GIFS | GLOBAL INSTITUTE FOR FOOD SECURITY

Growing science for life

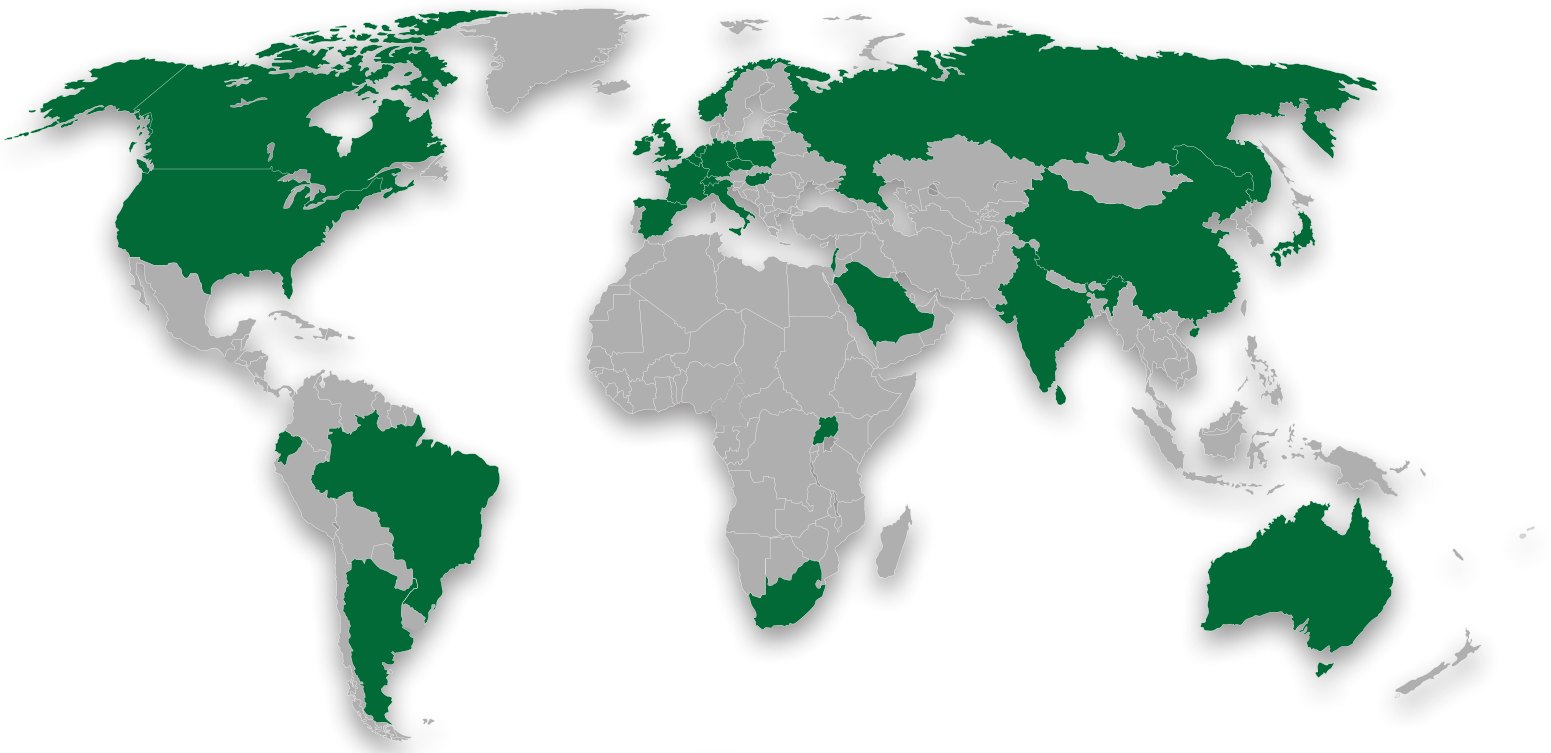
Nutrien - a Founding Partner

2017-2019 REPORT

GIFS is partnering with researchers in over 240 universities, as well as research institutes and agriculture experts in almost 30 countries, on projects that will advance agricultural innovation.

Connecting

with the world to achieve global food security.



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The Global Institute for Food Security (GIFS) was founded to perform research that will help deliver transformative innovation to agriculture in both the developed and the developing world.

With 9.6 billion people expected to be living on the planet by 2050, food security is one of the greatest issues facing humanity.

To tackle this issue, GIFS was established in 2012 by three Founding Partners - Nutrien (formerly PotashCorp), the Government of Saskatchewan and the University of Saskatchewan.

As a research institute at the University of Saskatchewan (USask), GIFS has been building an interdisciplinary foundation for agricultural innovation that will help move the agriculture industry forward and feed the world's growing population.

Technologies created at GIFS will play a critical role in helping growers increase food production in a sustainable manner. Here at home, our research will help drive the competitiveness of our economy and advance our natural resource strengths through sustainable agriculture solutions using fewer resources. Internationally, our work will lead to increased trade and investment through collaborative research and knowledge-sharing, and help developing nations around the world advance their own agricultural industries and become self-sustaining.

Today, GIFS researchers are collaborating with over 240 research institutions, universities and agricultural industry experts in almost 30 countries around the world. We are connecting with the world to achieve global food security.

OUR VISION

Ingenious science that delivers sustainable food security for the world.

OUR MISSION

To help feed the world through transformative innovations in agriculture and food production that will benefit Saskatchewan's economic, social and environmental well-being and which will empower developing countries to achieve local food security.

Our Founding Partners: Nutrien Feeding the Future™ | Government of Saskatchewan | University of Saskatchewan

GIFS **IN NUMBERS**

240
institutions and organizations within the GIFS Research Network

20+
USask centres, colleges and departments GIFS researchers are collaborating with

5
GIFS-supervised labs (Canada, China, Brazil, Germany and the United States)

$60M
funding leveraged by GIFS since 2012

110+
research papers published by GIFS researchers and affiliates

21
countries GIFS core researchers hail from

90
speaking invitations received by GIFS researchers and affiliates

$26.5M
funding applications currently in process

GIFS **BOARD OF DIRECTORS**

Alanna Koch
BOARD CHAIR

Lorne A. Babiuk
BOARD VICE-CHAIR

Timothy Hawryluk, Q.C.
CORPORATE SECRETARY TO THE BOARD

Rick Burton
DEPUTY MINISTER
Saskatchewan Ministry of Agriculture

Dr. Lutz Goedde
PARTNER
McKinsey & Company

Marco Ferroni
CHAIR
CGIAR System Management Board

Stephen Visscher, CBE
DIRECTOR OF STRATEGIC PARTNERSHIPS AND CHIEF OPERATING OFFICER
Global Institute of Food Security
(Interim Executive Director and CEO from November 2018-July 2019)

Note:
Lorne Hepworth
(Until October 2018)

Leslie Prosser, Q.C.
(Until February 2019)

GIFS International Scientific Advisory Panel Members

The GIFS International Scientific Advisory Panel (ISAP) provides GIFS with independent expert science. The panel is made up of internationally recognized scientists in areas of expertise that align with GIFS' research themes.

John Pickett, CBE, DSc, FRS – ISAP Chair

Margaret Gadsby, MSc, PAg

Joerg Bohlman, Phd, Professor and Distinguished University Scholar, Michael Smith Laboratories, University of British Columbia.

Julia Bailey-Serres, PhD, Professor of Genetics, Department of Botany and Plant Cell Biology, University of California, Riverside

Bill Lucas, PhD, DSc, Distinguished Professor and Chair, Department of Plant Biology, University of California, Davis
(Until February 2019)

Gijs van Rooijen, PhD, Chief Scientific Officer, Genome Alberta

Richard 'Dick' Flavell, PhD, DSc, CBE, FRS

Kiran Sharma, PhD, CEO and Theme Leader for the Agribusiness and Innovation Platform, and Principal Scientist - Cell Biology at ICRISAT.

MESSAGE FROM THE

BOARD CHAIR

Alanna Koch

After being away from GIFS for a period of time, I am so pleased to see the unwavering commitment to addressing global food security and the momentum building at GIFS is stronger than ever. This is evident in the research partnerships and collaborations that have been created locally and internationally, and in the depth of research being completed in our core research areas, at the GIFS-managed USask Plant Phenotyping and Imaging Research Centre (P^2IRC), and by our Affiliates.

During this reporting period we said goodbye to individuals who were instrumental in building what has become a truly multi-disciplinary research institute that will positively impact global food security through the transformation of seed and plant breeding of crops like wheat, canola and lentils.

As the first permanent Executive Director and CEO, the vision of Dr. Maurice Moloney helped make GIFS a focal point for innovative research in the agriculture and agri-food sector and we thank him for his years of service. At the Board level, we bid farewell to past Chairs Mr. Dallas Howe and Mr. Lorne Hepworth, both of whom steered GIFS through periods of change with precision and an unwavering commitment to our vision. We have immense gratitude for both.

As the search for a new Executive Director and CEO began, we welcomed Mr. Stephen Visscher to the position on an interim basis until July 2019. Steve's experience as a member of the GIFS board since 2015 and his long history of bringing together diverse teams in institutional, national and international partnerships through executive positions in the United Kingdom served us well. We are so thrilled he will be staying on at GIFS as the Director of Partnerships and Chief Operating Officer.

Our leadership search was concluded and it is our pleasure to welcome Dr. Steven Webb to the GIFS family. Coming from Corteva Agriscience in Indianapolis, Steven has over 20 years' of expertise developing and managing multidisciplinary enterprises and new business opportunities. He also has a strong understanding of Saskatchewan's historic role in the innovation of food production and technology. His visionary leadership will be helpful in developing long-term strategies for growth and in fostering strong working relationships with scientific, agricultural and agri-food business communities in Canada and around the world. We also welcomed former director of the USask Vaccine and Infectious Disease Organization (VIDO), Dr. Lorne Babiuk, as Board Vice-Chair. Lorne was instrumental in building and leading VIDO to become an internationally recognized research powerhouse and we welcome his expertise.

