ALBERTA INNOVATES

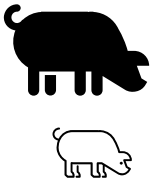
CLEAN RESOURCES

SMART AGRICULTURE AND FOOD

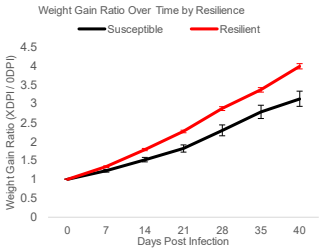
AGRICULTURE FUNDING CONSORTIUM

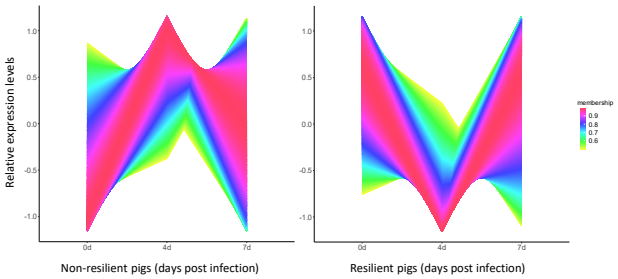
Development of a prediction screening model for porcine disease resilience based on a combination of mRNAs and non-coding RNA biomarkers

Infectious disease in pigs has a significant impact on pig welfare, productivity and producer income, antimicrobial use, and the environmental footprint of pig production in Canada. Multiple pathogens cause disease in pigs requiring a range of measures to combat them including biosecurity, vaccination, and antimicrobial treatment. Screening for resilience, a relatively unexplored opportunity, allows for the selection of animals that maintain their growth performance despite becoming infected with a pathogen. This project aims to identify novel biomarkers (RNA genomic signatures) connected with resilience that would help to select for resilient pigs, producing more pork from fewer resources and improving sustainability.



Some pigs succumb to infectious disease (black curve) while others are "resilient" to infection and quickly recover and continue growing at a similar rate to uninfected pigs (red curve)





A time course of RNA analysis (rainbow plots) shows distinct patterns between the two groups. These RNAs may be biomarkers of resilience.

FUNDING DETAILS

RECIPIENT:
University of Alberta
PI: Graham Plastow

PARTNERS:
University of Lethbridge
PigGen Canada

TOTAL BUDGET:
$333,250

AI FUNDING:
$260,000

PROJECT DATES:
Mar 2021 - Sep 2022

PROJECT TRL:
Start: 3
End: 5

APPLICATION

The target industry is the livestock sector, particularly swine breeding and production. Development of new tools to select and manage animals to improve disease resilience could also reduce the need for some antimicrobial treatment and therefore may reduce antimicrobial use in pig production. Such novel biomarkers include various classes of RNA biomolecules (mRNAs and non-coding RNAs), that have recently been shown to control key biological processes in infected animals, and leveraging their potential may lead to broader impacts in livestock agriculture, such as improving the sustainability.

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PROJECT GOALS

- Develop biomarkers (i.e., predictors) for disease resilience with the aim of selecting for animals reared in high health units (genetic nucleus or multiplier herds) whose offspring will perform well in lower health status commercial farms.
- The project will use existing samples and new next generation sequencing technologies and bioinformatics approaches to identify useful biomarkers (RNA genomic signatures).
- Field test the ability of a portable cell phone sized sequencer to recognize the identified expression signatures in the same RNA samples to establish the potential for its adoption as a real time pen-side test.

BENEFITS TO ALBERTA

- The development of more resilient pigs will reduce disease losses, reduce the cost of production, and help contribute to reducing the threat of antimicrobial resistance.
- Adopting RNA genomic enhanced selection to improve pig health could also assist Canada in maintaining or increasing its exports of pig genetics as well as pork.
- Improvement of data generation through advanced sequencing and software platforms could enable faster and better on-site screening.
- This project will maximize previous investments by utilizing previously unexplored information, including the combination of RNA genomic data with current omics models and phenotypic data.
- The new collaboration with University of Lethbridge's Southern Alberta Genome Sciences Centre provides the opportunity to develop a new range of sequencing and bioinformatics tools and assays for application in Canadian livestock systems.

1 New Method for Phenotyping

3 Scientific Papers & 6 Industry Presentations

Collaboration with 7 pig breeding companies

2 Project HQP

CURRENT STATUS

MAY 2021

This project takes a novel approach to investigating disease resilience using existing samples from an industry partnership. Preliminary results indicate there is an association between tolerant and susceptible pigs in terms of non-coding RNA expression, suggesting that these elements could serve as potential biomarkers of resilience. Currently, the project is working on direct RNA sequencing using Nanopore PromethION technology in a bench top system to identify RNA biomarkers related to resilience.