7TH ANNUAL

PLANT PHENOTYPING AND IMAGING RESEARCH CENTRE

P²IRC SYMPOSIUM 2022

OCTOBER 25

Holiday Inn Express & Suites
Saskatoon East-University
Saskatoon, SK

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Growing the Future ***with Digital Agriculture***

Welcome Message

Welcome to the seventh annual Plant Phenotyping and Imaging Research Centre (P²IRC) Symposium.

After two years of virtual conferences, we are excited to meet again in person and bring together researchers, industry representatives and students to discuss the latest advances in genomics, phenomics, machine learning, root plant imaging and more.

Today's program — Growing the Future with Digital Agriculture — will provide updates on P²IRC's Flagship and Platform programs, explore emerging science and share insights from plant breeders who are putting these and other digital technologies to work.

It's also a time to reflect on P²IRC's mission and all it has accomplished. Since 2015, over 200 graduate students have received training through P²IRC. The centre has also brought together interdisciplinary researchers who have published over 100 research papers and are developing innovative tools to revolutionize crop improvement by accelerating the process of plant breeding and transforming food production capacity.

This work is made possible thanks to funding from the Canada First Research Excellence Fund and the leadership of many collaborators.

Collaboration is built into everything P²IRC does. The centre is managed by the Global Institute for Food Security (GIFS) at the University of Saskatchewan and has benefitted from the guidance of its institutional, industrial and international advisory committees consisting of renowned research, business and innovation leaders.

P²IRC's research has also engaged scientists and officials within many public and private organizations, including but not limited to Agriculture and Agri-Food Canada, various Colleges and departments at USask, the Canadian Light Source, the Sylvia Fedoruk Canadian Centre for Nuclear Innovation and the National Research Council of Canada.

Together, P²IRC and its partners have conducted leading-edge research and equipped plant breeders with new insights and innovative tools that will contribute to the development of better crop varieties for Canadian producers — and P²IRC's work isn't complete. As a result of the pandemic, P²IRC's seven-year mission will extend through the 2023 growing season and the resulting body of work will, no doubt, lay the foundation for further research and development.

Thank you to today's presenters, many of whom have travelled to be here, the Symposium Program and Organizing Committees and everyone at P²IRC and GIFS for their support.

I hope you find today's sessions engaging and informative and I encourage everyone to take advantage of the networking opportunities throughout the day and at the evening reception.

Dr. Ian Stavness,

P²IRC Program Director and Global Institute for Food Security Enhancement Chair

Tuesday, October 25, 2022

7:30 to 8:30 a.m. ***Conference Foyer***	**Registration and Continental Breakfast**
8:30 to 8:45 a.m. ***High Up Above Rooms A&B***	**Welcome and Opening Remarks** **Dr. Ian Stavness,** P²IRC Program Director and Global Institute for Food Security Enhancement Chair **Dr. Baljit Singh,** Vice-President Research, University of Saskatchewan
8:45 to 9:25 a.m. ***High Up Above Rooms A&B***	**Keynote Address** **Dr. Valerio Hoyos-Villegas,** McGill University — Turning the phenotyping bottleneck into a pipeline
9:25 to 10:15 a.m. ***High Up Above Rooms A&B***	**P²IRC Flagship 1: Yield Stability** **Dr. Eiji Nambara,** University of Toronto — Development of tools and methods to visualize/modulate abscisic acid signaling for improving water use in crops **Carlos Erazo Melo,** University of Saskatchewan - Dissecting the genetic basis of root gravitropism towards improving crop drought performance **Dr. Sampath Perumal,** Global Institute for Food Security — The structural variants landscape of canola (*Brassica napus*) genome
10:15 to 10:30 a.m. **Conference Foyer**	**Break**
10:30 to 11:20 a.m. ***High Up Above Rooms A&B***	**P²IRC Flagship 2: Mobilizing Root-Soil-Microbiome Interactions** **Dr. Bobbi Helgason,** University of Saskatchewan **Dr. Etienne Yergeau,** Institut national de la recherche scientifique of the Université du Québec — Modeling and engineering plant and soil microbiomes
11:20 a.m. to 12 p.m. ***High Up Above Rooms A&B***	**P²IRC Poster Competition Flash Talks**
12:00 to 1:00 p.m. ***Conference Foyer***	**Lunch**

1:00 to 1:50 p.m. ***High Up Above Rooms A&B***	**P²IRC Flagship 3: Deep Learning for Phenomics** **Derek Wright,** University of Saskatchewan — Dissecting lentil crop growth across multi-environment trials using unoccupied aerial vehicles **Pujitha Macha,** University of Saskatchewan — High-throughput automated phenotyping pipelines for 2D and 3D plant root images **Dr. Jordan Ubbens,** Global Institute for Food Security — What really matters? Exploring learned representations of genotype data
1:50 to 2:40 p.m. ***High Up Above Rooms A&B***	**P²IRC Flagship 4: Field Imaging for Phenotyping** **Dr. Kwabena Nketia,** University of Saskatchewan — Agriculture, big data and xAI: current and future needs of crop phenotyping **Dr. Breeanna Kelln,** University of Saskatchewan — Integrated forage management and utilization: Research for Western Canada
2:40 to 2:55 p.m. ***Conference Foyer***	**Break**
2:55 to 3:45 p.m. ***High Up Above Rooms A&B***	**P²IRC Platforms** **Dr. Peter Phillips,** Johnson Shoyama Graduate School of Public Policy — Responding to the climate crisis with biotechnology **Travis Gray,** Global Institute for Food Security — PlotVision: A software platform for aerial crop image storage, organization and analysis **Dr. Banani Roy,** University of Saskatchewan — Supporting multidisciplinary data analytics
3:45 to 4:25 p.m. ***High Up Above Rooms A&B***	**Keynote Address** **Dr. Danny Singh,** Iowa State University — Diversity in breeding projects and technical approaches for more sustainable crop production
4:25 – 4:35 p.m.	**Closing Remarks** **Dr. Ian Stavness,** P²IRC Program Director and Global Institute for Food Security Enhancement Chair
5:00 – 7:30 p.m. ***High Up Above Rooms A&B***	**Poster Competition & Networking Reception** **6:30 p.m.** Awards Presentation

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University of Saskatchewan

Finding solutions to the challenges facing the global food system requires an innovative and collaborative approach that delivers value to all stakeholders.