I had the pleasure of attending the GIFS June 2018 Conference, Emerging Technologies for Global Food Security, and the 3rd annual P^2IRC Symposium held in October, both of which were huge successes. Collectively, nearly 100 presentations and panel discussions with renowned scientists and researchers from all over the world were held. It was heartening to see these leaders in global food security converge in Saskatoon to share their knowledge and insights on continuing to move our discovery research forward.

On behalf of the Board, thank you to everyone at GIFS – our researchers, students and staff who are working hard to help us achieve our vision of ingenious science that delivers sustainable food security to the world. Thank you to the members of our International Scientific Advisory Panel for providing us with scientific advice. And finally, thank you to our founding partners – Nutrien, the Government of Saskatchewan and the University of Saskatchewan (USask), for their vision in creating this world-class research institute.

MESSAGE FROM THE CEO

(INTERIM, FROM NOVEMBER 2018 TO JULY 2019)

Stephen Visscher, CBE

A rapidly growing world population, the proximity of major climate change effects, almost 1 billion under nourished people, and the requirement to produce more with less resources means that research for sustainable global food and nutritional security remains a major international grand challenge. Fortunately, there is an incredible new box of research tools developed in recent years, meaning that we can address this challenge with more speed and precision.

Having served on the GIFS Board of Directors for a number of years, taking on the interim position as Executive Director and CEO gave me a new and exciting perspective on the institute, its people, the research that is taking place here and its huge potential to catalyze new multidisciplinary collaborations in Saskatoon and beyond, with public sector and industry partners. Our Founders had a vision to serve Saskatchewan and the world by operating differently with new transdisciplinary approaches. Linking our core skills with the best academic partners and industry teams is our way forward. GIFS is absolutely becoming the world-class research institute envisioned at the outset.

Over the past 18 months, GIFS has continued on its trajectory of growth. Our core staff grew by almost 50 per cent to almost 70 people. This dedicated team is working closely with many agriculture and food-related centres, colleges and departments at the University of Saskatchewan (USask), Agriculture and Agri-Food Canada (AAFC) and the National Research Council (NRC), and has formed collaborations with research institutions around the world. For example, our roots lab has identified and cloned a number of genes in sorghum, maize and rice that show tolerance to acidic soil. We are studying how these genes function in the root, and through a collaboration with the Embrapa Maize and Sorghum Laboratory in Brazil and plant breeders in Africa, we are translating these discoveries into improved maize and sorghum yields on acid soils in Sub-Saharan Africa.

The GIFS-managed Plant Phenotyping and Imaging Research Centre (P^2IRC) is becoming an internationally recognized multidisciplinary centre of excellence in phenotyping. In P^2IRC's first three years, over 250 researchers and graduate students collaborated with 106 research institutes, universities and agricultural industry experts from 25 countries on research projects. One example is the creation of two new novel interactive genome viewing platforms which are now being used to interrogate and interpret multiple plant genomes to represent the reference wheat, canola and lentil genomes. As P^2IRC enters its next phase, research like this will be used to create new technologies that will lead to commercial spin-offs involving field and aerial sensors, artificial intelligence tools and more, all to ultimately transform crop breeding.

Our growing number of GIFS affiliates at USask are working in areas that are contributing to our vision and enhancing our efforts. One example is Albert Vandenberg's international work on lentils – an initiative that could improve the health of millions of people around the world and open up the Saskatchewan lentil market substantially.

This past year we were delighted to play a role in the completion of the fully annotated reference genome for bread wheat, a discovery that will help breeders create more nutritious grain that can be grown more effectively and efficiently in harsher climates. A further manuscript describing the full assembly of the durum wheat genome, together with other key aspects of genome biology, was published in Nature Genetics in early 2019.

At GIFS, educating the next generation of scientists and researchers is a priority. In addition to providing individual scholarships, we were excited to award two Dr. Donald Baxter Scholarships to very deserving Chinese students who are working with supervisors in our core research areas.

GIFS is thrilled to be moving forward in so many positive ways, and as we continue on this journey of long-term discovery research, I wish to thank everyone – all of the staff, researchers, affiliates and students working in the institute and P^2IRC.

With GIFS' leadership search successfully concluded, I am very much looking forward to working with our new Chief Executive Officer, Steven Webb, PhD. I am also pleased to be staying on with the organization in a new and exciting role of Director of Strategic Partnerships and Chief Operating Officer.

Looking ahead, we are approaching the end of our first seven year phase agreed with our Founders – Nutrien, the Government of Saskatchewan and the University of Saskatchewan. We are looking forward to working with them to develop the framework for the next period, refreshing our strategy, and delivering new research and innovation to benefit both Canada and the developing world.

Finally, I wish to thank our Chair, Board of Directors, International Scientific Advisory Panel and Founders for their support and guidance as we work to address the issue of global food and nutritional security.

EXECUTIVE DIRECTOR & CHIEF EXECUTIVE OFFICER

Steven Webb, PhD

Dr. Steven Webb (PhD), a visionary and strategic research leader with more than 20 years of expertise in developing and managing multidisciplinary enterprises and new research and business opportunities, has been chosen as the executive director and chief executive officer of GIFS.

As GIFS' executive director and CEO, Webb will develop long-term strategies for growth and foster strong working relationships with scientific, agricultural and agri-food business communities in Canada and around the world.

"Steve's established record of achievement in research and R&D and his international reputation for scientific excellence made him a stellar choice to lead GIFS forward," said Alanna Koch, chair of the GIFS board of directors.

"His world-class career and track record of accomplishments in the areas of precision transformation and genome editing platforms for canola, corn, soybean and wheat have earned him the respect and international recognition of the agricultural industry, academia and the public sector."

With graduate degrees from the University of Guelph, Webb has worked for many years as a research scientist and has held numerous international roles in the areas of cell biology, animal health and nutrition. He has more than 60 publications and 16 patents.

Webb was the R&D director of external technology at Corteva Agriscience in Indianapolis, U.S. While there, he led many research collaborations with private sector companies, research institutes, and universities. He also led the successful design and building of the company's Omega 9 Health Canola business. As well, he has developed and deployed Corteva's external innovation partnership process for driving new products and technologies to accelerate innovation across the seed, crop protection and digital platforms.

Prior to that, Webb was the global leader of external technology, intellectual property development and early stage commercial assessment for Dow AgroSciences' crop protection and seeds global businesses in Indianapolis. He led the design and development of the company's EXZACT™ precision technology transformation and genome editing platforms for canola, corn, soybean and wheat.

As a board member for Ag-West Bio since 2016, Webb has a strong understanding of Saskatchewan's historic role in innovation of food production and technology. He serves on other research institute boards such as the Indiana Biosciences Research Institute board and the Indiana Biosciences Research Institute's scientific advisory board, and will serve as a non-voting member of the GIFS board.

"GIFS is a magnet for outstanding researchers and graduate students, making it a focal point for innovative, trans-disciplinary research in the agriculture and agri-food sector," said Webb. "I look forward to working with our many partners to strategically build upon that research success and engaging with companies and others to develop and transfer technologies that will benefit farmers and foster economic and societal growth."

OUR PEOPLE:
A PASSION FOR GLOBAL FOOD SECURITY

GIFS RESEARCHERS

Over 50 researchers from 21 countries including Australia, Mexico, India and China are working in our core research areas of seeds, roots-soil and digital agriculture. These bright, young scientists are dedicated to their research and are committed to being part of the solution to ending global food insecurity.

In addition to partnering with our USask centres and colleges, our GIFS research team has formed research collaborations with 25 research institutions around the world including the United States, European Union member countries, Brazil and India to name a few.

PLANT PHENOTYPING AND IMAGING RESEARCH CENTRE (P²IRC)

Over 250 researchers and graduate students have been working on research projects within the GIFS-managed Plant Phenotyping and Imaging Research Centre (P²IRC), a USask Centre. Funded by the Canada First Research Excellence Fund, P²IRC is an internationally recognized centre of excellence in phenotyping - a unique resource for plant breeders around the world - making possible the development of sustainable new crop varieties with specific desired traits, all at a previously unimaginable speed and scale.

P²IRC researchers have collaborated with 106 research institutes, universities and agricultural industry experts from 25 countries.

GIFS AFFILIATES

GIFS partners with researchers at USask to support their work in seed and developmental biology, social sciences, and other areas. This work is contributing to GIFS' vision of creating ingenious science that delivers sustainable food security to the world.

This group of researchers and their teams have had their work published in almost 80 publications and been invited speakers to over 40 conferences and research events. In addition, they are collaborating with over 70 other individuals and organizations around the world to strengthen and extend their research capabilities.

CURTIS POZNIAK - Professor, College of Agriculture and Bioresources

Project: Wheat Genome Project

STUART SMYTH – Assistant Professor, Industry Research Chair in Agri-Food Innovation, College of Agriculture and Bioresources

Project: Economic and Environmental benefits of Bio Tech enhanced crops in Canada and evaluates Canadas Regulatory System

Project: Assessment of Sask Ag Greenhouse Gas Emissions

ALBERT VANDENBERG – Professor and NSERC Industrial Research Chair, College of Agriculture and Bioresources

Project: Effect of Biofortified Lentils on Iron and Selenium Status (EBLISS)

CAROL HENRY – Associate Professor, Nutrition and Dietetics and Assistant Dean, College of Pharmacy and Nutrition

Project: Scaling up Pulse Innovations for Food Nutrition Security in Southern Ethiopia

DAVID NATCHER – Professor, College of Agriculture and Bioresources, Director, Indigenous Land Management Institute

Project: Arctic as a Food Producing Region

Project: GIFS Research Chair in the Social Dimensions of Food Security

BOBBI HELGASON – Professor, College of Agriculture and Bioresources

Project: Affiliate Chair in Soil-root-microbial interactions.

