAD TO INNOVATION IS OFTEN PAVED WITH UNCOMFORTABLE EXPERIENCES — BUT AWARD-WINNING EDUCATOR KEN VAN REES IS GLAD HE STEPPED OUT OF HIS COMFORT ZONE

Ken Van Rees poses in the Kenderdine Art Gallery, located in the Agriculture Building.

By Glenn Cheater

It's a pretty nice feeling, accepting a prestigious teaching award while the audience enthusiastically applauds.

It's the exact opposite, standing in front of a group of students not knowing if you're about to totally embarrass yourself.

Ken Van Rees has experienced both, and says the former would never have happened if he hadn't been willing to risk the latter, after getting "this weird idea" that painting and soil science might go together.

"Going in, I had no idea of how the students would react," Van Rees says of the first time he added painting to a soil science field trip. "I never asked, but I suspect some of my colleagues wondered what the heck I was doing, too. I was definitely way out of my comfort zone."

Of course, it all worked out, which is why the soil science professor has added the Desire2Learn Innovation Award to a long list of teaching awards, including the university's Master Teacher Award. It shows how taking a creative approach to teaching can pay dividends — but also how unnerving it can be setting out on a new path.

Van Rees's journey started with a visit to his mother's in 2004, which included a tour of the McMichael art gallery north of Toronto, home to many paintings by the Group of Seven.

"I can't remember if it was an A.Y. Jackson painting or one by Tom Thompson, but it was one of the larger ones at the back of the gallery," recalls Van Rees. "I was just overwhelmed by what the artist had done. I thought, 'The landscape he depicted is so wonderful. Why couldn't my students try to do that, too?'"

At the time, Van Rees was preparing a new course called *Soils and Boreal Landscapes*. It would include a field trip during which students would dig soil pits, study vegetation, and look at how the two were related. Adding a bit of painting wouldn't be a logistic challenge. But teaching it would.

"My life was totally devoid of art," says Van Rees. "I knew nothing. And I mean absolutely nothing. I had heard of the Group of Seven, but I never went to galleries. I knew nothing about painting or drawing, or even what primary colours were."

Still, the idea wouldn't go away. So he turned to his sister-in-law, a high school art teacher, for advice.

"She said, 'Go for it. Just keep it simple.' She said to get oil pastels because they could be used in any weather conditions, and gave me some paper and a few rules."

Her primer was very basic — why you should use both thick and thin lines; the difference between shapes (which have width and height) and forms (which are three dimensional); and complementary colours. Van Rees didn't do much with the notes — he was still too uncertain to be talking the language of painting — but took to heart her advice to keep it simple.

Bringing oil pastels was a good move, and so was bringing a big tarp — which was hastily erected on the second day when snow began to fall even though it was only the first week of September.

"But the students were very gracious and enthusiastic, and I thought there was enough there to take it further."

But again, the fear factor came into play. Van Rees decided he'd better take an art class and he still winces at the memory.

"It was intimidating and it was embarrassing," he says. "I'm in this room with all these people who are painting up a storm and I didn't even know how to mix colours. It was a big stretch for me because I'm a guy that likes to be in control."

These days, it's Van Rees who is painting up a storm. He has painted hundreds of landscapes (and abstract versions of them), become part of a painters' group (dubbed Men Who Paint) which regularly mounts shows, and also sells his work online (kenvanrees.com). And he's become a fan of creativity experts such as Sir Ken Robinson, who advocates a broad educational experience, and Steven Johnson, who talks of how "collisions" between different academic fields can spark innovation.

This is why Van Rees and art professor Allyson Glenn came up with a course in which soil science and fine arts students create art from paint made with pigments they have forged from soils and bones.

Although his teaching career spans 24 years, Van Rees says he still has much to learn about how to foster creativity and exceptional learning experiences. But he's discovered a few of the elements.

First, he says, don't be afraid to try something different. Plunging into art was a big scary leap, but little jumps are also important.

"I don't know where that idea came from, but the other day we had a classroom debate on what is the biggest global issue related to forestry — deforestation, global warming or something else," he says. "We did a ranking and had a discussion and then I said, 'OK, pull out your phone, text your friends, and ask what they think.'"

The students loved it ("Alright, we get to use our phones in class!"), but Van Rees just wanted to see "where it might lead."

Pulling people out of their usual environment is another thing that fosters creativity. At the Desire2Learn Innovation Award event in June, the five winners spent a morning sharing insights into teaching. And then they did something completely different.

"In the afternoon they took us to the Kingston Penitentiary for a tour. It was very different, believe me. It goes back to the Steven Johnson thing — that when you immerse people in a completely different environment, sometimes creative ideas happen."

In this case, Van Rees wasn't inspired to create some sort of soil science and criminology course, but that's not the point, he says.

"Before they paint, I always tell the students, 'Don't have any expectations of your work. Just have fun,'" he says.

> **"JUST GO OUT AND PLAY. I THINK WE'VE LOST THAT ABILITY AND I THINK THAT NEEDS TO BE PART OF THE STUDENT EXPERIENCE – LEARNING SHOULD ALSO BE ABOUT PLAYING AND HAVING FUN."**

And that's the other key element.

"This is something I've learned from other artists. Just go out and play. I think we've lost that ability and I think that needs to be part of the student experience — learning should also be about playing and having fun."

What Lies Below

SOILS ARE CRITICAL FOR LIFE ON EARTH, BUT HOW THEY FUNCTION IS A MYSTERIOUS PROCESS THAT SCIENTISTS LIKE DEREK PEAK ARE JUST BEGINNING TO UNRAVEL

By Glenn Cheater

In a field in Niger, a woman carries a pail of fertilizer. She stops beside each millet stem poking out of the dusty soil and, using a bottle cap, sprinkles a bit of its precious contents beside each stem.

Half a world away, a tractor costing nearly a half-million dollars and pulling a massive air seeder is laying down canola and fertilizer in an 80-foot-wide strip. The goal is to place each tiny seed a half-inch into the ground and then 'band' a mix of phosphorus and nitrogen fertilizer two inches to one side and two inches deeper than the seed.

The contrast seems so immense, but the two farmers have much in common. Both fret over the cost of their painstakingly applied fertilizer and hope Mother Nature provides sun, rain, and the right temperatures at the right time.

And although our Saskatchewan farmer studied plant nutrition and soil chemistry at college, how those nutrients make their way through that soil is as mysterious to him as his West African counterpart. But it's a mystery Derek Peak and other soil scientists are beginning to unravel, thanks in part to new technology.

"There's no question that in soil chemistry we're able to measure and analyze in ways we were never able to before," says the professor of environmental soil chemistry.

"Even when I was a graduate student, we often couldn't look at a whole soil with the techniques we were using. We would have to ask, 'What minerals do we think are important?' or 'Is it organic matter that is important?' Then you would extract these different phases and do experiments.

"Now we look at whole intact soils all the time. The advent of synchrotron science has been a major advance for soil chemistry and fertility. The challenge is to disseminate those results." Peak is part of a group of researchers (funded by Canada's International Development Research Centre) who have used the Canadian Light Source synchrotron to study West African soils subjected to fertilizer 'micro-dosing.' He is also part of a team examining how phosphorus applied in a band in Saskatchewan fields becomes available to plants.

