Towards Environmental Sustainability – The role of Genomic technologies in building a low-carbon, climate-resilient Ag-sector bioeconomy.

Naveed Aziz

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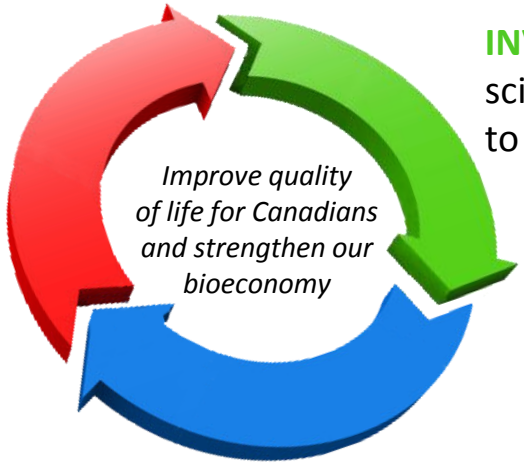
Genome Canada's Mission

CONNECT ideas and people across public and private sectors to find new uses and applications for genomics



INVEST in large-scale science and technology to fuel innovation

TRANSLATE discoveries into applications to maximize impact across all sectors

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Canada's Genomics Enterprise

6	REGIONAL GENOME CENTRES
10	TECHNOLOGY PLATFORMS
313	FUNDED PROJECTS
>1,700	ACTIVE ANNUAL HIGHLY-QUALIFIED PERSONNEL
33	UNIVERSITIES
7	KEY SECTORS
>$1.3B	GENOME CANADA
>$1.7B	PROVINCES, INDUSTRY AND OTHER CO-FUNDERS
>195	INDUSTRY CO-FUNDING PARTNERS
> 110	COMPANIES CREATED OR ENHANCED

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Technology Platforms Across Canada

1. The Proteomics Centre
2. Sequencing Platform at the BC Cancer Agency Genome Sciences Centre
3. The Metabolomics Innovation Centre
4. The Centre for Applied Genomics
5. Toronto Centre for Phenogenomics
6. Network Biology Collaborative Centre
7. Canadian Data Integration Centre
8. McGill University and Genome Quebec Innovation Centre
9. Centre for Advanced Proteomics Analyses
10. Canadian Centre for Computational Genomics

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Genomics Is Driving Innovation And Growth Across All Sectors

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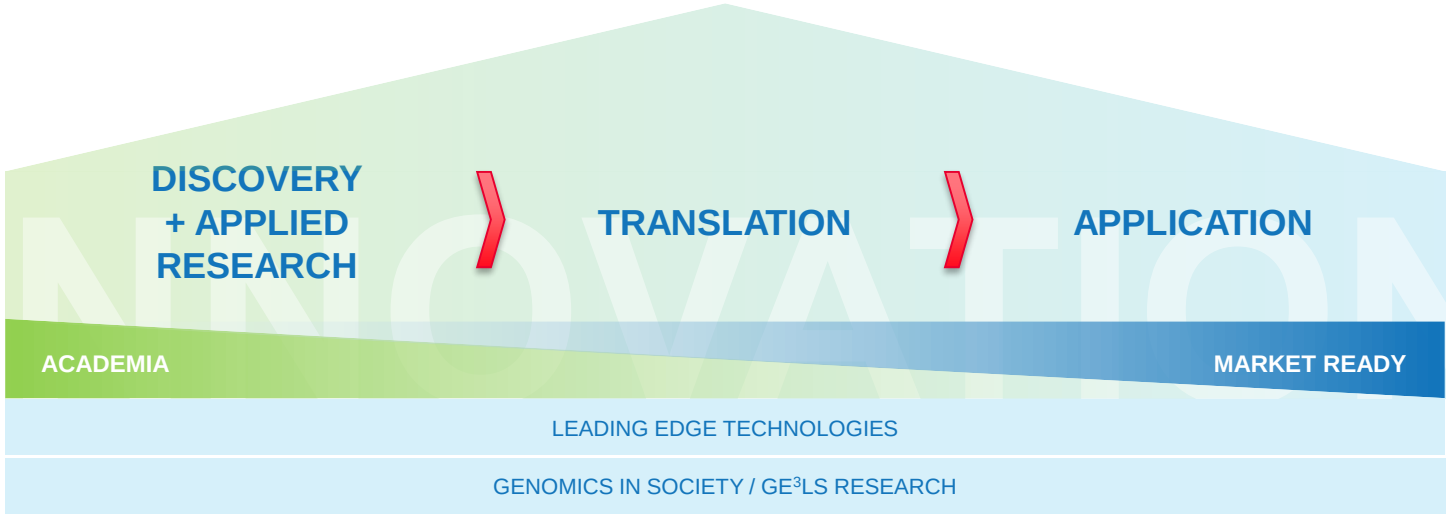
We Invest In The Entire Spectrum Of Innovation



