The research projects listed below are funded in whole or part by the Beef Checkoff and are intended to help ensure a safe and nutritious beef supply.

Funded by the Beef Checkoff

Current Research Projects — September 2024

Analysis of beef *Salmonella* outbreaks using the USMARC SNP analysis pipeline, USDA-ARS, Meat Animal Research Center
Using the pipeline developed in a previously funded project (*see* Enhanced Characterization of Sequence Differences Among *Salmonella* isolates within SNP Clusters Identified by the NCBI Pathogen Detection System), genomes from previous beef *Salmonella* outbreaks will be evaluated to characterize the genomic variation between sequenced isolates related to the outbreak. The findings will detail the reliability of Beef *Salmonella* outbreak traceback.

Creating Alternative Support for Lethality and Stabilization for Heat Treated and Fully Cooked Meat and Poultry Products, University of Wisconsin, HansonTech
Nearly all meat processors in the United States utilize USDA, FSIS Appendix A and B to ensure adequate thermal lethality and stabilization is achieved for partially and fully cooked products. Through the development and release of updated versions in 2017 and 2021, and the realization that a host of potential food safety vulnerabilities exist, the widespread usefulness and in-plant practical application of these guidance documents has become a significant concern and practical challenge to implement. The primary objective of this study is to develop a scientific-based, regulatory-supported, and industry-useful thermal processing and cooling resource (*e.g.* cooking and cooling food safety handbook) for validating pathogen destruction and control, and regulatory compliance for partially and fully cooked meat products that can be used in conjunction with or in lieu of USDA, FSIS Appendix A & B.
Funded in part by the Meat Foundation

Developing a Quantitative *Salmonella* Baseline from Ground Beef in the United States, Texas Tech University, Kansas State University, University of Georgia, USDA-ARS, Meat Animal Research Center, Food Safety Net Services
The *Salmonella* level in ground beef across the U.S. is unknown. As a result, risk assessments and understanding the public health impact of potential *Salmonella* control programs across the industry are not always accurate. This study intends to conduct a representative *Salmonella* baseline and develop a blinded quantitative *Salmonella* baseline for the U.S. beef industry representing season and geographical waves.

Recently Completed Research

Enhanced Characterization of Sequence Differences Among *Salmonella* isolates within SNP Clusters Identified by the NCBI Pathogen Detection System, USDA-ARS, Meat Animal Research Center
This research intended to better understand the full picture of relatedness within critical *Salmonella* serovars of interest by performing a comparative genomic analyses on currently available data within the Pathogen Detection Isolates Browser (PDIB). An analysis pipeline was developed to catalogue *Salmonella* SNP cluster diversity in the NCBI PDIB . Relatedness analysis performed using the pipeline closely approximated the SNP differences reported by the PDIB and showed that the analysis can be done outside the database. The pipeline allows for a more complete understanding of the sequence similarity between isolates by identifying novel or missing elements in the genomes and cataloguing the sequence diversity.

Recently Completed Research

Novel TaqMan assays for the specific detection and simultaneous differentiation of virulent and avirulent non-O157 Shiga toxin-producing *Escherichia coli* strains, Florida State University, USDA-ARS, U.S. Meat Animal Research Center
This study standardized and validated assays for the specific detection of virulent strains of *E. coli* O26, O103, O111, and O121 with significant accuracy. These assays can be used as a molecular confirmation tool to reduce product and financial losses from misleading positive results caused by avirulent strains.

Effects of proportioning meat and plant-based protein-rich foods within the U.S. Healthy Eating Pattern on cardiovascular disease risk factors, Purdue University
This project assessed the effects of consuming different proportions of red meat and plant-based, protein-rich foods incorporated into a U.S. Healthy Eating Pattern (HEP) on cardiovascular disease risk factors in adults at high risk of developing a heart-related disease. Improvements in heart disease risk factors and consumer satisfaction among the three HEPs were compared. Unlike most published research that compares red meat-containing diets to vegetarian diets, this project assessed how red meat and plant-based protein-rich foods are complementary for cardiovascular health.
Funded in part by the Meat Foundation

Impact of sanitization and natural biofilm communities on *Salmonella* prevalence at processing plants, USDA-ARS, U.S. Meat Animal Research Center
This project evaluated the efficacy of commercial sanitizers against *Salmonella* harbored within environmental mixed biofilms by measuring biofilm forming ability and community structure of environmental biofilms before and after sanitization. It then compared environmental microbial communities and *Salmonella* survival in mixed biofilms before and after sanitization to determine the impact of different sanitizers on controlling *Salmonella*.

Using empirical evidence, modeling, and risk assessment methods to estimate the public health impact of incorporating enumeration and virulence as part of the criteria for evaluation of *Salmonella* contamination in ground beef in the US, EpiX Analytics, Colorado State University
The EpiX analytics team incorporated novel genomics methods into a fully quantitative risk assessment. The genomics methods allowed for the identification and differential targeting of *Salmonella* serovars into higher- and lower-virulence groups. The results of the risk assessment show that considering quantitative criteria to target higher virulence serovars combined with high rates of combo testing can significantly reduce human salmonellosis. Although low virulence serovars cause salmonellosis, targeting these serovars only slightly improved the reduction of illnesses. Using modeling, *Salmonella* prevalence in beef products significantly increased along with the number of cattle coming from the Southwest and Midwest regions. Additionally, prevalence was significantly higher in the summer season and increased with the distance cattle traveled from source to slaughter. There were no significant associations between region or season with high-virulence *Salmonella* serovars.

Contact Bill Sessions at bsessions@meatinstitute.org or Susan Backus at sbackus@meatinstitute.org for more information on post-harvest beef safety research and activities.