It's high-level academic research, but also critical to dealing with the big challenge of our time.

"We're looking at the world having 10 billion people by 2050, so we need to intensify agriculture," says Peak. "That's going to take fertilizer, and just like fossil fuels, fertilizer is a finite resource.

"It's a really important area of science. We are starting to develop a clear picture of soils and how to make the right decisions so we can make agriculture sustainable."

Sustainability is critical for the semi-arid Sahel belt of West Africa, where the population is rapidly expanding but crop yields are not. The region should be ripe for micro-dosing, which can double yields with just a quarter of the usual amount of fertilizer.

> "WE ARE STARTING TO DEVELOP A CLEAR PICTURE OF SOILS AND HOW TO MAKE THE RIGHT DECISIONS SO WE CAN MAKE AGRICULTURE SUSTAINABLE."

But only five to 10 per cent of farmers are using the technique, says Peak.

"One of the concerns is that if you're only putting on a small amount of fertilizer and yields are doubling, you may be mining the soil, degrading the land, and creating an unsustainable system in the long term."

Sahel soils have very low levels of carbon — 0.2 to 0.3 per cent — and there's no practical way to build them up. (Leave any stubble on your fields and your neighbours will graze their livestock or collect it as fuel.) Soil testing found micro-dosing wasn't depleting carbon levels, but the why wasn't known and so fears of soil mining remained.

But the synchrotron opens up a new window on what is happening below ground. Carbon comes in many forms — including carbohydrates, amino acids, carboxyls, phenols, and ketones — and the Light Source can tell you precisely how much of each.

"So we can see how the types of carbon are changing because of agricultural practices," said Peak. "What we're really doing is taking a fingerprint of carbon in the soil."

The analysis conducted by Peak and his team showed micro-dosing was creating more readily bio-available carbon, which drove the yield increases.

"Micro-dosing isn't making things worse than normal agricultural practices in that area," says Peak. "Long term, we're not going to see major improvements unless we change those agricultural practices, but this could be a gateway, a stepping stone, to allow that to happen. If you can get a little bit of fertilizer into the ground at the right time and double yields, then you improve incomes and food security. Then farmers have the opportunity and means to employ more advanced agronomic practices."

Agronomic practices have been advancing by leaps and bounds in the West, but here, too, Light Source — and some plywood — are providing important new insights.

In this case, it's the phosphorus cycle in soil. Using the synchrotron to look at the "whole soil" would provide a wealth of knowledge. However, you can hardly take a device as big as a football field out to a farm.

So instead, Peak's research team, in collaboration with the soil fertility program of departmental colleague Jeff Schoenau, took shovels out to the field along with half-sheets of plywood, studded with nails.

"We used flags to mark where fertilizer was placed in the field and at different times of the growing season, we would dig a soil pit across the band, pound the plywood into the side of the soil pit, and then take the entire monolith of soil back to the lab."

Those clumps of soil clinging to the nails allowed the researchers to measure pH, adsorption, mineralization, soluble and fixed P, leaching potential, and other factors — and know what was happening where.

It's complex research, but with a clear bottom line. Banding fertilizer is the smart choice both environmentally and in terms of nutrient-use efficiency, but it also has to be the best economic choice for farmers, says Peak. The hope is whole soil research will lead to improvements in banding technology that promote both efficiency and profitability.

Peak is quick to note the magic of the synchrotron is only part of the equation. Technological advances in other areas are also allowing research that was impossible even a few years ago, he notes.

"Molecular biology and genomic techniques have given us an enormous wealth of information about the biota that make up the soil — the things that make soil alive. Modern techniques have really changed soil science."

For the farmers growing millet or canola, the focus is all on what happens above the ground. But Peak is hopeful modern soil science will give people a new appreciation of what happens below their feet.

"I just find soils so fascinating — I guess that's why I'm a soil scientist — but they really are the critical zone for how the Earth functions," he says. "They are the skin of the planet where all the important stuff happens that sustains life." ■

Derek Peak stands in Canadian Light Source Synchotron ▼

AgBio Grad Makes her Mark on Saskatchewan's Food Economy

By Brittany Stevens

From a very young age, Rachel Buhler (BSA '02, MSc '05) knew that she would have a career in agriculture. Growing up on a mixed dairy and grain farm in Osler, SK she was exposed to the industry very early on.

"I always knew I wanted to farm, but I was intimidated by the physical demands of dairy farming," she says. "So I started brainstorming ways to pursue agriculture on a smaller scale."

Floating Gardens Ltd., the greenhouse Buhler co-owns and operates with her brother Chris, is the result of such brainstorming. Located just outside of Osler, the mandate of the greenhouse is to grow fresh, high quality food.

"I read an article that really stuck with me," says Buhler. "It said that Saskatchewan only grows 4.7% of their own fruit and vegetables. Compared to Manitoba and Alberta at about 40% each, our number seemed very small."

Seeing a huge potential for growth in Saskatchewan, Buhler came up with t he idea for Floating Gardens during her last semester as an AgBio student. Daunted with the task of deciding her next step after graduation, Rachel applied for BioVenture Challenge, a program funded by the university's Industry Liaison Office.

Rachel Buhler and her brother Chris Buhler

The program, which helps aspiring entrepreneurs translate their business ideas into a start-up company, works closely with the applicants helping them put together a detailed business plan that they later present to a panel of judges.

The idea for Floating Gardens, helped Rachel and her brother beat out four other finalists for the $50,000 grand prize and throughout the process Rachel relied heavily on the relationships she had built with AgBio faculty.

"This program was so essential for us," says Rachel. "A business plan alone can cost upwards of $10,000 so having an opportunity to work closely with someone who knows the process was very rewarding."

Buhler says that business was never her area of expertise, so she worked closely with economics faculty from the Bioresource Policy, Business and Economics department to compile her application.

The 24,000 square foot greenhouse occupies a half-acre of land and uses the hydroponic growing method—half the greenhouse is outfitted with reusable bins using coir, ground coconut shells, in place of traditional soil and rock wool slabs.

The other half of the greenhouse contains non-fruiting crops such as basil and lettuce varieties grown in float culture. These crops float on reusable trays, with their roots submerged, unencumbered in fertilized waterbeds.

These growing methods are important as they help cut down on waste, and allow Floating Gardens to be as environmentally sustainable as possible.

Operating a year-round greenhouse is not without challenges, however, and has been a steep learning curve for the brother-sister duo. Of those challenges, heat and climate control in harsh Saskatchewan winters, along with pest control are the major players.

Floating Gardens Ltd. opts to take a less conventional route for both using wood diverted from landfills in place of gas, and biological controls instead of conventional bug sprays to ward off harmful insects.

"THE AGRICULTURE COMMUNITY CERTAINLY EXTENDS BEYOND THE WALLS OF THE UNIVERSITY, AND I AM ALWAYS GRATEFUL FOR THEIR ADVICE AND THEIR WILLINGNESS TO ANSWER MY QUESTIONS."

