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RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY
Beef Science Cluster
IN PROGRESS

Developing more rapid, accurate and cost-effectiveness BRD diagnostics

Project Title:		Project Code:	ANH.18.19
Development of multiplex recombinase polymerase amplification (RPA) assays for the detection of antimicrobial-resistant (AMR) bacterial pathogens causing bovine respiratory disease (BRD)		Completed:	*In Progress. Results expected in 2023.*

Researchers:

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Background:

The bacterial culture and antibiotic sensitivity tests that are currently available to diagnose which bacteria are causing a specific BRD case take weeks to produce results. By the time the diagnostic result is available, different bacteria may be responsible for the illness (if the animal is still alive). This delay in the availability of diagnostic information is not practical in large-scale, commercial feedlots. As a result, feedlot BRD treatment decisions are based on recent clinical trials, veterinary protocols and producer experience rather than an actual diagnosis.

Complicating things further, not all bacteria are equally capable of causing disease. For example, there are different serotypes (strains) of *Mannheimia haemolytica* (one of the main BRD bacteria). Serotypes 1 and 6 frequently cause BRD, whereas serotype 2 is typically found in healthy cattle. Some bacteria may be carrying antibiotic resistance genes and others don't (but this requires a whole different diagnostic procedure). Sometimes clusters of antibiotic resistance genes are carried on mobile genetic elements that can be easily traded with other bacteria. This can lead to rapid spread of antibiotic resistance.

Objectives:

- Design recombinase polymerase amplification assays to simultaneously detect *Histophilus somni* and *Pasteurella multocida* strains known to cause BRD and identify mobile (i.e. transferrable) genetic elements and antimicrobial resistance genes associated with these bacteria from deep nasopharyngeal swabs obtained from feedlot calves.
- Using recombinase polymerase amplification, describe the frequency of detection of the four main bacteria associated with

BRD, the antimicrobial resistance genes and associated mobile genetic elements isolated from calves on arrival and at five days post-arrival at a feedlot, as well as from calves that are sick and/or have died from BRD.

What they will do:

This project will use a technology called Recombinase Polymerase Amplification (RPA), which requires minimal equipment, minimal sample preparation, and produces results in as little as 30 minutes. They will try to develop a rapid, accurate, cost-effective test to simultaneously detect whether feedlot calves are carrying the most dangerous strains of *Histophilus somni*, *Pasteurella multocida*, *Mannheimia haemolytica* and/or *Mycoplasma bovis*, whether those bacteria are carrying antibiotic resistance genes, and if any antibiotic resistance genes are being carried on mobile genetic elements.

The tests will be evaluated in high risk auction mart calves when they arrive at the research feedlot, before receiving preventative antibiotics. They will be sampled again 5 days after arriving to identify optimal sampling time. Calves that become sick or die from BRD will also be sampled. RPA results will be compared to bacterial culture and antibiotic sensitivity test results to determine the sensitivity (can it accurately identify sick animals?) and specificity (can it accurately identify healthy animals?). The ability of RPA results to predict individual calf BRD outcomes will be assessed.

Implications:

Timely, accurate and cost-effective tests will contribute to more appropriate and strategic antibiotic treatment options that improve treatment outcomes.

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