PROJECT SNAPSHOT

3A: Investigation of AMR Spread via MGEs and Developing Machine Learning Biotools for Quantitative AMR Level Prediction

Pillar: Surveillance

Theme: Innovation and Commercialization

Keywords: Biotools; Mobile Genetic Elements; Horizontal Gene Transfer; Genomics; Antimicrobial Resistance

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AIM

To expand information on the role of mobile genetic elements (MGE) in the spread and persistence of AMR from a "One Health" perspective and to develop machine learning biotools for quantitative AMR prediction and transmission.

WHY IS THIS IMPORTANT?

MGEs such as plasmids and integrative and conjugative elements (ICE) are integral to the exchange of antimicrobial resistance genes (ARGs) within bacterial populations and converting susceptible bacteria to multidrug resistant (MDR). Regulatory factors that control the mobility and the expression of ARGs are critical for assessing risk and developing AMR policy as part of a "One Health" initiative.

OUTCOMES

1. Information to detect and manage MGE in human and livestock health settings to reduce the risk of AMR.
2. New biotools for AMR prediction and knowledge on the function of MGEs to support risk assessments and the development of AMR policy.

RESEARCH QUESTIONS

1. Can phenotypic antimicrobial resistance be predicted from genomic information?
2. What are the factors that determine the mobility of MGEs?
3. Can methods/tools be developed to reduce the risk that MGEs pose to the development of MDR bacteria?

OUR APPROACH

1. Insights will be garnered through the development of machine learning tools that draw heaviliy upon phenotypic, genomic and metagenomic analyses to formulate predictive outcomes for AMR.
2. The application of high throughput omics tools with an emphasis on a combination of Illumina short-read and nanopore long read sequencing technologies to understand the entirety of MGEs/ICE and to predict their horizontal transferability intra- and inter species.

ALIGNMENT WITH THE AMR - ONE HEALTH CONSORTIUM

LEVERAGED SOURCES OF SUPPORT

Agriculture and Agri-Food Canada • Alberta Agriculture and Forestry • Beef Cattle Research Council • Canadian Food Inspection Agency • Genome Alberta • Genome Canada • Genomics Research and Development Initiative • Results Driven Agriculture Research (RDAR) • University of Lethbridge Infrastructure

KNOWLEDGE & TECHNOLOGY EXCHANGE AND EXPLOITATION

- Identification of new tools for the management of AMR within livestock and humans
- Understanding role of MGEs within bacterial pathogens
- Informing policy and risk management
- Partnership with commercial sector

HIGHLY QUALIFIED PERSONNEL

- 1 PhD
- 2 MSc
- 1 Research Assistant

AFFILIATIONS: University of Lethbridge; Agriculture and Agri-Food Canada; Canadian Food Inspection Agency

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