No matter the challenge however, Rachel is quick to credit her training and the skills she acquired in university. "Looking back," she says, "I think about how I've learned to solved problems and ask good questions. Being humble and finding the right people to ask has been very useful as we tackle day-to-day challenges." She also credits the support from college faculty as a factor in her success.

"I often run into my former professors and colleagues," Rachel says. "The agriculture community certainly extends beyond the walls of the university, and I am always grateful for their advice and their willingness to answer my questions."

"Even years later, it's so nice to still have that support from the college and the ability to maintain relationships, as we continue to grow our business."

There are plans to expand Floating Gardens over the next few years, but for now the Buhlers are content with maintaining their current crop assortment, which includes tomatoes, eggplant, cucumbers, and a variety of lettuces and herbs.

"We have up to 27 different crop varieties in the greenhouse at any given time," says Rachel. "That is unusual, as most greenhouses would grow just one single crop in large quantities. We are more like a market garden under one roof."

With a Canada Gap food safety certification, Floating Gardens has the ability to sell their produce to large grocery store chains, but for now is sticking to their niche market: the Saskatoon Farmer's Market and local restaurants.

She adds, "I know we can't drastically change that 4.7%, but we are attempting to make a difference by supplying high quality, local food to Saskatchewan in any way that we can."

The (really) Inside Story

ANIMAL WELFARE CRITICS ARGUE CATTLE AREN'T DESIGNED TO EAT GRAIN, BUT GREG PENNER'S RESEARCH SHOWS THERE'S MUCH MORE TO THE STORY

Greg Penner

By Glenn Cheater

Naturally raised beef is all the rage these days. After all, cows meandering in pastures make for prettier pictures than those huddled in feedlot pens.

But critics of 'industrial farming' also argue Mother Nature designed cows to forage, and that a grain diet is unnatural and leads to serious health problems.

A condition called acidosis is at the heart of this criticism. The ruminant version of heartburn, acidosis is typically sparked by eating feed high in starch or sugar, which results in a sharp drop in pH. Low pH is acidic, and repeated bouts of acute acidosis can result in nasty outcomes — such as liver abscesses and lameness — that fuel criticism of feeding cattle grain.

But research by Greg Penner is shining a new light on the 'cattle weren't meant to eat grain' debate.

"Actually, we can't say acidosis is an issue only caused by feeding grain," says the associate professor of animal and poultry science. "People perceive grass as being more beneficial, but acidosis can occur in grazing cattle when there's lots of sugar in the grass."

That fact has been known for a long time. But Penner, whose work in ruminant nutritional physiology earned him the award of a Centennial Enhancement Chair earlier this year, is delving much deeper than past researchers could.

It's a story that starts with a very clever invention he created as a Masters student and ends with insights into how cows share

a bad human habit that comedian Louis C.K. calls "eating until I hate myself."

But first, Penner's cool invention.

Researchers have long measured pH via a process called fistulation, in which a removable plastic device (called a cannula) is surgically inserted into the side of an animal allowing access to the rumen. It's not the most pleasant way to measure pH and has a serious drawback — acid levels in the rumen can fluctuate dramatically in a matter of minutes. So it's not easy to get a true picture of what's happening if you have to physically collect a sample for every test.

By the time Penner was taking his Masters in 2005, the process had been automated — but there was a catch.

"Automatic pH measurement required the cow to be hardwired to a data logger and the data logger hardwired to a computer," he says. "I needed to be able to measure pH in an animal that wasn't tied up in a stall, so I was looking for a way to get rid of those cords."

His solution was to buy some compact data loggers and put them in a water-tight capsule. It worked so well, other researchers wanted them and Penner asked a company to manufacture some. The company recognized there was a global market for the device and has since sold about 500.

"My mistake was not getting licensing rights," Penner says with a laugh.

But the loss in royalties was offset by a big leap forward in research capability. Fistulated animals require special care and so they're kept at research facilities. But Penner's device could be used in a commercial feedlot — the cow simply swallows the small device, which is retrieved from the rumen once the animal is slaughtered and its data downloaded.

This allowed real-world testing. Using this new technology, Penner measured the pH levels in the rumen of 30 feedlot steers with measurements occurring every 15 minutes until the cattle were slaughtered 141 days later. Penner expected the test would confirm a rich grain diet causes frequent bouts of acidosis.

"Based on the literature, we had some preconceived notions as we went in," he says. "We thought the greatest risk would be as we transitioned cattle from a forage diet to the high grain finishing diet, and then maybe again at the end at the finishing when they've been on the grain diet for a long time. But that wasn't really the case."

The study found the feedlot steers, on average, were experiencing acidosis one to two hours per day — far below the six to 20 hours a day that earlier studies had recorded.

So why the difference?

It will take further investigation to definitively answer that question, but there's a big and obvious difference between a feedlot and a research facility.

"Most of the previous studies would have housed animals individually in a pen, so they could make very detailed measurements on each individual," says Penner. "What we think is happening is that when you house an animal by itself, they change their eating habits."

It's a little like the difference between a big family dinner and binge-eating, Louis C.K.-style. It turns out feedlot cattle don't simply stick their head in the trough and eat until they're stuffed. They mill about and have continuous bovine interactions, including the old favourite of bumping another steer out of the way because the animal decides it wants that exact spot at the feed bunk.

However, a cow or steer by itself appears to eat more out of boredom.

"That seems to be the case," says Penner. "Intake is a bit higher, even when we put in, for a lack of a better term, toys for the animals to play with and also give them nose-to-nose contact with other animals so they're not socially isolated. It's just different."

The study shows feedlot operators are doing a better job than they've been given credit for, he says, but also opens the door to further improvements. It's common practice to re-sort animals in the feedlot to keep ones of the same weight, for example, in one pen. But that may disrupt feeding patterns, as it takes a while for a new social hierarchy to be established, notes Penner.

"We think that may be another risk factor, although we haven't been able to test that yet."

Penner's research wasn't designed to settle the grass-versus-grain debate. But it is replacing conjecture with hard scientific data.

"I'm not advocating either — there are pros and cons to each," he says. "But I think people need to understand the amount of forage you need to produce a kilo of beef is very large relative to cereal grains. Feeding a high-grain diet allows us to improve efficiency in cattle production.

> **"WHEN I TALK ABOUT EFFICIENCY, I'M ALSO TALKING ABOUT ANIMAL WELFARE, BECAUSE THAT IS A KEY PART OF IT."**

"And when I talk about efficiency, I'm also talking about animal welfare, because that is a key part of it." ■

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We would like to acknowledge and celebrate those who have arranged planned gifts for the College of Agriculture and Bioresources. Making these arrangements today help shape and secure our college's future.

The Heart of Higher Learning

THE GEDDES GRADUATE SCHOLARSHIP IS BOTH AN ACT OF GENEROSITY AND A TRIBUTE TO A FAMILY'S LOVE OF LEARNING

Marguerite, the daughter of Daniel Geddes for whom the Geddes plum was named.

By Glenn Cheater

It was their aunt's 100th birthday that got Keith and David Geddes thinking about the past — and the future.

"We celebrated Aunt Marguerite's 100th birthday this past June 30th, and that's what instigated our family's thought process and how we might mark that milestone," says Keith Geddes. "That was when we thought about commemorating her father Daniel, our grandfather, at the same time."

