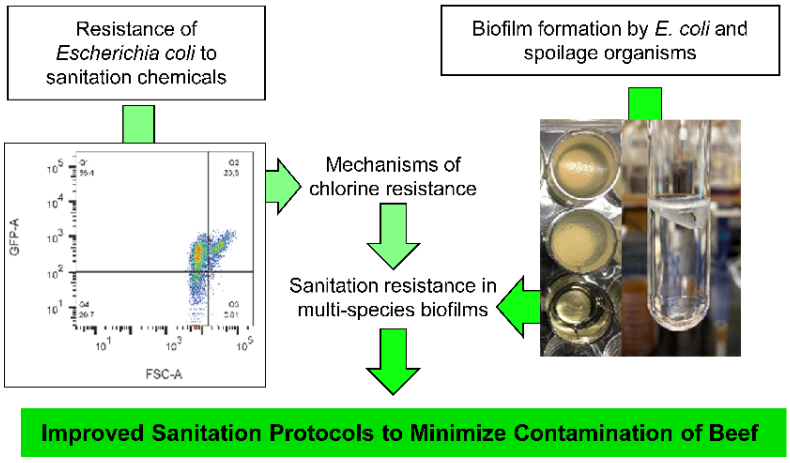
ALBERTA INNOVATES

Clean Resources

Smart Agriculture and Food

Chlorine Resistant *Escherichia coli* in Beef Processing Facilities: Selective Pressure for Heat-Resistant Pathogens?

Enteric pathogens may survive conventional cooking processes in meat production and thus are a concern for food safety. The beef processing industry minimizes contamination with multiple antimicrobial interventions, including carcass treatment with steam, hot water, lactic acid and peroxyacetic acid, and plant sanitation with chlorine, peroxyacetic acid, and quaternary ammonia compounds (QUATS). Heat resistance in pathogens decreases the effectiveness of sanitation protocols used in food processing. This project will explore the relationship between the heat resistance of *E. coli* and its resistance to sanitation. This information will be used to develop improved sanitation protocols, which will enable the meat industry to proactively address a critical concern in food safety.



FUNDING DETAILS

RECIPIENT:
University of Alberta
PI: Dr. Michael Gänzle

PARTNERS:
Alberta Agriculture and Forestry

TOTAL BUDGET:
$381,100

AI FUNDING:
$123,500

PROJECT DATES:
March 2019 – February 2022

PROJECT TRL:
Start: 1
End: 4

APPLICATION

The results will be applied in the validation of alternative sanitation strategies that minimize or reduce carry-over of *E. coli* from cattle to beef, and the persistence of *E. coli* in the beef processing environment. As *E. coli* is used as a food safety indicator in meat products, the response to the presence of *E. coli* in fully cooked products results in holds throughout the supply chain which is an economic burden to the beef industry. Decreasing contamination of beef with (heat-resistant) *E. coli* will significantly improve food safety.

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PROJECT GOALS

- Determine whether oxidizing sanitizing agents, particularly chlorine, peroxyacetic acid, and H_2O_2, select for heat-resistant *E. coli* strains. Sanitizing agents with a different mode of action will be used for comparison.
- Determine the persistence of heat-resistant and/or pathogenic *E. coli* in biofilms. The resistance of *E. coli* cells that reside in bacterial biofilms to sanitation agents will be compared to the resistance of planktonic or "free living" cells.
- Identify alternative sanitation strategies that minimize or reduce carryover of *E. coli* from cattle to beef, and the persistence of *E. coli* in the beef processing environment.

BENEFITS TO ALBERTA

- Determine whether the use of pathogen interventions in the beef industry exerts selective pressure for strains of *E. coli* with increased resistance to heat and oxidizing chemicals. This knowledge potentially allows for elimination of a contamination source of heat- and chlorine-resistant enteric pathogens and will contribute to the reduction of foodborne disease caused by enteric pathogens.
- Enable processors and contract sanitation companies to optimize their sanitation strategies to reduce or eliminate contamination of beef with *E. coli*. Improved carcass decontamination and sanitation strategies will also reduce the cost of recalls for contaminated beef.
- Contribute to a reduced and more targeted use of sanitation chemicals. This will reduce the contamination of wastewater from beef processing plants with oxidizing chemicals, halogenated organic compounds, and heat- and chlorine-resistant pathogens.

2 Publications

6 Students Trained

3 Project Jobs

1 New Product/Service

CURRENT STATUS

April 2021

The research team has found that locus of heat resistance (LHR) also increases resistance of *E. coli* to commonly used sanitizing agents including chlorine, peroxyacetic acid and hydrogen peroxide. They have also identified LHR-encoded mechanisms of oxidation stress resistance in *E. coli*. The planned activity to identify alternative sanitation strategies for the control of LHR-positive *E. coli* in beef processing environment could not be completed due to COVID-19 restrictions. Instead, research on pellicle formation in *E. coli* and its impact on resistance to sanitizing agents was conducted in the current reporting year.