New Diagnostics to Inform Antimicrobial Treatment Decisions

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Background:
Bovine respiratory disease (BRD) remains the most common and economically important disease affecting feedlot cattle. About 15% of cattle in North America are treated for BRD, and it accounts for about 75% of the illnesses and 40% of deaths. Economic losses to the North American beef industry exceed 5 billion dollars annually.

Research Objective:
1) Design and screen the appropriate DNA primers and optimal temperatures for detection of BRD pathogens and common AMR genes.
2) Develop a test that can detect multiple pathogens and AMR genes at the same time.
3) Determine the specificity (true positive rate) and sensitivity (true negative rate) of the test under practical conditions in both healthy cattle and those diagnosed with BRD.
4) Evaluate the performance of the test's ability to correctly detect BRD pathogens and AMR profiles.
5) Develop a portable test kit and validate it under field conditions in a commercial feedlot.

What They Did:
At Agriculture and Agri-Food Canada in Lethbridge, the research team modified a genetic technique used in human medicine known as recombinase polymerase amplification (RPA). RPA was able to detect the bacteria that cause BRD in less than 30 minutes.

What They Learned:
The RPA assay was able to correctly detect and identify all 4 causative bacteria species in a single assay. The assay was shown to be 100% specific for these causative bacteria and did not detect other bacteria that normally live in the nasal passages of cattle. The assay could also detect seven different genes that code for resistance to the antimicrobials listed above. We could also reliably detect the mobile genetic elements responsible for transferring antimicrobial resistance among bacteria. Typically, mobile genetic elements were found in conjunction with the bacteria responsible for RDR, suggesting that RDR-causing bacteria are exchanging genes in order to become resistant to a broad range of antimicrobials. Most of these elements could be performed within a period of 30 minutes.

What It Means:
Additional improvements will be needed in order to use RPA as a chute-side diagnostic tool. Further research into these refinements is already underway in a new project funded by Genome Canada. It is hoped that these assays can be applied as part of a risk assessment program to predict the potential for certain of cattle to develop RDR and identify which antimicrobials will be most effective for controlling this disease. As the current assay demonstrated a high level of accuracy in identifying RDR-causing bacteria and AMR related genes, once optimized further, RPA presents a significant opportunity to advance and improve BRD diagnostics.

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