The result was a gift to establish the Geddes Graduate Scholarship in plant sciences, along with the planting of a "Geddes Plum" tree at the Patterson Garden Arboretum on the U of S campus.

Both tell a story about what's at the heart of higher learning.

Daniel Geddes was struggling to make a go of dryland farming in Weyburn a century ago when he began seeking advice from the then Department of Horticulture. That's how he got to know Cecil Frederick Patterson, who would become renowned for developing Prairie-hardy fruits and flowers during his 39 years as department head. The relationship continued after Geddes moved to Paynton, 60 kilometres north-west of North Battleford: The farmer seeking advice on agronomic issues and helping Patterson test hybrid varieties of fruit trees.

But something else was taking root on the Geddes farm, an intellectual curiosity that spanned the generations.

"My father (Elmer) was always up on the latest developments from the university on crops,

▲ *Keith and David Geddes*

how to prevent soil from eroding, and that sort of thing," recalls Keith Geddes, a Class-of-69 grad.

He encouraged his children to explore their "academic bent" and Marguerite helped make it possible by opening her Saskatoon home to the boys (and many other nephews and nieces) when they attended university. While both loved farming, it was David (a vocational ag grad) who would take over the family farm while Keith decided to become a mathematician.

In those days, math was not a sexy career choice ("What can you do with that except teach?" Geddes' high-school guidance councillor disdainfully remarked), but it captured the young man's imagination. He was especially intrigued by a strange new thing called 'computer programming.' And so was his father.

"He was very interested in my studies and very keen when he heard I wanted to go into computer science," says Geddes.

This was long before the rise of Silicon Valley, a time when a computer program consisted of several hundred stiff cardboard 'punch cards.' Each card represented a single line of code and it took hundreds of them to run a very simple program.

Things had advanced greatly by the time Geddes earned his PhD in 1973 and joined the computer science faculty at the University of Waterloo. But computers were massive, hugely expensive things housed in rooms and mathematicians could only get a precious few hours of programming time a week. But personal computers were appearing on the scene, and the farm boy from Paynton realized this was a game-changer.

In the 1980s, Geddes and colleague Gaston Gonnet earned international renown for inventing the Maple computer algebra system. Maple programming language allowed symbolic mathematical computations — which are essential for doing algebra and calculus — to be done on low-cost personal computers. Universities around the world snapped up the system and the duo soon founded Waterloo Maple Inc. (Now called MapleSoft, it is a subsidiary of Japan's Cybernet Systems.)

It's a great Canadian success story, and something quite magical when you consider how it came to be. A farmer in the horse-powered age of agriculture writing letters to a university asking how to deal with crop problems. A plant scientist responding and asking if the farmer would help test new fruit tree hybrids. A love of learning becoming a multi-generational family tradition. A young man feeling free to set aside career concerns to pursue a passion and see where it might lead.

The particulars of his family's story are unique, but Geddes says he would advise any student to let curiosity — not a 'sensible' career choice — be their guide.

"This was something I said at the commemoration ceremony: Find something that you're passionate about," says Geddes. "I don't think it works when parents say, 'Son, you must take that course.'

"You better be passionate about what you're doing. Whatever it is, there will be tough slogging at times but if you have that passion, it will work out well." ■

> **"THERE WILL BE TOUGH SLOGGING AT TIMES BUT IF YOU HAVE THAT PASSION, IT WILL WORK OUT WELL"**

Canadian Feed Research Centre Comes Online

By Michael Robin

Canadian feed researchers now have a powerful new set of tools coming online at the Canadian Feed Research Centre (CFRC) to help turn crop and bioprocessing byproducts into consistent, nutritious feed for food and companion animals – plus added value for farmers and consumers.

"Feed accounts for 60 to 70 percent of the production costs of animal protein such as meat, milk and eggs," said Tom Scott, research chair in feed processing technology at the College of Agriculture and Bioresources.

Scott explained that since animal feed ingredients are generally sourced from lower quality feed grains and process byproducts, they vary greatly in their physical and nutritional characteristics. Some examples of ingredients include feed-grade grains and crop byproducts such as pea hulls, as well as distillers grains from brewing and canola meal from crushing plants. While the characteristics of these ingredients are well known, putting them together into consistent, high-quality feeds poses challenges.

"We're exploring the potential for using processing and additives to see how they interact with various ingredients alone or in different combinations used to produce a complete diet," Scott said. "We want to better understand how we can use processing – and feed additives in combination with processing – to more consistently produce a high quality, safe and efficient feed source regardless of the variability of the ingredients."

Dignitaries gathered in North Battleford in late October 2014 for the grand opening of the CFRC – but they met at the Western Development Museum, since operations and biosafety protocols were already in full swing. The $13.9 million facility is a joint venture of the University of Saskatchewan, the Saskatchewan government, the Canada Foundation

for Innovation, Western Economic Diversification, and Cargill Ltd.

The only facility of its kind in Canada, the CFRC features a full range of feed processing equipment. This includes the latest feed mill equipment, such as rolling, grinding, mixing, pelleting and vacuum-coating for coated feed products.

The CFRC and the handful of similar facilities in the world have full pilot-scale feed mill capacity, but the Canadian facility has the added advantage of a full industrial-scale processing line. This means new formulations and processes developed at the pilot scale can be scaled up to commercial scale so full market competitiveness analyses can be conducted.

Scott explained that while some portions of the CFRC are still being tested for operational control and accuracy, researchers and technicians are already hard at work.

"We have been producing some research diets but we are still working out some issues, for example with process control that increase the time and labour needed," he said. "We have however managed to provide research diets for the poultry research centre, Rayner dairy, beef feedlot, and Prairie Swine Centre."

The tools that researchers can bring to bear as the CFRC comes fully online are formidable. For example, a near-infrared reflection (NIR) system – the first of its kind at a feed mill in Canada is being installed. It captures an estimate of physical and chemical characteristics of feed ingredients every five seconds.

This means, for instance, that if the protein content of a stream of wheat going into a formulation suddenly changes (for example if the bin contained wheat from different sources), the computerized system detects it and adjusts the other ingredients to compensate on the fly.

"John Smillie, (manager of the CFRC and PhD candidate)is working with NIR and other technologies to see if they can make it easier to produce consistent quality in pelleted feeds," Scott said. "It's often referred to as the 'art of pelleting.' We hope to change this to a science."

The CFRC is also the first site in North America to install and evaluate the BoMill TriQ seed sorter, a Swedish-built technology capable of scanning characteristics of individual kernels. Examples include crude protein, starch, moisture, and grain hardness. The TriQ system can sort 30,000 seeds per second, which translates into three metric tonnes per hour. The units can be run in tandem, so 10 units could handle enough volume to service a typical inland grain terminal.

Scott explained that industry partners brought in two other seed sorting technologies to test against the BoMill TriQ in early December, 2014. About 50 producers and industry people participated in the demonstrations.

The impact of seed sorter technology could be profound. For example, on average, 20 per cent of Western Canadian grain – about eight million tonnes, depending on the year – is graded as feed. Farmers' grain can be downgraded by the presence of as few as one per cent of kernels showing signs of germination or sprouting. This can cut the farm gate price by a third or more.