From discovery and applied research through translation into real-world applications driven by user needs, solving challenges in all key sectors of our bioeconomy.

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Our Programs… *Large-Scale Science*

Large-Scale Applied Research Project (LSARP) Competitions:

- $2M to $10M projects for up to 4 years term
- targeted competitions to support projects using genomic approaches to address challenges in Canada's economic sectors.
- A rationale for how the research will bring value to the sector user, including where appropriate an economic analysis
- A detailed plan which explains how the deliverables from the research will be transferred, disseminated, used and/or applied to realize the social and/or economic benefits

❖ For example, the 2014 *Large-Scale Applied Research Project Competition (Genomics and Feeding the Future)*

❖ New 2018 LSARP Competition in Agriculture/Agrifood sector with a likely focus on *climate change* and *clean tech*.

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Our Programs… *Translation*

Genomic Applications Partnership Program (GAPP):

- Accelerate the application of Canadian genomics-derived solutions to real-world opportunities and challenges defined by receptor/users in public and private sectors.
- Support user-driven, academic-industry collaborations.
- Focuses on late stage R&D
- Driven by the user
- Focuses on user identified opportunity or challenge
- User puts “skin in the game” through at least one-third of investment

- On-going program with 7 rounds of competition complete, Round 8 underway.

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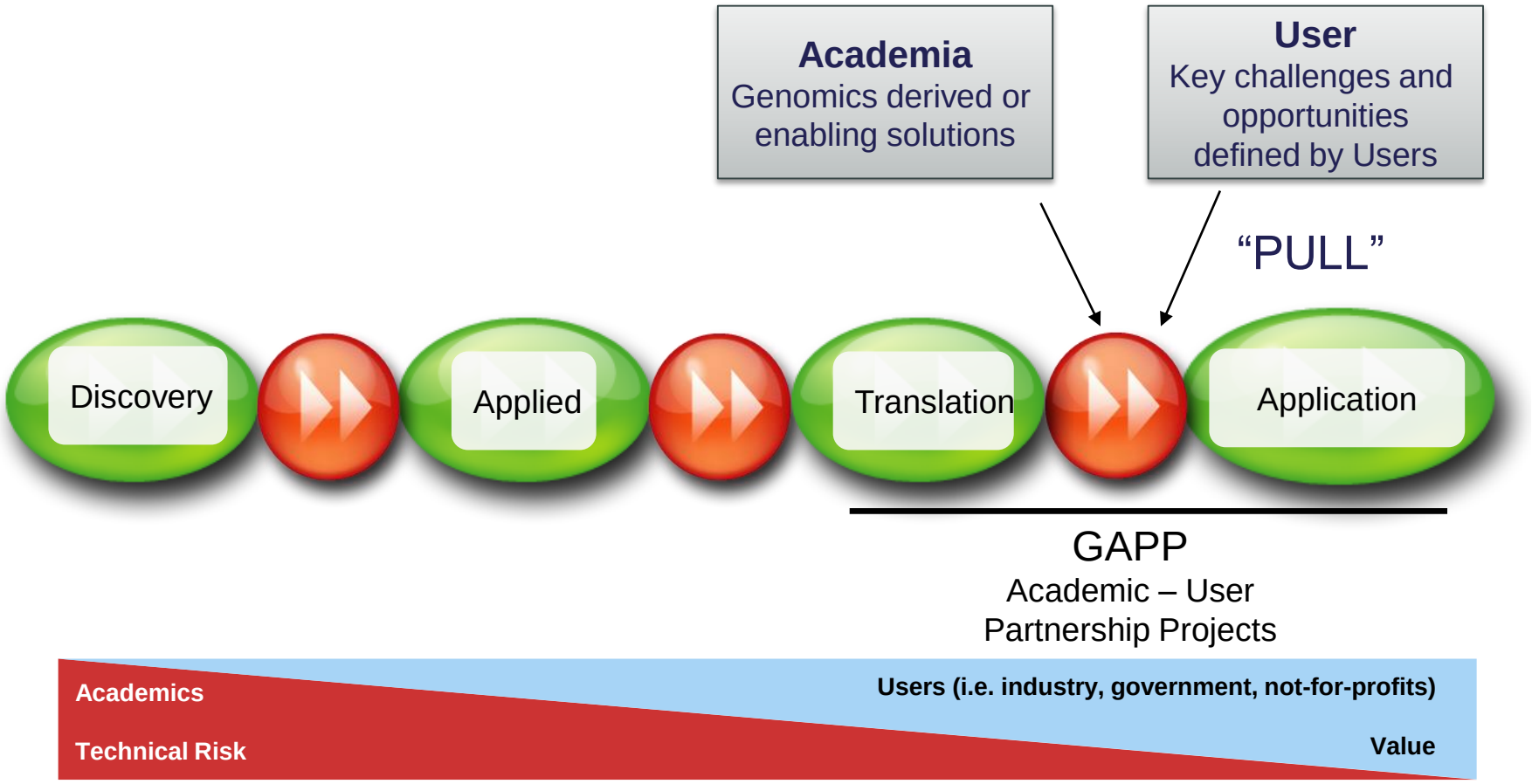
Genomic Applications Partnership Program (GAPP)