DWAYNE HEGEDUS - Adjunct Professor, College of Agriculture and Bioresources

Project: Developing Camilina Sativa as a Modern Crop Platform

ISOBEL PARKIN - Research Scientist, Agriculture and Agri-Food Canada and Adjunct Professor

Project: Developing Camilina Sativa as a Modern Crop Platform

LANA AWADA – Senior Policy Fellow, Centre for the Study of Science and Innovation Policy, Johnson Shoyama Graduate School of Public Policy

Project: Assessment of Sask Ag Greenhouse Gas Emissions

MICHAEL NICKERSON - Associate Professor, College of Agriculture and Bioresources, Ministry of Agriculture Strategic Research Chair

Project: Development of innovative therapeutic food products for treating malnutrition and responding to emergencies within high risk communities

PETER PHILLIPS – Distinguished Professor, Johnson Shoyama Graduate School of Public Policy; Director, Centre for the Study of Science and Innovation Policy; Associate Member

Project: Canadian Institute for Science & Innovation Policy (CISIP)

RAJU DALTA – Senior Research Officer, National Research Council of Canada

Project: TOR Signalling Targets to Improve Efficiency in Wheat

OUR PARTNERS:

CREATING A GLOBAL RESEARCH NETWORK

Our location on the USask campus means our researchers can work efficiently with partners such as the National Research Council and the Canadian Light Source, where fluorescence imaging using synchrotron light is helping researchers gain better knowledge of plants. This data will enhance breeding strategies and help farmers be more resource-efficient in their field operations.

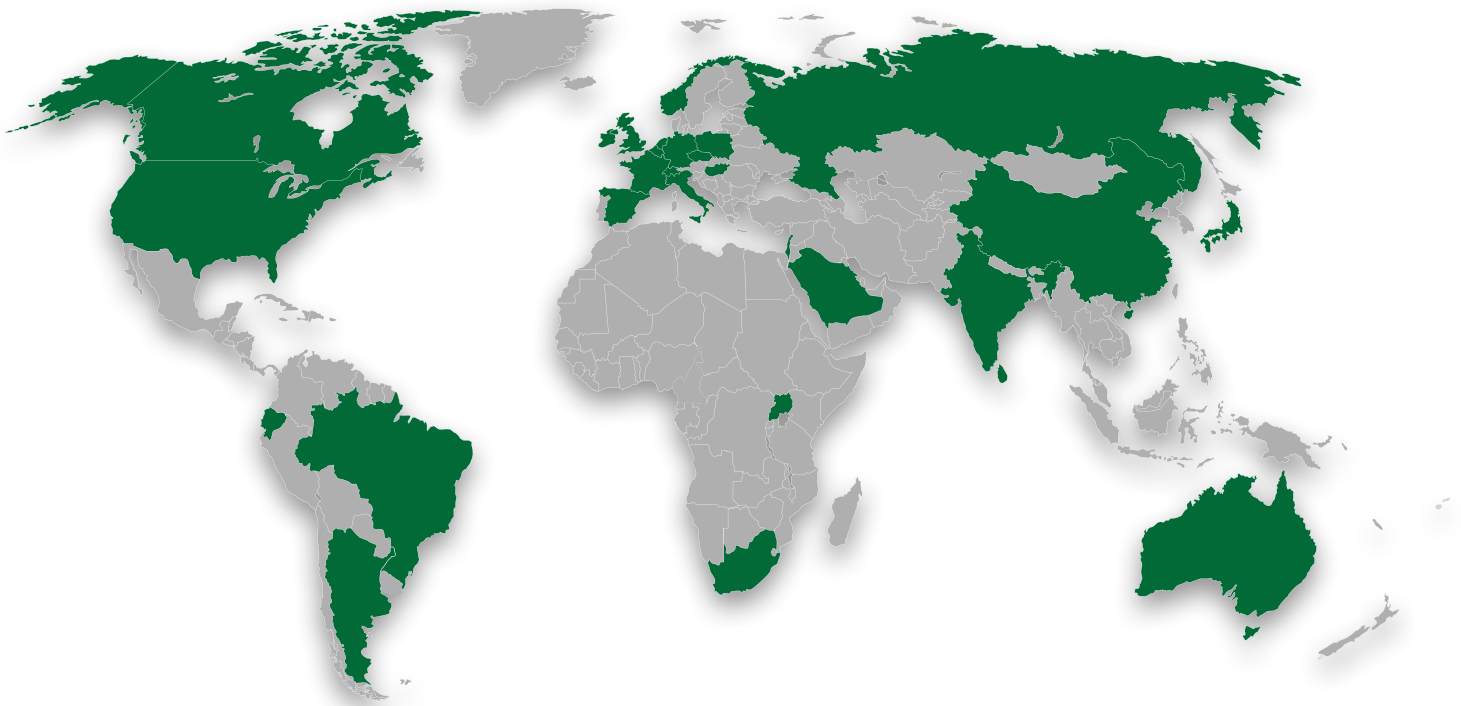
Another example of collaboration: Leon Kochian at GIFS and Steve Siciliano, Professor of Soil Science at the Toxicology Centre at USask, are using the Saskatchewan Centre for Cyclotron Science at the Sylvia Fedoruk Centre for Nuclear Innovation to image microbial and root activity in soil ecosystems to help sustain the environment. Access to the BioPETx real-time imaging detector provides plant and soil researchers with a combination of technology platforms that is unique in the world.

The BioPETx provides real-time imaging of plant growth

LEGEND: GIFS PARTNERS

1. SYVLIA FEDORUK CANADIAN CENTRE FOR NUCLEAR INNOVATION
2. SASKATCHEWAN CENTRE FOR CYCLOTRON SCIENCES
3. NATIONAL RESEARCH COUNCIL BUILDING/GIFS
4. AGRICULTURE AND AGRI-FOOD CANADA
5. CANADIAN LIGHT SOURCE
6. AGRICULTURE AND BIORESOURCES
7. PHARMACY AND NUTRITION
8. ARTS AND SCIENCE
9. COMPUTER SCIENCE
10. BIOLOGY
11. CHEMISTRY
12. PLANT SCIENCES
13. SOIL SCIENCE
14. FOOD AND BIOPRODUCT SCIENCES
15. ANIMAL & POULTRY SCIENCE
16. AG & RESOURCE ECONOMICS
17. CROP DEVELOPMENT CENTRE
18. SCHOOL OF ENVIRONMENT AND SUSTAINABILITY
19. JOHNSON SHOYAMA GRADUATE SCHOOL OF PUBLIC POLICY
20. ENGINEERING
21. CROP SCIENCE FIELD LABORATORY

INTERNATIONAL PARTNERSHIPS



Internationally, GIFS researchers, affiliates and P²IRC researchers are partnering with researchers in over 240 universities, research institutes and agricultural industry experts in almost 30 countries, on projects that will advance agricultural innovation.

A number of MOU's and agreements have been signed or are in the works with numerous industry organizations who will partner with GIFS to advance agricultural innovations and technologies.

GIFS has partnerships in the following countries:

Australia
Brazil
Canada
China
Czech Republic
France
Germany
India
Japan
Poland
USA
Spain
Argentina
Belgium
Colombia
Hungary
Israel
Italy
Netherlands
Norway
Russia
Saudi Arabia
South Africa
Switzerland
Uganda
UK

DivSeek

In 2019, GIFS will become the international hub for Div Seek, a global network of 68 organizations which will help breeders, researchers and farmers around the world mobilize to accelerate crop improvement and adapt to climate change and other stresses. Div Seek is using genomic and other tools to characterize the rich biodiversity and species variation from millions of years of evolution - held in global seed stores containing over seven million seeds from diverse crop species - with the aim of working to develop a worldwide 'genebank.' Div Seek will also provide expert advice to the International Treaty on Plant Genetic Resources for Food and Agriculture, to help ensure that the benefits from research, including digital sequence information, can be realized while honouring all aims of the Treaty.

ROOTS-SOIL-MICROBIAL INTERACTIONS

IMAGING ROOTS FOR TAILORED DESIGN
PROGRAM LEAD: DR. LEON KOCHIAN

Canada Excellence Research Chair (CERC) Leon Kochian, formerly of Cornell University and one of the most highly cited researchers in the world, and his team, are working to image roots to better understand how they grow and interact with their surroundings. This will help lead to tailored design and breeding of improved root systems for major crops including barley, lentils, soybean and canola.

CUTTING-EDGE TECHNOLOGIES ALLOW RESEARCHERS TO STUDY ROOTS LIKE NEVER BEFORE

Kochian's team is using technologies at USask, like the Canadian Light Source synchrotron, the cyclotron at the Saskatchewan Centre for Cyclotron Sciences and other advanced imaging equipment, to look at root form and function in ways not previously possible. The research is finding that plants have a significant genetic control over how they distribute their roots in the soil – an important trait that helps plants acquire nutrients and water efficiently.

In March 2018, Kochian was awarded $800,000 from the Canada Foundation for Innovation (CFI), $9,000 from USask, and $391,000 from in-kind vendor contributions - to develop more sophisticated tools for imaging root architecture and function of roots grown both hydroponically and in soil.

GLOBAL RESEARCH LEADERSHIP

In September 2018, Kochian was appointed to China's Thousands Talent program by the Fujian Agricultural and Forestry University and the Fujian Province, and awarded the title of "National Distinguished Expert in China."

The award includes $1.175 million for research start-up, another $200,000 for research costs, and $200,000 for travel and living costs while visiting at the Fujian Agricultural and Forestry University.

Kochian has been collaborating for many years with plant scientists from several Chinese universities, including Fujian Agriculture and Forestry University, Zhejiang University, Chinese Agricultural University, Tsinghua University and S. China Agricultural University, on research on improving crop production in marginal soils. He also has trained a large number of Chinese graduate students, postdocs, and visiting professors in his labs, many of whom now run successful research programs in Chinese universities.

CANOLA – EARLY RESEARCH RESULTS UNCOVERED

Canola is one of Canada's most economically important crops, and about 30 per cent of the worlds' canola is produced in Saskatchewan. The seeds are used to make cooking oil and canola meal is used for animal feed. Canola can also be used to make biodiesel to power trucks and heavy machinery, which has been proven to reduce greenhouse gas emissions by up to 90 per cent compared to petroleum-based diesel. These benefits make it one crop that GIFS PhD Student Hasan Ahmed wants to learn more about.