"We're looking at samples of wheat, barley and durum to determine what percentage of samples graded as feed could be salvaged as high-value grain," Scott said, adding that another project is looking at seed sorter technology to help address the problem of *Fusarium*-contaminated grain. The fungal disease produces toxins that pose a hazard to both animal and human health.

"One of our graduate students, Michael Kautzman, is writing up the results of his research on removing *Fusarium*-damaged kernels of wheat and its effect on the safety of feed for broiler chickens," Scott said.

Scott and his colleagues are also looking at opportunities to produce and export complete processed feed using mostly Saskatchewan ingredients, adding value in the province rather than simply exporting raw materials.

> **"BEING ABLE TO DEMONSTRATE HOW THESE PIECES OF EQUIPMENT WORK, OPEN THEM UP AND VIEW THEM HAS MUCH MORE SIGNIFICANT IMPACT THAN SIMPLY WALKING THROUGH A COMMERCIAL PLANT."**

"There are successful examples of this, but the new CFRC facilities allow us to develop other opportunities – and produce sufficient material for testing in international markets," Scott said. "Success in this area will have benefits for crop growers, producers of byproducts such as canola meal, pea hulls and distillers dried grains, and of course the feed processing industry."

For the university, the CFRC is a major advantage not only for research but to enrich the education of students with hands-on experience in feed processing, right from small batch pilot runs to full-scale commercial operation.

"Being able to demonstrate how these pieces of equipment work, open them up and view them has much more significant impact than simply walking through a commercial plant," Scott said. "This facility provides major opportunity for teaching, learning, and research at all levels." ■

College Receives $5 Million Boost to Support Research in Ag Policy

The department of Bioresource Policy, Business and Economics (BPBE) received a $5 million boost from the Canadian Canola Growers Association (CCGA) in 2014, to support agricultural policy research initiatives.

The funding is aimed at establishing a faculty chair position in agricultural policy research that will encourage students to explore a broad range of policy issues and delve into important fundamental aspects of the industry.

"This gift will support both graduate and undergraduate-level teaching and mentorship, and will help build strong partnerships among our college and industry stakeholders as we work to identify important policy issues," said Bill Brown, head of the BPBE department.

With agriculture playing such an integral part in the province's economy, CCGA's contribution will further expand the college's research capacity, examining policy areas such as: international trade, transportation, labour, crop innovations and issues specifically related to the canola sector.

"Canola is an important crop internationally, as it is used for both food and fuel, says Brown. "The research conducted within the parameters of this gift, will provide policy guidance not just for managing these two conflicting uses, but also for new and emerging policy issues."

Policy plays an important role in Saskatchewan's agriculture industry, and understanding the foundational elements are essential for the growth and expansion of the industry to a global scale.

"Ag policy decisions have a dramatic impact on the day-to-day operation of our farms," said CCGA President Brett Halstead, a farmer near Nokomis, Saskatchewan. "While ag policy may not be the main topic of conversation during harvest or seeding, it is an essential foundation that impacts the economic, social and environmental sustainability of our farms."

The College of Agriculture and Bioresources has a long, rich history of industry partnerships and such a significant contribution continues this tradition, and will enable the college to remain a leader in agricultural research in Canada. ■

An Unrelenting Foe

DARREN KORBER KNOWS E. COLI O157 ALL TOO WELL — AND WHY WE CAN NEVER DROP OUR GUARD AGAINST THIS DEADLY PATHOGEN

By Glenn Cheater

Every major incident of Escherichia coli O157:H7 contamination creates a furor. Is our food safe? What went wrong? Who is at fault?

The E. coli strain sickens more than 60,000 North Americans every year, and sometimes kills. Seven died and 23,000 became ill in Canada's worst incident when O157 contaminated the water supply in Walkerton, ON. in 2000. While there were no fatalities linked to contaminated beef at XL Foods's Alberta plant in 2012, it made national headlines and prompted a massive recall of beef products.

"E. coli O157 wasn't really linked with foods until the 1990s when the term 'hamburger disease' was coined following the incident at the (American burger chain) Jack in the Box and a few other outbreaks," notes Darren Korber, a professor of food and bioproduct sciences and an expert on the pathogen.

"Since then, there have been thousands and thousands of laboratory-confirmed cases. That's partly because the symptoms are so drastic and we've become very good at detecting it, but it really has spread."

Korber is a strong advocate of food-safety measures, but says they must extend from "farm to fork," and O157 outbreaks show this is a challenging concept for many consumers.

"There's really no reason for anybody to get sick from E. coli O157 from raw meat products," says Korber. "It bugs me when I see food thrown into the dump because E. coli O157 was detected in hamburger, as was the case with XL Foods. You cannot get sick from beef as long as it is handled and cooked properly."

> **"YOU CANNOT GET SICK FROM BEEF AS LONG AS IT IS HANDLED AND COOKED PROPERLY."**

It's also a misconception that this pathogen can be entirely eliminated from the food system, and Korber's extensive research into O157 shows why. Take, for example, his work on its ability to survive in soil.

"The general thinking used to be that these organisms don't survive very long out of the gastrointestinal tract," he says.

"But in sterile soils, you could detect them more than a year later and they even increased in number if you added water. These were organic soils with a bit of material for them to grow on. And you would see the numbers increase from, say, one million to 100 million cells per gram of soil in only a few weeks."

In another study, Korber found upwards of 60 per cent of feedlot cattle were infected with O157. It lives (harmlessly) in the cow's rumen and is constantly being excreted, not only contaminating the soil in the pen but clinging to the legs and bellies of cattle.

So it's inevitable it will show up at slaughter plants, and that presents a huge challenge. While these facilities use a variety of cleaning procedures, O157 is a determined foe. In a recent paper with colleague Sinisa Vidovic, Korber notes the genetic make-up of this variety of E. coli has given it "survival capabilities to endure a wide spectrum of stressors found within the human food chain."

Expose it to cold or heat, and O157 becomes better able to withstand extreme temperatures, and the same thing happens if you expose it to low pH. That's not good if your approach to cleaning is limited to using hot water with an acidic disinfectant in it.

And the pathogen's adaptive ability doesn't stop there.

"We often see something called cross-protection," says Korber. "If you expose them to low pH, for example, they become more resistant to high temperature or oxidative stress, and more difficult to kill."

Research has found O157 can even acquire resistance while in what's called the "stationary" phase when it's not actively growing, he notes.

"It's a bit like an onion — you keep pulling back layers and finding new ones below them," says Korber. "We're finding these organisms have multiple stress-response mechanisms and have evolved and developed very complex regimes to survive all of these things that we call 'insults' — UV irradiation, oxidation, pH, temperature, and other stresses. Their repertoire is really quite amazing."

The cattle industry would love to have a vaccine to eliminate O157, and one is licensed for Canada. But it's not a silver bullet

— it only reduces "shedding" of the pathogen in infected cattle. Even if you could develop one that was 100 per cent effective and lasted for a cow's entire life, it likely wouldn't be enough. O157 is not the only type of E. coli that produces the shiga-toxin that causes hemorrhagic diarrhea and, in severe cases, kidney failure, notes Korber.