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Our Programs… Leading-Edge Technologies

- Bioinformatics & Computational Biology (BCB)
  - ➢ Support the development of next generation Bioinformatics and Computational Biology tools and methodologies
  - ➢ Provide broad and timely access of these new tools to the research community

  - ❖ Previous competitions in 2012 and 2015.

  - ❖ NEW 2017 BCB Competition will be open to the Agriculture/Agrifood sectors

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The Challenge

Significant challenges for Canadian Ag-Sector - likely impacts include:

- Longer, warmer growing seasons
- Altered and extreme weather patterns, leading to droughts, fires and floods
- Affected variations in biodiversity and impacted ecosystem services from Canada's natural environment
- Increased frequency and severity of insect and disease manifestations

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The genomics response…

- A powerful tool for unlocking biological solutions to climate change challenges.
- Genome Canada – and its network – is a key partner for all governments.
- Support Canada in its commitment to the COP21 goals, AND help grow Canada's bioeconomy:
  - Innovative genomics-fueled approaches can yield new "made-in-Canada" products and strategies within the agriculture & Agri-food sector.

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Genomics and mitigation…

Genomics can help mitigate the effects of climate change, contribute towards transformation to a low-carbon economy, and grow the bioeconomy.

- ✓ Reduce methane emissions from livestock through selective breeding and development of feed additives.
- ✓ Develop sustainable agriculture practices based on the use of beneficial soil microbes to reduce the overuse of chemical fertilizers linked to emission of nitric oxide – a potent greenhouse gas.
- ✓ Identify microbes and enzymes that can convert plant material into biofuels, bioproducts, and biodegradable materials.
- ✓ Identify and repurpose new plant-based biomaterials to replace existing petroleum-based materials, thereby reducing greenhouse gas emissions.

Genomics and adaptation…

Genomics can help Canada adapt to a changing climate and grow the bioeconomy.

- ✓ Develop climate-resilient crops and trees, which can withstand climate change stresses such as drought, heat, cold, floods, diseases and pests.
- ✓ Re-introduce into major food crops climate-adaptive genes lost through centuries of domestication, by utilizing seeds from heritage plants and wild relatives stored in gene banks around the world.
- ✓ Employ genomic variability to identify crop cultivars that can thrive under changing temperature and other conditions.
- ✓ Enhance the photosynthetic and nitrogen fixing capacity of major crops;
- ✓ Inform reforestation – to ensure the right trees are being planted in changing climatic areas.

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GLOBAL CHALLENGES ✦ GENOMIC SOLUTIONS DÉFIS MONDIAUX ✦ SOLUTIONS GÉNOMIQUES