While the canola seed itself is very fine, about the size of a radish or turnip seed, its roots are the opposite. When grown in soil, canola roots are thick and short, a trait that would appear to make it difficult for the roots to efficiently mine the soil for nutrients and water. Ahmed found that when a seed of the same canola cultivar was grown in hydroponic media (water with mineral nutrients added), the roots were quite fine and the root system resembled that of other crop species GIFS researchers study, like wheat, soybean, lentils, sorghum and corn. In observing these differences, GIFS researchers have uncovered something previously unknown to scientists who study roots: canola roots have by far the most plasticity they have ever seen. They literally adapt very dramatically to changes in their growth environment.

But why, and what are the genetic triggers that cause canola roots grown in soil to be so thick and those grown in hydroponics to be much finer and longer? Could it be possible to develop a commercial canola line with finer roots that more easily absorb nutrients and water?

Now, Ahmed is seeking new ways to image canola roots grown in soil, the same way he can image the roots of hydroponically grown plants using the lab's 2-dimensional and 3-dimensional

Hasan Ahmed makes a hydroponic nutrient solution to grow Boechera *napus.*

root imaging and traits quantification platforms. The goal is to study the genetic bases of the roots for this plasticity and hopefully identify the physiological mechanisms and genes that control these surprising differences in root thickness and length.

So far, Ahmed has grown canola in pots with more dense soil and much less dense potting mix, to see if mechanical resistance on root growth by the soil plays a role in these differences. He found that roots grown in these two different media were still quite thick and stubby.

He is also investigating whether differences in the root microbiome in soil, versus hydroponically-grown plants, which have a much less extensive and complex root microbiome, could play a role in these differences.

He has found that in hydroponics, altering the iron in the root media can affect primary root thickness - more iron results in thicker primary and lateral roots. If the physiological and genetic controls of this switch from fine and long roots to thick roots can be discovered, he may be able to modify the root system of commercial canola varieties to develop plants with more long and fine roots. This should enhance nutrient and water absorption from the soil, resulting in a commercially viable line of canola that is more resilient to climate change and could be grown in non-ideal soil conditions.

PLANT SHOOTS TALK TO PLANT ROOTS: HOW DIGITAL BREEDING COULD CHANGE WHAT THEY'RE SAYING

Scientists have long known that the plant root is the primary organ for mineral nutrient uptake from the soil, and that root-to-shoot and shoot-to-root signaling play pivotal roles in mineral nutrient uptake and transport through the vascular system of the plant. It was also believed the purpose of the plant phloem was primarily to move sugars produced through photosynthesis in the leaves to the growing shoot and root tips.

But researchers have discovered the phloem is capable of much more than that. The phloem is more like a super-information pathway loaded with specialized proteins and different types of ribonucleic acid (RNA) molecules that communicate signals between shoots and roots (e.g., communicating that the shoot needs more phosphorous). They also modify root gene expression networks to alter root structure and function - to more efficiently acquire phosphorus from the soil.

Byung-Kook (Brian) Ham, GIFS Research Chair in Plant Molecular Signaling, provided much insight into this discovery while working at a leading laboratory run by Bill Lucas, Distinguished Professor and Chair of the Department of Plant Biology at the University of California, Davis.

With colleagues at GIFS, Ham is now studying root systems and the role of the RNA and proteins in the phloem as specific mobile messengers that enable communication between shoots and roots. In particular, he is using genomics, physiology, molecular biology, and protein chemistry approaches to study the role(s) these signals play in the integration of root and shoot growth, under optimal and nutrient-stress conditions like poor nitrogen, phosphorous and potassium.

Ham believes that rather than use expensive fertilizers to replace these minerals, digital breeding could be used to design root systems to more efficiently acquire them from the soil. Changing the way the roots grow, for example placing them in soil layers which are higher in phosphorous, would turn on gene networks encoding the elegant mechanisms the roots have developed to solublize and absorb phosphorous from the soil.

To help advance this research, Ham and colleagues have established a long-term collaboration with the Agricultural Genomics Institute, Shenzhen, China. This Institute has extensive resources both in plant genomics and field evaluation of crop traits that will be of great values to GIFS. In the long term, the results of Ham's work could be used to fine-tune communication between shoots and roots to optimize the uptake and use of these essential minerals, a discovery that would enable the generation of plant cultivars that maintain higher yields on less fertilizer – thus making plants that do more with less.

Dr. Brian Ham, GIFS Research Chair in Plant Molecular Signaling, Root-Soil-Microbial Interactions

DISCOVERY OF NOVEL ALUMINUM TOLERANCE GENES COULD IMPROVE YIELDS IN DEVELOPING COUNTRIES

Next to drought, aluminum (Al) toxicity, is one the biggest issues affecting farming in regions like Mexico, South America, South Asia, Sub-Saharan Africa and others where the soil is highly acidic.

Aluminum is the most abundant metal in the earth's crust. When soil pH becomes acidic, Al dissolves into the soil. This soluble Al is toxic to plant root systems and results in stunted or damaged root systems. With up to 40 per cent of the world's potential agricultural soils highly acidic, especially in the humid tropics and subtropics where most developing countries are located, the effect on agricultural production is great.

In developed nations, lime can be used to raise the pH of the topsoil. However, this does not address subsoil acidity, and in developing countries this tactic is too costly to be of widespread practical use.

For a number of years, Kochian has been collaborating with Jurandir Magalhaes, a researcher at Brazil's Embrapa Maize and Sorghum Laboratory, to identify genes in the important cereal crop, sorghum, that confer tolerance to Al toxicity on acid soils.

With Kochian's expertise in the molecular plant physiology of roots, and Magalhaes a molecular geneticist and a molecular biologist, the skills each brings to this research is significant. To date they have cloned a number of genes that work together to confer a high level of Al tolerance in sorghum. They are also working with maize geneticists and breeders at Embrapa, and have identified similar genes in that crop as well.

In 2018, led by Magalhaes, the labs identified two new minor but essential sorghum Al tolerance genes that regulate the expression of the major Al tolerance gene, SbMATE, which they also discovered. The gene enables the roots of tolerant sorghum to release citric acid from the root tip into the soil, where the citric acid binds and detoxifies toxic Al ions in acid soils.

This research was published in the prestigious, Proceedings of the National Academy of Sciences of the United States of America journal, and has paved the way for the labs to breed for sorghum lines with increased yields on acid soils in Brazil. The group will also work with sorghum breeders in sub-Saharan Africa to improve crop production on the significant areas of acid soils in Africa.

Magalhaes recently became an adjunct professor in the Department of Plant Sciences at the University of Saskatchewan. This will allow the Magalhaes and Kochian and their teams to enhance their collaborative work to improve crop production on acid soils in developing regions.

SEED AND DEVELOPMENTAL BIOLOGY

IMPROVING SEED TRAITS AND OPTIMIZING REPRODUCTION

PROGRAM LEAD: DR. TIM SHARBEL

An expert in plant reproduction, Tim Sharbel came to GIFS from Germany's Leibniz Institute of Plant Genetics and Crop Plant Research. He leads a program to improve seed traits and optimize reproduction, highly disruptive research that could halve the time it takes to develop new crop varieties.

SCIENTIFIC ADVANCES SHOWING PROMISE FOR APOMIXIS

GIFS Postdoctoral Fellow Martin Mau's goal is to speed up plant breeding in Saskatchewan and around the world through apomixis, a naturally occurring form of plant reproduction, where a flowering plant produces seeds without sexual 'crossing' with another plant.

Apomixis is currently largely absent in food crops and could have tremendous potential in plant breeding. For farmers, bringing apomictic reproduction into elite hybrid crop plants would result in identical favourable traits in future offspring, reducing the cost of seed production. For breeders, apomictic crops could enable the cost-efficient transfer of favourable traits from wild relatives into their elite inbred lines, for world-wide use on locally adapted crops in niche breeding projects.

Apomixis is a naturally occurring form of plant reproduction, where a flowering plant produces seeds without sexual "crossing" with another plant. This trait is largely absent from agricultural crops but is found in many wild species. If successful, plant breeders could develop new varieties of crops, with "smarter" seeds that could respond to specific environments, germinate more efficiently, and provide increased yields.

Dr. Martin Mau, Postdoctoral Fellow, Seed and Developmental Biology

The study of the genetic principles of apomixis is very time consuming. For the past four years, supported in part by funding through Tim Sharbel's Research Chair in Seed Biology at GIFS, Mau and his team have been working to successfully demonstrate the transfer of apomixis into a sexual *Boechera* plant—a scientific model organism of the economically important mustard family.

In February 2019, Mau was awarded $625,000 from Saskatchewan's Agriculture Development Fund which includes 10 per cent from the Saskatchewan Canola Development Commission for a four-year project. The goal is to preserve hybrid vigour in Brassica crops, such as canola.

With this funding, Mau and his team will now have sufficient time to trial their breeding approach in canola. They will use the successful apomixis donor lines from their pilot study in a crossing strategy to generate apomictic hybrid Brassica seed material. They will also conduct crossing with the pilot study plants, combined with state-of–the art sequencing technology to identify all of the genetic factors that contribute to apomictic reproduction. This approach is designed to provide them with the information they need to potentially introduce apomixis in other crops.

Postdoctoral Fellow **Joanne Ernest** and PhD Student **Maryam Honari** have been studying the expression patterns of a candidate gene for apomixis in *Boechera* called APOLLO.

This work is helping them determine where and when the gene is turned on in the plant, or how it is regulated. It is yet another building block in our eventual toolbox to introduce apomixis into crop plants.

HELPING TO CRACK THE WHEAT GENOME CODE

For the past 13 years, over 200 scientists from 73 research institutions in 20 countries have been working through the International Wheat Genome Sequencing Consortium (IWGSC) to complete the sequencing of a billion-piece jigsaw puzzle - the bread wheat genome.