"It would be nice to have a vaccine that was effective for O157 so we could get rid of it," he says. "But the truth is that it isn't the only one and, with time, another one would come along and replace it. In fact, we now test for various hemorrhagic non-O157 strains that include what is called the Big 6, which together cause more illnesses than O157.

"So I'm not harbouring any illusions that we can eradicate these organisms any time soon. We may learn something about it that could have general applicability to a whole range of pathogens that rely on similar infective mechanisms. But that's probably the best-case scenario."

However, that would be a big step forward in developing new defences against pathogens, and that is why Korber and others keep peeling back the onion layers, looking at things such as extracytoplasmic stress response and rpoE sigma factor (a regulator of stress response).

"We hope by understanding the molecular response, we will learn ways to interrupt the way these pathogens utilize these stress response pathways. That sounds pretty nebulous for the general public, but that's essentially what we're trying to do."

But the key message is plain: This is a battle centred around building multiple lines of defence, and not by eliminating the enemy.

"When we talk about food safety barriers against pathogens, we typically are referring to what we call 'hurdle technology,'" he says. "We want to set up as many barriers as we can against the pathogenic organism growing, surviving, or occurring in food."

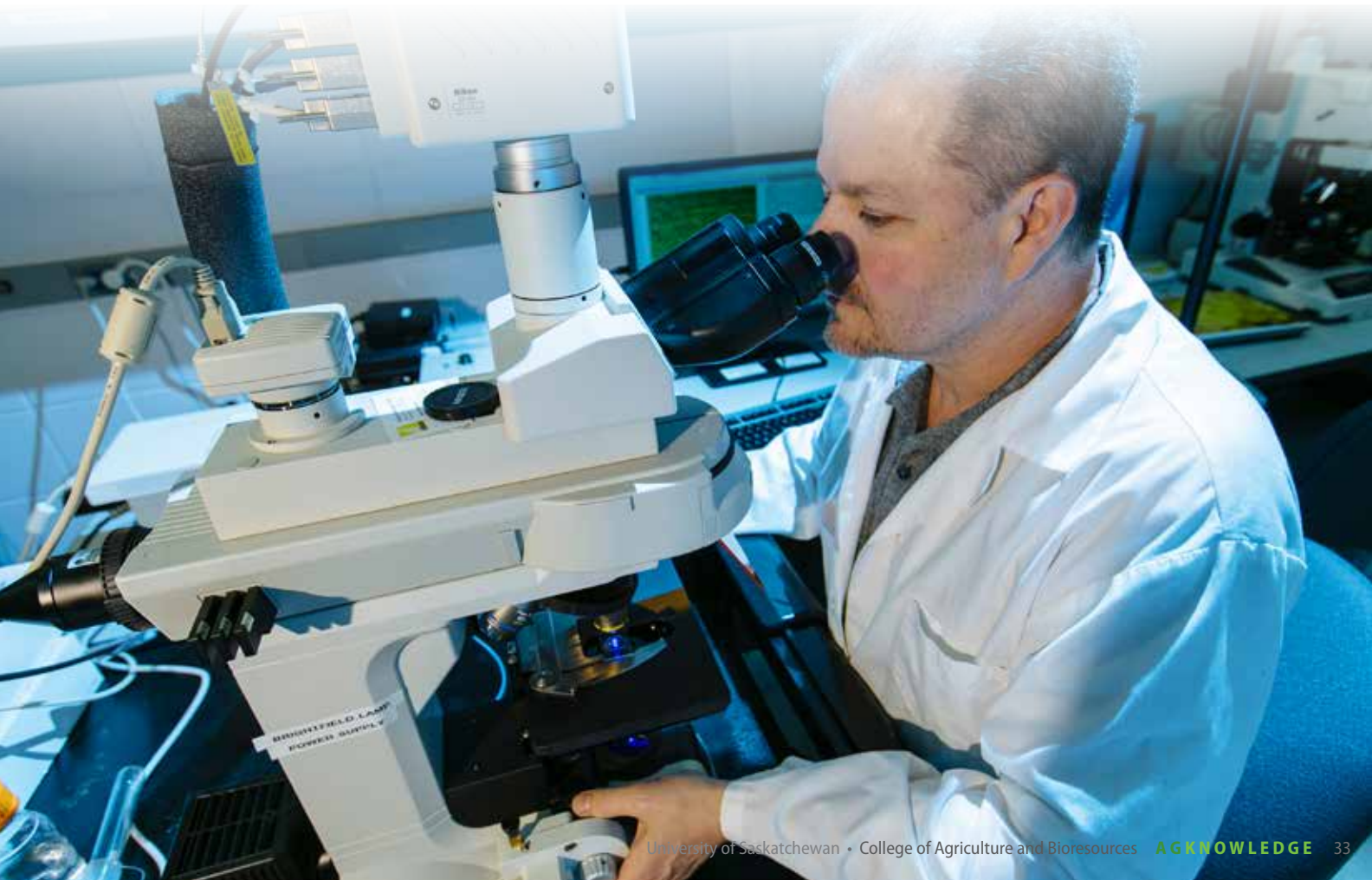
Reducing rates of infection in cattle, whether through vaccines or better management practices, is one part of that, as are all the prevention and control procedures in slaughter plants and food-processing facilities. An extensive monitoring and testing system has also been created to detect hazards and to sound a quick alert when something goes awry.

"You identify where the hazard may occur and you control that hazard," says Korber.

And that's the approach consumers must also take, he adds.

"People are getting sick and dying from some of these outbreaks, but science can't make E. coli O157 disappear," he says. "That's why consumer education is critical." ■

