## **GENOMICS:**

Changing what we know today and how we will live tomorrow

> Dr. Simon Potter Director of Operations Genome Prairie



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Our Mission is to accelerate and leverage knowledge translation of genomic discoveries to social and economic benefits for the people of Manitoba and Saskatchewan.

- Non Profit organization part of the Canadian Genomics Enterprise
- Facilitates the commercialization of innovative genomics-based projects which address the regional priorities of the Prairies
- Focus on delivering solutions for regional priorities in agri-food, health and energy/mining.

Genomics will change what we know today and how we live tomorrow.

### **GENOME PRAIRIE**

### **Our Goal**

To support stakeholders across Manitoba and Saskatchewan in capturing the benefits of advanced research in genomics and related biosciences



Align the partners and resources needed to develop and manage targeted projects addressing regional priorities



Enable participation among regional researchers in Genome Canada's competitive granting process



### WHAT IS GENOMICS?

#### What is a genome?

A genome is an organism's complete set of DNA – basically a blueprint for an organism's structure and function.

#### What is genomics\*?

Genomics is the science that aims to decipher and understand the entire genetic information of an organism. Used here to encompass other related technologies – transcriptomics, proteomics, metabolomics etc...

#### Why is genomics critical to Canada?

- It is driving Canada's emerging bioeconomy.
- Genomic research and applications relate to forestry, agri-food, fisheries & aquaculture, energy & mining, environment and health.
- Delivers solutions to global challenges and equips Canadian industries with knowledge that can drive growth, productivity, commercialization and global competitiveness in these sectors.



### GENOMICS & CLEAN TECHNOLOGY



### **CANADA'S ACTIONS FOR CLIMATE CHANGE**

### The Challenge:

Canada's commitment to transform to a low-carbon and climate-resilient economy

### The Opportunity:

For significant economic growth, in particular in the agriculture and forestry sectors

### **The Priorities:**

Clean Technology

Indigenous economic development





### POTENTIAL ECONOMIC IMPACT

Total Canadian exports 2015	\$525 billion
Farm, fishing and intermediate food products	\$32 billion
Forest products	\$40 billion
Food beverage products	\$30 billion
Total farm, forest, fish, processed food	\$102 billion

- The agriculture, forestry, fisheries and aquaculture sectors account for 20% of Canadian exports
- These sectors have growth opportunities in Canada, but must take the appropriate actions in response to climate change.

## *Economic growth in Canada will not happen without innovation in these Ag sectors.*



### **CLEAN TECHNOLOGIES**

**Genome**Prairie

#### **Eight categories of cleantech**



### **CLIMATE CHANGE MITIGATION**

### Genomics research in clean technology can support Canada's commitment to mitigating climate change and lead to economic growth.

#### Genomics can be used to:

- develop cleaner technologies, ex. the identification of better enzymes for the conversion of biomass into biofuels;
- select and breed trees that will enhance the ability of our forests to act as major carbon sinks;
- biomanufacture new biomaterials to replace existing petroleum-based materials;
- develop new tools for the bioremediation of contaminated sites; and
- reduce the environmental footprint of the dairy industry by breeding cows that produce less manure and emit less methane.



### ADAPTATION

#### Genomics can be used to:

- develop climate change-resilient crops, which can withstand a broad-spectrum stresses such as drought, heat, cold, floods, diseases and pests;
- identify adaptive genes in the major food crops that have been lost through centuries of domestication, by sequencing their wild relatives stored in genebanks around the world;
- enhance the nitrogen fixing capacity of legumes, such as lentils; and
- inform reforestation to plant the right tree in the right climactic area.



## OUR PROJECTS



### PLM

#### Augmenting the Plant Microbiome to Improve Crop Yield and Stress Resilience



- The PLM project stems from the findings of Professor Vujanovic and his colleague Jim Germida at the University of Saskatchewan
- PLM project aims to develop breakthrough microbial products that can colonize crop hosts and substantially improve seed germination, yield, and drought-and heat-stress resilience.
- The products have been successfully tested in over 20 genotypes of wheat, barley, canola, and pulses – crops that account for more than \$15 billion in annual production in Canada alone.



### CTAG2

#### **Canadian Triticum Applied Genomics**



- Wheat accounts for a staggering 20 per cent of all calories consumed throughout the world.
- The emphasis of CTAG2 is to conduct research to better understand the wheat genome and to apply this research to develop genetic markers and predictive genetic tests to improve selection efficiency in Canadian wheat breeding programs.
- The end result will be the development of tools and strategies for wheat breeders to develop improved cultivars that are more productive and resistant to disease and pests, and resilient to heat and drought stresses.



### REVAMP

## Reverse vaccinology approach for the prevention of mycobacterial disease in cattle



- This project aims to develop vaccines against two important infectious diseases of cattle, Johne's disease and bovine tuberculosis.
- Lack of effective vaccines for some diseases contributes to the overuse of antibiotics and to a strategy of slaughtering infected animals.
- Project will increase productivity and profitability for cattle producers by reducing the use of slaughter or antibiotics to control infections.
- The annual financial impact of the vaccines is estimated to be around \$100 million, with international sales of a further \$400 million.



## CUC

#### **Commercial Utilization of Canola Oil**



- Canola is Canada's fastest growing crop and generates one-quarter of all farm cash receipts.
- Objective of project is to use genomic approaches to enhance the seed's oil content and its protein levels while also reducing fibre and saturated fatty acid content.
- Success will ensure that Canadian canola growers and associated sectors continue to play a leading role in capturing global markets.



### FICOGEN

#### **Fibre Composites and Biomatrix Genomics**





- Bast fibres are grown in North America for their oil seeds, used in foods, cosmetics and lubricants.
- One of the most promising uses of biofibres is in combining them with a resin to make a biocomposite.
- To develop and test a prototype part from a parking enforcement vehicle using a novel biocomposite.
- The biocomposite uses flax fibres with traits enhanced for use in advanced composite materials and a binding resin/polymer produced from novel microbial strains.



### GENICE

### Microbial Genomics for Oil Spill Preparedness in Canada's Arctic Marine Environment



- Designed to help mediate needed information for bioremediation and develop capacity and preparedness for oil spills in Arctic waters.
- Will study the naturally occurring microorganisms present in the Artic environment, which are well-known to mobilize and biodegrade oil and help mitigate the negative impacts of oil spills.
- Will help enhance and strengthen Canada's oil spill emergency response by improved understanding of the Arctic marine microbiome and its bioremediation potential.



### **GENOME360**

- Proposal to Western Economic Diversification
- Combination of mobile teaching / analysis and central data management laboratories
- Designed to support SMEs across the prairies in the development of clean technologies





# THANK YOU!

**Dr. Simon Potter** Director of Operations

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