Dr. Curtis Pozniak

In August 2018, a USask-led research team which included P²IRC researcher Dr. Curtis Pozniak of USask's Crop Development Centre and Dr. Andrew Sharpe, Director of Bioinformatics at GIFS, published the highest quality genome sequence produced to date for the bread wheat variety, Chinese Spring, in the journal 'Science', entitled: Shifting the limits in wheat research and breeding using a fully annotated reference genome.

Dr. Andrew Sharpe

This international discovery will have an impact on the food security of millions of people around the world. Breeders now have the information they need to identify economically important traits more quickly, which will better enable the development of wheat varieties with higher yield, enhanced grain quality, improved disease resistance and resiliency to environmental stresses. The result will be more nutritious grain that can be grown more effectively and efficiently in harsher climates.

Pozniak led Canada's contribution to the IWGSC-led initiative, through the Canadian Triticum Applied Genomics (CTAG2) project, which includes scientists from the National Research Council, Agriculture and Agri-Food Canada, and the Universities of Guelph and Regina.

The new sequence was produced using NRGene technology, the backbone of the IWGSC genome assembly. This work was funded by Genome Canada, Genome Prairie, Western Grains Research Foundation, Saskatchewan Ministry of Agriculture via the CTAG2 project, the Saskatchewan Wheat Development Commission, the Alberta Wheat Commission, and the Canada First Research Excellence Fund through the Designing Crops for Global Food Security initiative at USask.

The USask team also contributed to a second related Science article led by the U.K.-based John Innes Centre and published in August entitled: The transcriptional landscape of polyploid wheat that describes the repertoire of expressed genes in the new wheat genome sequence.

The team's next step is to initiate a larger-scale international initiative to sequence more than 10 cultivated wheat varieties from the main growing areas across the globe. The 10+ Wheat Genomes Project is using the same NRGene technology to sequence the genomes. Sequencing for several varieties is already complete. More information can be found at: www.10wheatgenomes.com

Wheat is the world's most widely cultivated crop, accounting for 20 per cent of all calories consumed throughout the world. In Canada, wheat accounts for more than $4.5 billion in annual sales and, when value-added processing is factored in, contributes more than $11 billion each year to the Canadian economy.

Photo Credit: Simona Corneti, University of Bologna.

GIFS AFFILIATES MAKING IMPACTS

SUSTAINABLE AGRICULTURE TO IMPACT CLIMATE CHANGE

Just as no-till agriculture and herbicide-resistant canola were made possible through biotechnological interventions, new agricultural science and technologies are part of the global solution to combat the negative effects of climate change. GIFS is helping to find solutions.

The "Assessment of Saskatchewan Agriculture Greenhouse Gas Emissions," produced by GIFS affiliates, Stuart Smyth and Lana Awada, accurately quantifies greenhouse gas emissions and sequestration in Saskatchewan and will serve as important research for use by the province's crop, livestock (grassland) and forestry sectors.

Specifically, the assessment found that greenhouse gas (GHG) emission reductions in the agriculture, livestock and forestry sectors are virtually one-third of the way to meeting the requirements of the Paris Accord, having dropped by 9.7 per cent of the required 30 per cent.

The report was developed in response to Canada's commitment to cut GHG by 30 per cent below the 2005 emission levels, and to do this by 2030.

The report also found that agriculture in Saskatchewan is a key component in the province's GHG mitigation ability. With over 40 per cent of the crop producing acres in Canada, agriculture represents an opportunity to sequester GHG emissions through the continuous production of food and feed crops. Following the adoption of sustainable agricultural practices such as no-tillage and crop rotations, millions of acres of summer fallow were removed from tillage, a carbon releasing process, and have entered continuous crop production, thus sequestering GHG.

Dr. Stuart Smyth

Assistant Professor in the USask College of Agriculture and Bioresources and Industry Research Chair in Agri-Food Innovation

Lana Awada:

Senior Policy Fellow, Centre for the Study of Science and Innovation Policy, Johnson Shoyama Graduate School of Public Policy

GIFS AFFILIATE PLAYING LARGE ROLE IN "MADE IN CANADA" INITIATIVE THAT COULD IMPROVE THE HEALTH OF MILLIONS

One of Canada's most exported food crops, lentils are widely consumed in many countries. On their own, lentils are high in nutritional value. However, certain populations such as women and adolescent girls are more vulnerable to iron and other micronutrient deficiencies. Lentils fortified with iron and other micronutrients provide a viable food vehicle for improving the health and nutrition status of vulnerable populations in low and middle-income countries.

Dr. Albert Vandenberg

Since 2015, GIFS affiliate, USask Professor and NSERC Industrial Chair, Dr. Albert Vandenberg, has been working with a team of researchers to develop a technique to fortify lentils with iron and other micronutrients. The project is an international collaboration that is exploring the potential for Saskatchewan lentils to be used in dietary solutions for iron and other micronutrient deficiencies and arsenic toxicity. The pilot country is Bangladesh, with the vision to expand to other countries where micronutrient deficiency is a public health concern.

As originating donor, funder and collaborator, GIFS has been supporting Vandenberg's research since 2015.

With core funding from the Government of Canada, and partners such as Nutrition International, Saskatchewan Agriculture Development Fund, and Grand Challenges Canada, Vandenberg and Dr. Rajib Podder of USask have successfully developed a technique to fortify lentils with iron. The technique is being reviewed to ensure that the new product withstands cooking and food preparation practices in low and middle-income countries. A research trial to determine the effectiveness of iron-fortified lentils in improving the iron status of adolescent girls of rural Bangladesh has been completed. The human efficacy trial was also completed, with final documentation available in late 2019.

The research is a stepping-stone to creating a market for fortified lentil products in Bangladesh. To that end, Vandenberg is also collaborating with Nutrition International through the Nutrition Leverage and Influence for Transformation (NLIFT), a Government of Canada-funded business model dedicated to improving the lives of millions of women, adolescent girls and young children in Asia and Africa.

Market research conducted by Nutrition International has indicated a willingness on the part of consumers and buyers to purchase and try the fortified lentils, and the "Canada" brand of lentils appears to be well-accepted. A parallel market study by Nutrition International will be used to inform and engage processors in Saskatchewan to invest in processing and marketing fortified lentil products.

Should the human efficacy trial prove positive, the research results will be used to garner support for large-scale production of fortified lentils and consumption through social protection programs and open market channel in countries which consume lentils. The study results will also contribute to knowledge about how to enhance iron and micronutrient status of adolescents and women in countries where micronutrient deficiencies remain a public health concern.

QUICK FACTS ON **LENTILS**

- Canada is the top lentil producer and exporter in the world, with 40-50% of global production (FAOSTAT, 2014-16)
- Saskatchewan grows over 90% of Canadian lentils (Saskatchewan Specialty Crop Report, 2016).
- The value of lentil exports from Canada reached $2.4 billion in 2015 (Saskatchewan Pulse Growers, 2016).
- Global per capita production of lentils increased by more than 200% from 1973-1983 to 2003-2013 (FAOSTAT 2013). This upward trend in global lentil consumption will continue because of the popularity of lentils in diets and the fact that de-hulled lentils cook more quickly than milled rice. Canada will be the major beneficiary of the trend (AAFC Canadian Pulse Industry Report 2011).
- The nitrogen fixing capability of lentils is a positive sustainable attribute.

TRANSFORMING CROP BREEDING THROUGH PHENOTYPING

The Plant Phenotyping and Imaging Research Centre (P^2IRC) managed by GIFS at USask is quickly becoming an internationally recognized centre of excellence in phenotyping - a unique resource for plant breeders around the world. With P^2IRC, sustainable new crop varieties with specific desired traits will be developed at previously unimaginable speed and scale.

Created in 2015 with funding from the Canada Excellence Research Fund, P^2IRC is a multi-disciplinary program where almost 250 researchers and graduate students in breeding, agronomy, genetics, genomics, engineering, physics, soil science, chemistry, computer sciences and IT, and social sciences/economics, have been collaborating with 106 organizations and institutions in Canada and abroad to conduct research in four areas: Phenometrics, Image Acquisition Technologies, Computational Informatics of Crop Phenotype Data and Societal and Developing World Impact.

P^2IRC provides a unique training environment where skilled researchers and graduate students are leading next generation discovery with the goal of contributing to the commercial sector.

- Two new novel interactive genome viewing platforms were created and currently being used to interrogate and interpret multiple plant genomes and have been deployed to represent the reference wheat, canola and lentil genomes.
- A significant amount of data analysis has been completed, using large amounts of imaging data that were collected during canola, wheat and lentils field trials via the aerial (drone) and in-field phenomobile platforms.
- Two landmark papers on the bread wheat genome were published in Science in August 2018, co-authored by Drs. Curtis Pozniak and Andrew Sharpe.
- A manuscript describing the full assembly of the durum wheat genome together with other key aspects of genome biology was published in Nature Genetics in early 2019.

UNIVERSITY OF SASKATCHEWAN
Plant Phenotyping and Imaging Research Centre
www.p2irc.usask.ca

Using this foundational research, a new "Flagship" program approach is being developed to integrate and direct the new science and technology platforms created, to yield important outcomes that will transform crop breeding and lead to commercial spin-offs involving field and aerial sensors, artificial intelligence tools, satellite imaging, robotics, and big data analytics.

The annual P^2IRC Symposium brings together nearly 300 researchers, students and industry experts involved in P^2IRC-related research.

OMICS AND PRECISION AGRICULTURE

Dr. Andrew Sharpe with the PromethION, which is capable of completing DNA and RNA sequencing on a large scale at great speeds.

BUILDING INNOVATION IN AGRICULTURE

Opening in 2019, the Omics and Precision Agriculture Laboratory (OPAL) will serve as a one of a kind hub for agricultural research in Canada, by offering state-of-the-art integrated service platforms for the crop sector in genomics, phenomics and bioinformatics. Using OPAL research, plant breeders can ensure crop inputs such as fertilizer and plant protection products are used at the correct time and place to increase productivity and maximize yields, in a sustainable manner.