Darren Korber ▼

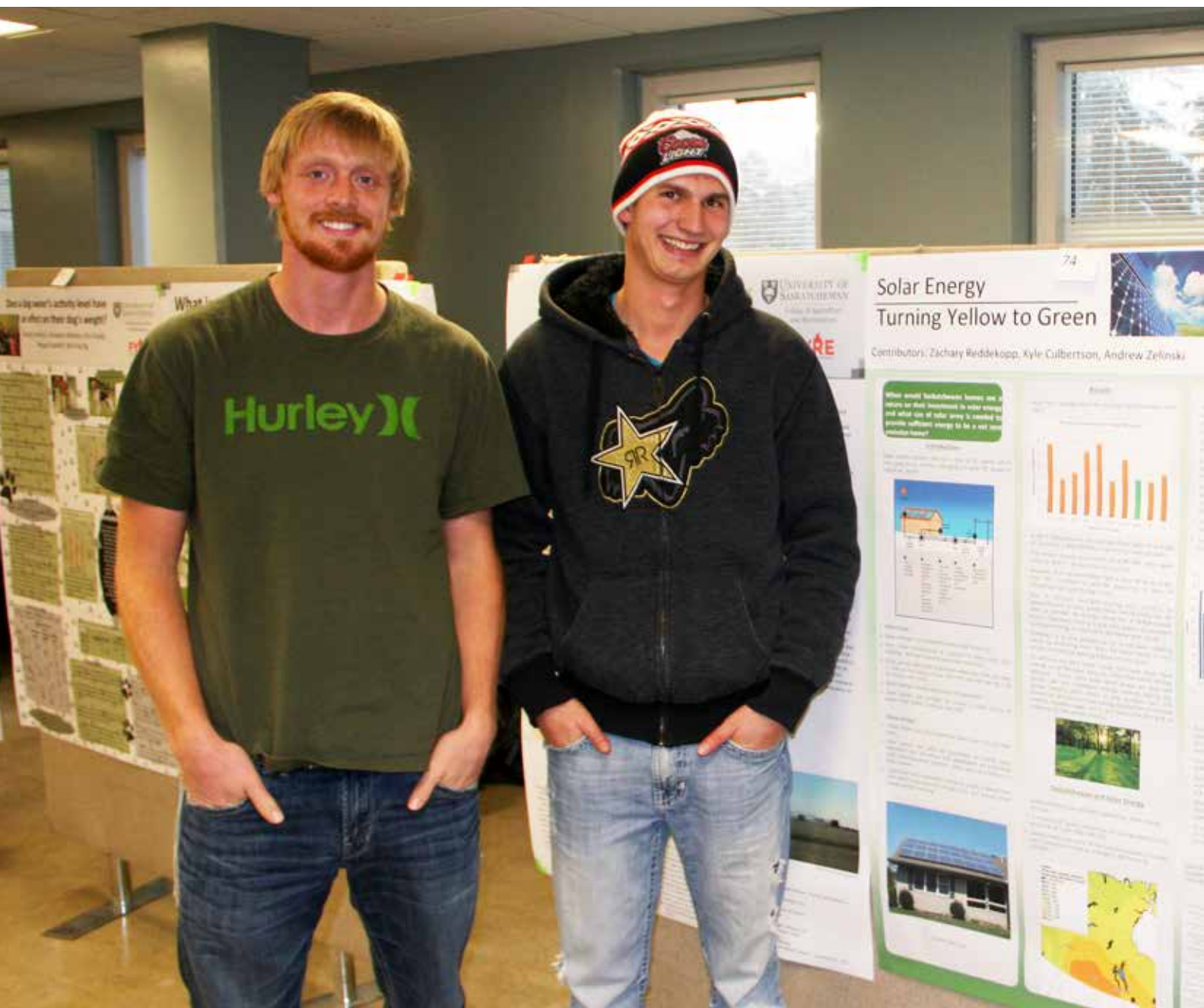


Research Opportunities are Changing the Face of the Undergraduate Student Experience

By Brittany Stevens, Photo by Ryan Brook

The College of Agriculture and Bioresources is opening doors for its undergraduate students to pursue unique and exciting research opportunities.

Co-directed by the Office of the Vice-President Research and the Vice-Provost Teaching and Learning, various research programs have been implemented by the college, to empower undergraduate students to take ownership of their learning and engage them in unique and exciting ways. The First Year Research Experience (FYRE) program, which includes every single first year student in the College, incorporates aspects of graduate studies to first year courses and was designed to help new university students find answers to questions using advanced research methods. The program



encourages students to think outside the box, and shift their way of thinking from what they've known in the past.

"Coming from high school, students often don't have the research skills necessary for university level courses," says Fran Walley, Professor in the Soil Science department. "FYRE provides them with hands-on learning opportunities, and encourages them to look outside popular media outlets and textbooks to find answers to complex questions."

"Programs like FYRE give students a chance to learn the process of science, rather than just memorize the information generated," says Murray Drew, a professor in the Department of Animal and Poultry Science. "Students, especially first years need to learn different skills—our goal was to improve their writing and develop useful skills like Excel, that will help them throughout their entire four years at university."

Under the FYRE initiative, students in three mandatory first year courses (Agriculture 111, Animal Bioscience 110 and Environmental Science 110) developed survey questions and data samples that aligned with course material. Students then spent lab sessions working in groups to research outcomes and compile results, which were then turned into research posters.

The end result was a poster session, held in the Agriculture atrium on December 3. Ninety-nine first-year research posters were displayed. Student posters were evaluated by faculty and graduate students, as well as their peers, and winning posters were picked in two categories: Judge's Choice and Students' Choice. The top posters were chosen based on a combination of creativity, clarity and visual appeal.

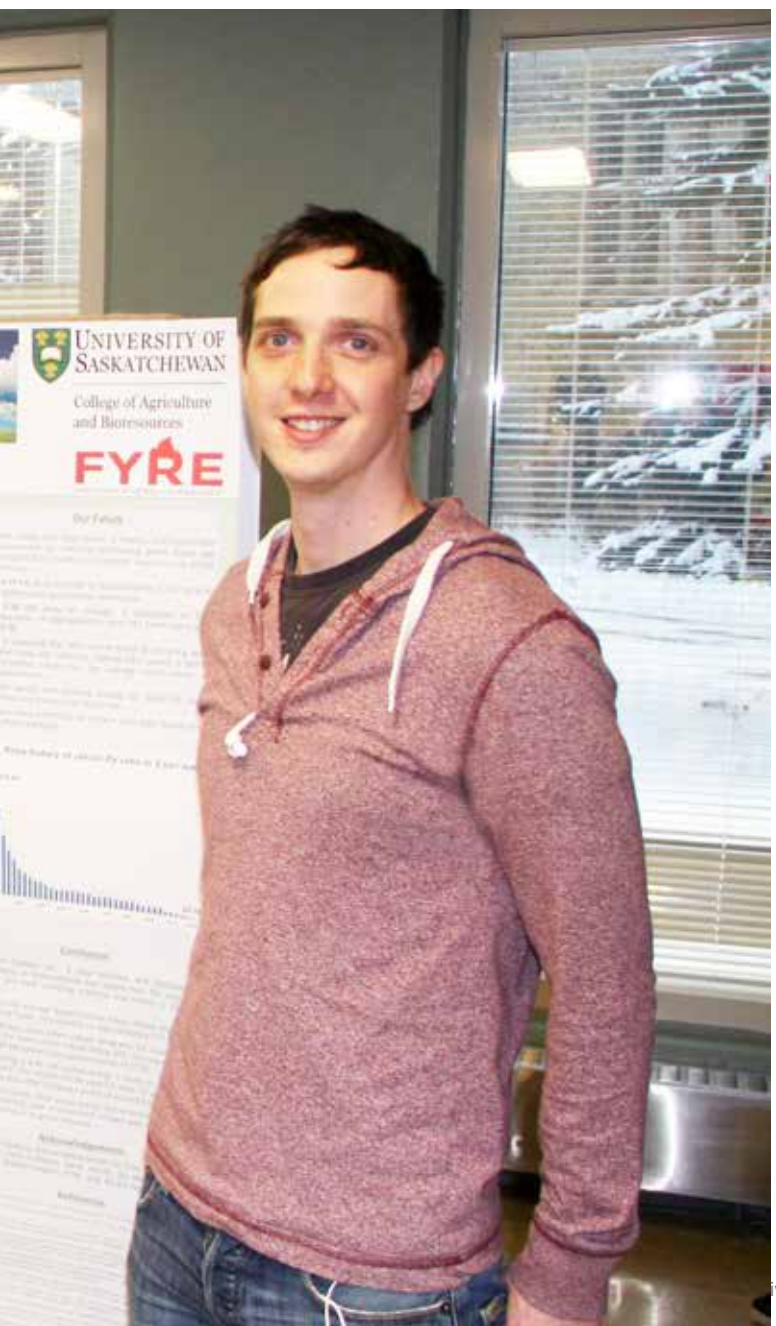
" FYRE is such an interesting approach to learning for first year students", says Kara Loy, Co-ordinator of Undergraduate Research Initiative in the Office of the Vice-President Research, "It encompasses so many valuable skills such as teamwork and collaboration, but also forces them to step back and evaluate their peers to see what worked and what didn't."