The Global Institute for Food Security (GIFS) at the University of Saskatchewan (USask) works with partners to discover, develop and deliver innovative solutions for the production of globally sustainable food. Serving as 'agriculture's innovation catalyst', GIFS is connecting the agri-food ecosystem, advancing innovation and bridging the gap to commercialization to deliver resilient and sustainable food security for all stakeholders. Our **scientific programs** span discovery research through to full-scale production of commercial outputs while our **technology platforms** transform our scientific competencies and capabilities into capacities for stakeholders.

WE ARE OPEN FOR BUSINESS.

Located within one of the world's strongest agri-science ecosystems, we are helping to build a food-secure world from Saskatchewan-out, working with, industry, producers, consumers, academics and governments both at home and abroad to decrease the time between the discovery of innovative science and its delivery to market at home and around the globe.

Programs

RESILIENT AGRICULTURE

By advancing new knowledge and understanding of the key genes and mechanisms underpinning agronomically important crop traits and technologies, our Resilient Agriculture Program will create a crop gene discovery pipeline.

ROOT-SOIL-MICROBIOME INTERACTIONS

Our Roots-Soil-Microbial Interactions program digs into the relationship between roots, soil and its micro-organismal complement—a dynamic ecosystem that has a substantial effect on soil fertility and crop health.

PLANT IMPROVEMENT

Our Plant Improvement program, the Plant Phenotyping and Imaging Research Centre (P^2IRC), is a digital agriculture research centre developing innovative tools to accelerate and transform crop breeding and food production.

Platforms

CELL BIOLOGY

Our Cell Biology Platform provides technical expertise and scale to support plant biology research, serving also as a practical tool for cultivar improvement for our research programs, our partners and the agbiotech ecosystem.

DATA MANAGEMENT & ANALYTICS

Our Data Management and Analytics Platform enables the development, deployment and use of digital technologies to improve the management, analysis and application of R&D data in the design of new innovations that advance food security.

ENGINEERING BIOLOGY

Our Engineering Biology Platform combines automation and miniaturization, biology and computation (ABC) to rapidly scale up the design, construction, refinement and production of more nutritious and sustainable crops and food products.

OPAL Omics and Precision AGRICULTURE LABORATORY

OMICS & PRECISION AGRICULTURE LABORATORY

OPAL is our state-of-the-art facility that provides comprehensive analyses of microbial, plant and animal samples – delivering crystal clear, actionable data for the agriculture and agri-food sectors.

PLANT GROWTH FACILITIES

Our Plant Growth Facilities Platform provides plant growth space, plant production supplies, integrated pest management solutions and quality seed to our internal and external stakeholders.

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Our integrated genomics, phenomics and bioinformatics services make GIFS' Omics and Precision Agriculture Laboratory a one-stop shop for the extensive analyses of microbial, plant and animal samples.
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OPAL's Genomics Platforms

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Omics and Precision
AGRICULTURE LABORATORY

APPLICATION AREA	ACTIVITY	PLATFORM
Next-Generation Sequencing	Whole Genome	Illumina NovaSeq 6000
	Metagenomics	Illumina MiSeq
		Illumina NovaSeq 6000
	Small Genomes	PacBio Sequel IIe
	Chromatin Conformation Capture (Hi-C)	Illumina NovaSeq 6000
Long-read sequencing	HiFi reads	PacBio Sequel IIe
	Nanopore sequencing	Oxford Nanopore PromethION
		Oxford Nanopore MinION
Functional Genomics & Epigenomics	RNA-Seq	Illumina NovaSeq 6000
	ChIP-Seq	Illumina NovaSeq 6000
Genotyping	SNP genotyping	Quantitative Real-Time PCR
	Genotyping by Sequencing (GBS)	Illumina NovaSeq 6000

Other sequencing needs? Email us at partnerwithus@gifs.ca to learn how we may help.

OPAL's Phenomics Platforms

Digital phenotyping

- Unmanned Aerial Vehicles (UAV): drones, fixed wing
- Ground support vehicle for UAV transport and operation
- In-field platforms for high resolution imaging
- PlotVision: Image data processing pipeline and machine learning feature resolution

Sensor technology

- Multi-spectral
- High spatial resolution RGB
- Thermal imaging

OPAL's Bioinformatics

Data acquisition and analysis

- Large data storage (2PB) and compute (3TB RAM/GPU)
- Genome assembly and annotation, transcriptomics and epigenomics
- Genome visualization tools
- Linkage Analysis and GWAS, quantitative traits (QTL)

2022 P²IRC Symposium Program Committee

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Global Institute for Food Security and Department of Computer Science, University of Saskatchewan

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Department of Plant Sciences, University of Saskatchewan

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The Plant Phenotyping and Imaging Research Centre (P²IRC) has been made possible thanks to funding from the Canada First Research Excellence Fund (CFREF). P²IRC is located at the University of Saskatchewan (USask) and managed by the Global Institute for Food Security (GIFS).

***Join us* #P2IRC2022**

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