OPAL is a joint initiative between GIFS, USask, National Research Council, and Agriculture and Agri-Food Canada, with a strategic investment from Western Economic Diversification Canada.

The partners combined will deliver an unparalleled agricultural research environment and their existing analytical capabilities provide a core foundation for the initiative. This partnership is an excellent example of collaboration across various scientific and other research partners, to achieve a common outcome with benefits in Canada and beyond.

Through OPAL, GIFS will provide the latest omics' technologies and support the use of next generation agricultural technology, such as advanced camera systems, drones and digital phenotyping. Overall, OPAL will provide a complete solution tailored to crop data and analysis for client stakeholders, and will support existing, emerging and transformative precision agriculture techniques

TRAINING THE NEXT GENERATION OF SCIENTISTS

P²IRC STUDENTS

To date, more than 80 students (undergraduate to PhD levels) from a multitude of disciplines including breeding, agronomy, genetics, genomics, engineering, physics, soil science, chemistry, computer sciences and IT, and social sciences/economics have been involved in P²IRC. These students have diverse interests, areas of expertise, and aspirations and are helping to play a role in creating an internationally recognized centre of excellence in phenotyping.

PhD Student in Applied Microbiology, Zayda Morales Moreira, has worked under Dr. Jim Germida and Dr. Bobbi Helgason, on the seed microbiome of agricultural crops.

The research premise was that by improving our understanding of seed microbiomes, we may be able to adjust and exploit the various organisms present in the microbiome to create diverse breeding lines. By harnessing the potential of the microbiota naturally carried by seeds, we can ensure sustainable ecological practices.

Moreira's research focused on characterizing the microbial communities that inhabit the seed surface among canola, lentil and wheat lines. This research will have implications for crop production and food security. It will also reduce the indiscriminate use of pesticides and organic and inorganic inputs in agriculture.

Moreira, obtaining wheat rhizosphere and root samples, in order to analyze the microbial communities. This photo received 'Viewer's Choice, Runner Up' in the University of Saskatchewan Images of Research Competition 2018.

BAXTER SCHOLARSHIP WINNERS

Current Dr. Donald Baxter Scholarship winners are working on research projects that could improve crop production and develop innovative quality products from crops.

YUJIE PEI

Master's student, Yujie Pei, is studying under David Schneider, GIFS Research Chair in Digital and Computational Agriculture. Pei received an undergraduate degree in mathematics and applied mathematics from Henan Normal University, and came to Canada from Luoyang, China in September 2018 to work on a Master's degree in the USask School of Environment and Sustainability. Her research could lead to new mathematical methods that researchers can use to evaluate, track and select developed root traits to improve crop production.

ZILIANG SONG

Originally from Guangdong, China, Ziliang Song (Len) came to Canada after receiving a Bachelor of Engineering degree in food quality and safety from Jinan University in 2013. He has a Master's degree in plant sciences and is currently pursuing a PhD under the supervision of Tim Sharbel, GIFS Research Chair in Seed Biology and Martin Reaney in the USask Department of Plant Science.

Song is studying flax orbitides which have great potential to be developed for agricultural and pharmaceutical applications because of their diversity, stability and functionality. While preliminary studies have revealed some evidence of health benefits such as antitumor and antiviral, a lot of questions remain to be answered on their physiological role in the plant itself. A further understanding of this class of small circular protein will ultimately help make better use of the orbitides.

Dr. Patrick Man Pan Yuen, MD, FRCP(C)

The Dr. Donald Baxter Scholarship in Global Food Security, valued at $40,000 each year to study at the U of S under the supervision of a GIFS researcher, was made possible by a $1-million gift from Dr. Patrick Man Pan Yuen, a distinguished pediatrician and USask alumnus living in Hong Kong. Dr. Yuen named the scholarship fund in memory of his mentor Dr. Donald Baxter, who taught Yuen neurology when he was a medical student at USask. GIFS is matching the awards through an annual contribution over 25 years. The scholarships reward achievement and recognize graduate students from the People's Republic of China and Hong Kong interested in research and study in areas including biology, plant sciences, soil science, computer science, genomic sciences, biotechnology, food health and nutrition, and agriculture and agri-food policy.

TEACHING THROUGH IMAGES AND INTERACTION

GIFS Postdoctoral Fellow, Joanne Ernest and former Postdoctoral Fellow, Dorota Paczesniak created a unique interactive lesson entitled: "Beyond GMO: new technologies in genetic engineering for designing future food" to address public misconceptions about biotechnology and genetic engineering in a visually compelling and engaging way.

The lesson, being provided at the request of schools and agriculture-related organizations, uses props and comic-style images to explain how basic "genetic modification" - what biologists call "mutation" - occurs constantly in nature. Throughout history, humans have relied on naturally occurring mutation, coupled with the selection of desirable traits, to diversify our crops (for example, to create larger grain size).

To demonstrate how mutations arise, participants are asked to copy a few dozen letters of an actual DNA string in a short period of time, an exercise prone to simple errors. As participants see the types of errors that can occur on paper, they can better understand that these same errors can happen when DNA is copied inside living cells. These "genetic mutations" happen at a constant rate, and often have no visible effect on the organism.

The lesson then discusses traditional breeding, and how advances in the understanding of genetics have led to progress in breeding tools. For example, the ability to increase the natural mutation rate (mutagenesis), led to the development of hundreds of familiar crop varieties, like ruby red grapefruits or many varieties of durum wheat.

Further advances in breeding tools are being used to address problems we face in agriculture, such as targeting pests and diseases. One example is eggplant, a major vegetable crop in south Asia. Eggplants often suffer large losses due to caterpillars eating their leaves. To stop caterpillars from eating the plants, scientists in India copied the gene for a natural protein found in the bacteria Baccillus thuringiensis (Bt) that is poisonous to caterpillars, and inserted it into the eggplant. Not only did this innovation lead to better crop yields, it resulted in less pesticide use and improved farmer health for Asian eggplant farmers.

The bottom line: genetic engineering is just another method used to create new genetic variants that will have a positive impact on a crop and the resulting food product. Dorota and Joanne hope that by explaining the science behind genetic engineering in a way that is engaging and accessible to those who do not have extensive knowledge of biology, both understanding and acceptance of the use of biotechnology will increase.

2018 GIFS CONFERENCE

EMERGING TECHNOLOGIES FOR GLOBAL FOOD SECURITY

Mr. Rex Murphy, formerly of CBC's The National and the National Post moderated a debate, the topic of which was: Agriculture and Forestry Hold the Solution to Mitigating Atmospheric CO_2 and Climate Change.

GIFS' June 2018 Emerging Technologies for Global Food Security attracted 60 of the world's preeminent researchers, thinkers and policy makers on agriculture and the developing world. The participants, from 20 countries around the world, converged in Saskatoon and shared their knowledge with almost 300 researchers, students and agriculture industry experts.

THE NUMBERS:

60

60 speakers and panelists including preeminent scientists, R&D from industry, agriculture and food security policy makers from developing countries

275

275 delegates (academics, industry representatives, students) from 25 countries

1,008

Number of individuals from over 24 countries who participated in the conference via livestream, with the majority being in Canada, followed by USA, the UK and Nigeria

1,682

Number of times speaker videos were watched on GIFS' YouTube channel after the conference

Global Institute for Food Security

Financial Statements
April 30, 2019

Independent auditor's report

To the Directors of Global Institute for Food Security

Our opinion

In our opinion, the accompanying financial statements present fairly, in all material respects, the financial position of Global Institute for Food Security (the Institute) as at April 30, 2019 and the results of its operations and its cash flows for the year then ended in accordance with Canadian accounting standards for not-for-profit organizations.

What we have audited
The Institute's financial statements comprise:

- the statement of financial position as at April 30, 2019;
- the statement of operations and unrestricted net assets for the year then ended;
- the statement of cash flows for the year then ended; and
- the notes to the financial statements, which include a summary of significant accounting policies.

Basis for opinion

We conducted our audit in accordance with Canadian generally accepted auditing standards. Our responsibilities under those standards are further described in the *Auditor's responsibilities for the audit of the financial statements* section of our report.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Independence
We are independent of the Institute in accordance with the ethical requirements that are relevant to our audit of the financial statements in Canada. We have fulfilled our other ethical responsibilities in accordance with these requirements.

Responsibilities of management and those charged with governance for the financial statements

Management is responsible for the preparation and fair presentation of the financial statements in accordance with Canadian accounting standards for not-for-profit organizations, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

PricewaterhouseCoopers LLP
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"PwC" refers to PricewaterhouseCoopers LLP, an Ontario limited liability partnership.

In preparing the financial statements, management is responsible for assessing the Institute's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless management either intends to liquidate the Institute or to cease operations, or has no realistic alternative but to do so.

Those charged with governance are responsible for overseeing the Institute's financial reporting process.

Auditor's responsibilities for the audit of the financial statements

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with Canadian generally accepted auditing standards will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

As part of an audit in accordance with Canadian generally accepted auditing standards, we exercise professional judgment and maintain professional skepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Institute's internal control.
- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.
- Conclude on the appropriateness of management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Institute's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Institute to cease to continue as a going concern.
- Evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

We communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

“signed PricewaterhouseCoopers LLP”

Chartered Professional Accountants

Saskatoon, Saskatchewan
July 24, 2019

Global Institute for Food Security

Statement of Financial Position

As at April 30, 2019

	2019 $	2018 $
Assets		
Current assets		
Cash held by University of Saskatchewan (note 3)	26,107,939	27,353,427
Accounts receivable	30,137	-
Prepaid expenses	15,762	108,385
	26,153,838	27,461,812
Liabilities		
Current liabilities		
Accounts payable and accrued liabilities (note 5a)	2,579,843	159,280
Deferred revenue	-	11,500
	2,579,843	170,780
Unrestricted net assets	23,573,995	27,291,032
	26,153,838	27,461,812

Economic dependence (note 1)
Commitments (note 5)
Contingencies (note 6)

Approved by the Board of Directors

Director

Director

The accompanying notes are an integral part of these financial statements.