The teamwork aspect was something the first-year students really responded to, as it helped break the ice with their classmates and break down urban/rural barriers. "It's hard in first year because you don't really know anyone, so it was nice to work in groups. It helped break the ice and now we are friends outside of class,' says Kyle Cuthbertson.

Cuthbertson and his group members Andrew Zelinski and Zachary Reddekopp won best poster overall, and were impressed with the freedom they got from the hands on learning associated with FYRE. "First year classes can be a little bit generic," says Zelinski. "It was great to change things up. Colin [Laroque] let us pick any topic we wanted, and it was so much easier to engage with material that we were actually interested in." All three students were quick to mention how much more they engaged with the material when they were given the autonomy to choose their own topic.

"What the U of S is doing, with this program is unique," says Drew. "Research is a really key part of our university, and this college in particular. Programs like this give students a chance to step outside the traditional learning environment and actively participate in that."

The FYRE program is currently underway in a few colleges across campus including Kinesiology and Arts and Science.



Overall student winners: Kyle Cuthbertson, Zachary Reddekop and Andrew Zelinski in front of their winning poster

Although a few changes will likely be made to the program in coming years, due in part to student and faculty feedback, it is hoped that the success of the program in AgBio will inspire more U of S colleges to adopt first year research programs.

First year students aren't the only ones benefiting from research initiatives, however. Upper year students are getting opportunities to broaden their research scope as well.

Other undergraduate research opportunities in the college are providing excellent opportunities for students to step outside the classroom and engage with the larger world through meaningful, hands-on experiences.

During the summer of 2014, six AgBio students took part in a research-based employment program, where they worked alongside a faculty member in the college on a specific project.

"This experience was so great, because I finally got to see what it was like to be a researcher, as opposed to a research tech," says Shannon Palmer, a former Animal Bioscience major. Palmer worked with Greg Penner, in the Animal and Poultry Science department, examining zoonotic infectious diseases in cattle.

"The experience was pretty intense," says Palmer, who had to be on-call to feed twenty-one animals, three times per day. "We were looking at the age of weaning dairy calves and how it affects their gut and digestive system. I wouldn't say I had much of a summer holiday, but in hind-sight, seeing what I learned, and what I accomplished, it was worth it."

Now in her first year of Veterinary Medicine, Palmer is grateful to be able to draw on her experiences working with Penner, as she prepares for a career in animal healthcare.

"THE EXPERIENCE WITH UNDERGRADUATE RESEARCH GAVE ME INDEPENDENCE IN MY STUDIES, AND CONFIRMED THAT THIS IS WHAT I AM SUPPOSED TO BE DOING. THE RESULTS OF THE RESEARCH FEEL LIKE THE CHERRY ON TOP OF THIS WHOLE EXPERIENCE."

"I really love what I am doing," she says. "The experience with undergraduate research gave me independence in my studies, and confirmed that this [vet med] is what I am supposed to be doing. The results of the research feel like the cherry on top of this whole experience."

Nicole Marleau agrees. Marleau spent her summer working under professor Colin Laroque, in the department of Soil Science. Currently in her first year of graduate studies, she credits her undergraduate research opportunity with helping her determine her future. "The project I worked on with Colin this summer was really instrumental in determining my future in grad school, as my thesis will essentially pick up where we left off."

The research she speaks of is dendrochronology—defined by Marleau, as, "the chemical concentration within tree rings." This process is done through x-ray defraction—shooting light into a sample, which releases x-ray flourescents to determine years of dramatic change for the tree.

"I didn't think there would be so many options available to undergraduate students," says Marleau. "My advice to other students is to build relationship with professors. If they know you, they will recommend you for opportunities they feel you will benefit from."

Amanda Schurman credits her summer research experience with giving her the field experience she knows will benefit her when she starts applying for jobs later this year.

Currently in the last semester of her undergrad, Schurman will graduate in 2015 with an Environmental Science major and a Soil Science minor. "This research incentive gave me an opportunity to work on three separate projects," she says. "Before this, I had little patience for traditional research, but once I was able to experience field work, it made me look at things from a totally different perspective."

Schurman divided her time between Yorkton, Indian Head and Kananaskis, working with PhD students on a variety of projects. These projects ranged from examining how climate change affects the green house gas emissions in peatlands, to soil sampling in wetlands, to the affect on willows placed in unnatural lands.

"I spent a lot of time hiking, sometimes 40 minutes out, wearing hip-waders, in water up to my knees," says Schurman of her experience. "It was intense, but I really enjoyed working on the different projects. I hope that once I graduate this spring, I can find something that aligns with what I did last summer—something in the field, and away from the lab."

University can be overwhelming to students, with so many degree options to choose from and the uncertainty of what will come after graduation, which is why programs like these are so important, especially early on.

The face of the AgBio community has changed a lot since the college was established in 1912. Opportunities like FYRE and other undergraduate research opportunities, along with various clubs are preparing undergraduate students for a well-rounded university experience.

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BILL BILIGETU

Academic Background: Bsc, in Grassland Sciences, Inner Mongolia Agriculture University, MSc in Rangeland Management, Inner Mongolia Agriculture University, PhD in Perennial Forage Management and Physiology, University of Saskatchewan.

Focus of Work: Breeding and genetics of perennial grasses and legumes that are adapted to the prairie region of western Canada. The examples of perennial species in his program are bromegrass, wheatgrass, alfalfa, and sainfoin.

Passion: I am excited to initiate a research program that focuses on the breeding and genetics of forage crops that are adapted to the prairie region of western Canada, as well as a research program that examines how the nutrients we ingest impact health and longevity.

KAREN SCHWEAN-LARDNER

Academic Background: BSc, College of Agriculture, University of Saskatchewan, MSc, "Enriched housing for laying hens", University of Saskatchewan, PhD, "Impact of darkness on broiler welfare and productivity", University of Saskatchewan.

Focus of Work: Primary focus is on poultry welfare, in particular how management of birds and nutrition impact poultry welfare and poultry productivity.

Passion: Any opportunity to do research in the poultry barn is fun! Being involved with and teaching students, and engaging with my family and dog in my free time.

STUART SMYTH

Academic Background: BA (Public Administration), University of Saskatchewan

PhD, "A Decade of Regulating Agricultural Biotechnology in Canada: A Case Study from 1994-2004", University of Saskatchewan

Focus of Work: The regulation and international trade of products of biotechnology, especially genetically modified crops.

Passion: If we are going to be able to feed a world of 9-11 billion people, we need to resolve the challenges resulting from agricultural innovations. Conducting research that contributes to this fuels my passion for the work I do.

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