Global Institute for Food Security

Statement of Operations and Unrestricted Net Assets

For the year ended April 30, 2019

	2019 $	2018 $
Revenue		
Contributions from founding partners (note 4)	3,750,000	4,250,000
Interest income (note 3)	436,078	447,673
Fee for service and other income	22,513	6,058
	4,208,591	4,703,731
Expenditures		
Research and education		
Grants and awards (notes 3 and 5a)	3,869,459	3,471,523
Occupancy costs (note 5b)	1,034,527	251,836
Salaries and benefits	551,199	85,108
Conferences and lecture series	402,448	-
External science advisory	73,116	43,096
Lab supplies	-	50,982
Consulting	-	39,983
	5,930,749	3,942,528
Administration		
Salaries and benefits	1,045,435	818,813
Consultants and contractors	394,456	283,629
Occupancy costs (note 5b)	208,303	182,890
Office operations (note 3)	105,636	108,171
Travel and recruitment	97,359	160,683
Board costs (note 3)	93,009	91,373
Communications and marketing	50,681	73,108
	1,994,879	1,718,667
	7,925,628	5,661,195
Deficiency of revenue over expenditures	(3,717,037)	(957,464)
Unrestricted net assets – Beginning of year	27,291,032	28,248,496
Unrestricted net assets – End of year	23,573,995	27,291,032

The accompanying notes are an integral part of these financial statements.

Global Institute for Food Security

Statement of Cash Flows

For the year ended April 30, 2019

	2019 $	2018 $
Cash provided by (used in)		
Operating activities		
Deficiency of revenue over expenditures for the year	(3,717,037)	(957,464)
Changes in non-cash working capital items		
Cash held by University of Saskatchewan	1,245,488	987,527
Accounts receivable	(30,137)	-
Prepaid expenses	92,623	(108,385)
Accounts payable and accrued liabilities	2,420,563	66,822
Deferred revenue	(11,500)	11,500
	3,717,037	957,464
Net change in cash	-	-
Cash – Beginning of year	-	-
Cash – End of year	-	-

The accompanying notes are an integral part of these financial statements.

1 Nature of business

The Global Institute for Food Security (the "institute" or "GIFS") was established by a Memorandum of Agreement (the "agreement") dated November 19, 2012 between the University of Saskatchewan, the Government of Saskatchewan, and Nutrien Ltd. (formerly Potash Corporation of Saskatchewan). The institute is a Type B Centre of the University of Saskatchewan (the "university"). The mandate of the institute is to place Saskatchewan among global leaders in food security research and policy development. The operation of the institute is economically dependent on the funding from Nutrien Ltd. and the Government of Saskatchewan (note 4).

2 Summary of significant accounting policies

a) Basis of presentation

These financial statements include the accounts of the institute and are presented in accordance with Canadian accounting standards for not-for-profit organizations ("ASNPO").

b) Use of estimates

The preparation of financial statements in conformity with ASNPO requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements and the reported amount of revenue and expenditures during the reporting period. Actual results could differ from these estimates.

c) Revenue recognition

The institute follows the deferral method of accounting for contributions which includes funding from the Government of Saskatchewan and Nutrien Ltd. as well as other funding sources.

Unrestricted contributions are recognized as revenue when received or receivable if the amount to be received can be reasonably estimated and collection is reasonably assured. Restricted contributions for expenses of the current period are recognized as revenue in the current period and restricted contributions for expenses of one or more future periods are deferred and recognized as revenue in the same period or periods as the related expenses are recognized.

Investment income earned on the cash held by University of Saskatchewan is recognized as revenue when the university can measure and transfer the income to the institute.

Contributions of materials and services are recognized only when a fair value can be reasonably estimated and when the materials and services are used in the normal course of the institute's operations and would otherwise have been purchased.

d) Financial instruments

Financial assets and financial liabilities, consisting of cash held by University of Saskatchewan and accounts payable and accrued liabilities, are initially recognized at fair value and subsequent measurement is at amortized cost. The institute does not consider itself to have significant exposure to credit risk, currency risk, interest rate risk, liquidity risk, market risk or other price risk.

3 Related party transactions

During the year ended April 30, 2019, the institute purchased goods and services from the university in the amount of $9,832 (2018 – $26,164), which are included in office operations expenditures. During the year, the university provided the institute with access to facilities, phones, computer networks and financial administrative systems needed to support the operational needs of the institute. Of the grants and awards made during the year ended April 30, 2019 by the institute, $3,522,236 (2018 – $3,188,375) were made to the university, including individuals or entities related to or employed by the university.

All funds received by the institute are held in, and payments to vendors of the institute are made from, bank accounts administered by the university, which are included on the statement of financial position as "Cash held by University of Saskatchewan". The average monthly balance earned a rate of 1.63% during the year (2018 – 1.65%) and interest income of $436,078 (2018 – $447,673) was received from the university during the year.

During the year ended April 30, 2019 members of the institute's Board of Directors received payments for per diems and expenses of $93,009 (2018 – $91,373).

All related party transactions described above are measured at the exchange amount, which is the consideration established and agreed to by the parties.

4 Contributions from founding partners

The agreement (note 1) features a funding commitment of $15 million from the Government of Saskatchewan over seven years ending April 30, 2020 and a provisional donation to the institute of up to $35 million by Nutrien Ltd. over seven years, subject to an annual review of the institute including certain reporting requirements being met and satisfactory performance against certain objectives and metrics. The provisional donation from Nutrien Ltd. may be structured such that funds are provided evenly over the seven year period, or proportionally matched with the growth of the institute, or by some other agreed upon manner. Nutrien Ltd. will determine on an annual basis whether or not to make a contribution during any fiscal year.

As of April 30, 2019, the funding received to-date is $13 million (2018 – $11 million) from the Government of Saskatchewan and $35 million (2018 – $33.25 million) from Nutrien Ltd.

5 Commitments

a) Funding awards

One of the core activities of GIFS is to provide grants to eligible scientific investigators for the purpose of research in a wide range of issues related to food production and food security. As of April 30, 2019, funding commitments have been made toward nineteen projects with multi-year grants. The total maximum commitment on these projects is $23,517,187, of which $3,869,459 was funded during the year (2018 – $3,471,523) and of which $16,170,851 has been funded in total as of April 30, 2019. These commitments include $7 million for the creation of a Chair in Seed Biology to support the "Seed" pillar of GIFS' strategic plan to address food sustainability. As of April 30, 2019, $6 million of the total amount funded to date relates to this item.

Based on the above, total anticipated maximum commitments over the next five years are as follows (note that this excludes $2,525,000 included in accounts payable and accrued liabilities at April 30, 2019):

	$
2020	2,640,227
2021	1,526,666
2022	1,339,443
2023	1,040,000
2024	40,000
Thereafter	760,000

Included in the maximum commitments disclosed above is a contribution of up to $499,999 from GIFS to Divseek International Network Inc. ("DIN") in relation to the award entitled "Building Global Research Collaboration for Mobilising Crop Diversity". The contributions are to be made over a term of April 1, 2019 to March 31, 2022 and are conditional upon a member of the university becoming and remaining a Board member for DIN for that term and receipt by the university of certain reporting from DIN. Any unspent funds are to be returned to GIFS within 30 days of the end of the term.

Also included in the maximum commitments disclosed above is an annual contribution of $1 million from GIFS to the university, for a 7-year period commencing in the year ended April 30, 2017, related to the $10 million Canada Excellence Research Chair (CERC) funding which was awarded to the university during the year ended April 30, 2017. The Research Chair is held by the Associate Director of GIFS and supports the "Roots" pillar of GIFS' strategic plan to address food sustainability.

Also included in the maximum commitments disclosed above is an annual contribution to the university of $40,000 from GIFS, for a 25-year period commencing during the year ended April 30, 2017, related to funding the Dr. Donald Baxter Scholarship for Global Food Security, which was created during the year ended April 30, 2017 by means of a gift of $1 million to the university. The scholarship fund will be endowed and awarded annually from the scholarship fund administered by the university by a committee comprised of members from GIFS and the university.

During the year ended April 30, 2016 the Canada First Research Excellence Fund (CFREF) Steering Committee approved funding to the university, for the application entitled Designing Crops for Global Food Security submitted by the university, for a total amount of $37.24 million between September 2015 and August 2022. The program focuses on the "Digital Agriculture" pillar of GIFS' strategic plan to address food sustainability. GIFS has no financial commitments related to the CFREF funding.

b) The university is party to "License to Occupy Premises at the National Research Council" agreements on behalf of the institute for office and laboratory space. The minimum future commitments under the agreements are as follows and assume renewal of existing leases at similar rates:

	$
2020	739,729
2021	514,017
2022	391,675

Included in the minimum future commitments immediately above is $90,000 per year for fit-up and leasehold improvement costs for the 2020 through 2022 fiscal years and additional one-time leasehold improvement costs of $200,000 in fiscal 2020.

6 Contingencies

In the normal course of operations, the institute becomes involved in legal actions. Some of these potential liabilities may become actual liabilities when one or more future events fails to occur. To the extent that the future event is likely to occur, and a reasonable estimate of the loss can be made, an estimated liability is accrued and an expense recorded. Management believes any resulting outcome would not have a material effect on the statement of financial position or the statement of operations and unrestricted net assets.

Global Institute for Food Security

Financial Statements
April 30, 2018

July 18, 2018

Independent Auditor's Report

To the Directors of
Global Institute for Food Security

We have audited the accompanying financial statements of Global Institute for Food Security, which comprise the statement of financial position as at April 30, 2018 and the statements of operations and unrestricted net assets and cash flows for the year then ended, and the related notes which comprise a summary of significant accounting policies and other explanatory information.

Management's responsibility for the financial statements
Management is responsible for the preparation and fair presentation of these financial statements in accordance with Canadian accounting standards for not-for-profit organizations, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditor's responsibility
Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with Canadian generally accepted auditing standards. Those standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

PricewaterhouseCoopers LLP
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"PwC" refers to PricewaterhouseCoopers LLP, an Ontario limited liability partnership.

Opinion
In our opinion, the financial statements present fairly, in all material respects, the financial position of Global Institute for Food Security as at April 30, 2018 and the results of its operations and its cash flows for the year then ended in accordance with Canadian accounting standards for not-for-profit organizations.

"signed PricewaterhouseCoopers LLP"

Chartered Professional Accountants

Global Institute for Food Security

Statement of Financial Position

As at April 30, 2018

	2018 $	2017 $
Assets		
Current assets		
Cash held by University of Saskatchewan (note 3)	27,353,427	28,340,954
Prepaid expenses	108,385	-
	27,461,812	28,340,954
Liabilities		
Current liabilities		
Accounts payable and accrued liabilities	159,280	92,458
Deferred revenue	11,500	-
	170,780	92,458
Unrestricted net assets	27,291,032	28,248,496
	27,461,812	28,340,954

Economic dependence (note 1)
Commitments (note 5)
Contingencies (note 6)

Approved by the Board of Directors

_____ Director _____ Director

The accompanying notes are an integral part of these financial statements.

Global Institute for Food Security

Statement of Operations and Unrestricted Net Assets

For the year ended April 30, 2018

	2018 $	2017 $
Revenue		
Contributions from founding partners (note 4)	4,250,000	2,000,000
Interest income (note 3)	447,673	508,044
Fee for service	6,058	-
	4,703,731	2,508,044
Expenditures		
Administration		
Salaries and benefits	818,813	847,228
Occupancy costs	434,726	503,289
Consulting	283,629	44,923
Travel and recruitment	160,683	124,660
Office operations (note 3)	108,171	79,223
Board costs (note 3)	91,373	61,525
Communications and marketing	73,108	155,630
	1,970,503	1,816,478
Research and education		
Grants and awards (note 3)	3,471,523	4,710,125
Salaries and benefits	85,108	41,786
Lab supplies	50,982	-
External science advisory	43,096	68,537
Consulting	39,983	-
	3,690,692	4,820,448
	5,661,195	6,636,926
Deficiency of revenue over expenditures	(957,464)	(4,128,882)
Unrestricted net assets – Beginning of year	28,248,496	32,377,378
Unrestricted net assets – End of year	27,291,032	28,248,496

The accompanying notes are an integral part of these financial statements.

Global Institute for Food Security

Statement of Cash Flows

For the year ended April 30, 2018

	2018 $	2017 $
Cash provided by (used in)		
Operating activities		
Deficiency of revenue over expenditures for the year	(957,464)	(4,128,882)
Changes in non-cash working capital items		
Cash held by University of Saskatchewan	987,527	4,093,594
Prepaid expenses	(108,385)	-
Accounts payable and accrued liabilities	66,822	35,288
Deferred revenue	11,500	-
	957,464	4,128,882
Net change in cash	-	-
Cash – Beginning of year	-	-
Cash – End of year	-	-

The accompanying notes are an integral part of these financial statements.

1 Nature of business

The Global Institute for Food Security (the "institute" or "GIFS") was established by a Memorandum of Agreement (the "agreement") dated November 19, 2012 between the University of Saskatchewan, the Government of Saskatchewan, and Nutrien Ltd. (formerly Potash Corporation of Saskatchewan). The institute is a Type B Centre of the University of Saskatchewan (the "university"). The mandate of the institute is to place Saskatchewan among global leaders in food security research and policy development. The operation of the institute is economically dependent on the funding from Nutrien Ltd. and the Government of Saskatchewan (note 4).

2 Summary of significant accounting policies

a) Basis of presentation

These financial statements include the accounts of the institute and are presented in accordance with Canadian accounting standards for not-for-profit organizations ("ASNPO").

b) Use of estimates

The preparation of financial statements in conformity with ASNPO requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements and the reported amount of revenue and expenditures during the reporting period. Actual results could differ from these estimates.

c) Revenue recognition

The institute follows the deferral method of accounting for contributions which includes funding from the Government of Saskatchewan and Nutrien Ltd. as well as other funding sources.

Unrestricted contributions are recognized as revenue when received or receivable if the amount to be received can be reasonably estimated and collection is reasonably assured. Restricted contributions for expenses of the current period are recognized as revenue in the current period and restricted contributions for expenses of one or more future periods are deferred and recognized as revenue in the same period or periods as the related expenses are recognized.

Investment income earned on the cash held by University of Saskatchewan is recognized as revenue when the university can measure and transfer the income to the institute.

Contributions of materials and services are recognized only when a fair value can be reasonably estimated and when the materials and services are used in the normal course of the institute's operations and would otherwise have been purchased.

d) Financial instruments

Financial assets and financial liabilities, consisting of cash held by University of Saskatchewan and accounts payable and accrued liabilities, are initially recognized at fair value and subsequent measurement is at amortized cost. The institute does not consider itself to have significant exposure to credit risk, currency risk, interest rate risk, liquidity risk, market risk or other price risk.

3 Related party transactions

During the year ended April 30, 2018, the institute purchased goods and services from the university in the amount of $26,164 (2017 – $15,935), which are included in expenditures. During the year, the university provided the institute with access to facilities, phones, computer networks and financial administrative systems needed to support the operational needs of the institute. Of the grants made during the year ended April 30, 2018 by the institute, $3,188,375 (2017 – $4,429,610) were made to the university, including individuals or entities related to or employed by the university.

All funds received by the institute are held in, and payments to vendors of the institute are made from, bank accounts administered by the university, which are included on the statement of financial position as "Cash held by University of Saskatchewan". The average monthly balance earned a rate of 1.65% during the year (2017 – 1.6%) and interest income of $447,673 (2017 – $508,044) was received from the university during the year.

During the year ended April 30, 2018 members of the institute's Board of Directors received payments for per diems and expenses of $91,373 (2017 – $61,525).

All related party transactions described above are measured at the exchange amount, which is the consideration established and agreed to by the parties.

4 Contributions from founding partners

The agreement (note 1) features a funding commitment of $15 million from the Government of Saskatchewan over seven years ending April 30, 2020 and a provisional donation to the institute of up to $35 million by Nutrien Ltd. over seven years, subject to an annual review of the institute including certain reporting requirements being met and satisfactory performance against certain objectives and metrics. The provisional donation from Nutrien Ltd. may be structured such that funds are provided evenly over the seven year period, or proportionally matched with the growth of the institute, or by some other agreed upon manner. Nutrien Ltd. will determine on an annual basis whether or not to make a contribution during any fiscal year.

As of April 30, 2018, the funding received to-date is $11 million from the Government of Saskatchewan and $33.25 million from Nutrien Ltd.

5 Commitments

a) Funding awards

One of the core activities of GIFS is to provide grants to eligible scientific investigators for the purpose of research in a wide range of issues related to food production and food security. As of April 30, 2018, funding commitments have been made toward eighteen projects with multi-year grants. The total maximum commitment on these projects is $22,072,188, of which $3,471,523 was funded during the year (2017 - $4,710,125) and of which $12,391,073 has been funded in total as of April 30, 2018. These commitments include $7 million for the creation of a Chair in Seed Biology to support the "Seed" pillar of GIFS' strategic plan to address food sustainability. As of April 30, 2018, $5,000,000 of the $12,391,073 funded to date relates to this item.

Based on the above, total anticipated maximum commitments over the next five years are as follows:

	$
2019	3,357,555
2020	2,171,060
2021	1,162,500
2022	1,075,000
2023	1,075,000
Thereafter	840,000

Included in the maximum commitments disclosed above is an annual contribution of $1 million from GIFS to the university, for a 7-year period commencing in the year ended April 30, 2017, related to the $10 million Canada Excellence Research Chair (CERC) funding which was awarded to the university during the year ended April 30, 2017. The Research Chair is held by the Associate Director of GIFS and supports the "Roots" pillar of GIFS' strategic plan to address food sustainability.

Also included in the maximum commitments disclosed above is an annual contribution to the university of $40,000 from GIFS, for a 25-year period commencing during the year ended April 30, 2017, related to funding the Dr. Donald Baxter Scholarship for Global Food Security, which was created during the year ended April 30, 2017 by means of a gift of $1 million to the university. The scholarship fund will be endowed and awarded annually from the scholarship fund administered by the university by a committee comprised of members from GIFS and the university.

During the year ended April 30, 2016 the Canada First Research Excellence Fund (CFREF) Steering Committee approved funding to the university, for the application entitled Designing Crops for Global Food Security submitted by the university, for a total amount of $37.24 million between September 2015 and August 2022. The university delegated management of the research program and fund management responsibilities to the CEO and Executive Director of GIFS. The program focuses on the "Digital Agriculture" pillar of GIFS' strategic plan to address food sustainability. GIFS has no financial commitments related to the CFREF funding and no responsibilities as an organization beyond those delegated and designated to its CEO and Executive Director.

b) The university is party to "License to Occupy Premises at the National Research Council" agreements on behalf of the institute for office and laboratory space. The minimum future commitments under the agreements are as follows:

	$
2019	562,530
2020	352,331
2021	357,400
2022	271,599

Included in the minimum future commitments immediately above is $190,000 related to fit-up and leasehold improvement costs for the 2019 fiscal year, and $90,000 per year for the 2020 through 2022 fiscal years.

6 Contingencies

In the normal course of operations, the institute becomes involved in legal actions. Some of these potential liabilities may become actual liabilities when one or more future events fails to occur. To the extent that the future event is likely to occur, and a reasonable estimate of the loss can be made, an estimated liability is accrued and an expense recorded. Management believes any resulting outcome would not have a material effect on the statement of financial position or the statement of operations and unrestricted net assets.

Notes

Thank you to our Founding Partners for their commitment to helping us achieve our vision of ingenious science that delivers sustainable food security for the world.

Nutrien™ Feeding the Future™

Government of Saskatchewan

University of Saskatchewan

GIFS | GLOBAL INSTITUTE FOR FOOD SECURITY

Growing science for life

Nutrien - a Founding Partner

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