

After a Busy 2018, the Foundation Looks Forward to 2019

In 2018, the Foundation undertook an aggressive agenda by conducting three requests for proposals (RFP). In the spring, the Foundation issued a mini-RFP to fill the data gaps in response to the Food Safety and Inspection Service's revised Appendices A and B, issued in June 2017.

The revised Appendices A and B provide safe harbor guidelines for ready-to-eat (RTE) meat and poultry processors. Appendix A was designed to help meat and poultry processors meet lethality requirements in RTE products and Appendix B was designed to assist processors in meeting the cooling and stabilization requirements for heat-treated RTE and non-RTE products.

In July, the Foundation Board of Directors approved three research projects to address these priorities:

- Effects of Product Moisture and Process Humidity on Pathogen Lethality during Continuous Cooking of Meat and Poultry Products, Michigan State University
- Development and Validation of Dynamic Predictive Models for Growth and Toxin Formation by *Staphylococcus aureus* in Low Temperature Cooked Products, University of Georgia
- Validating growth models for *Clostridium perfringens*, *Clostridium botulinum*, and *Bacillus cereus* during cooling of uncured meat and poultry products, University of Wisconsin

Signifying the importance of this research, these projects are jointly funded by the Beef Checkoff, Beef Industry Food Safety Council and the U.S. Poultry and Egg Association.

In August, the Foundation issued its annual RFP on key topics in food safety and, for the first time, included nutritional sciences and product quality in its request. During this two-step process, where selected pre-proposals are fully developed for review by the Foundation's Research Advisory Committee, the U.S. Departments of Agriculture and Health and Human Services released the [topics and scientific questions](#) to be addressed by the 2020 Dietary Guidelines Advisory Committee. A supplemental RFP was subsequently issued to address relevant questions on the role of meat and poultry products in healthy dietary patterns. The proposals submitted in response to the supplemental RFP were reviewed by the Foundation's Research Advisory Committee and NAMI Health and Wellness Advisory Committee alongside the proposals in response to the annual RFP. Several projects were recommended for funding and will be evaluated by the Foundation's Board of Directors in January 2019.

Foundation to Sponsor Consumer Food Safety Education Conference

The Foundation, through its contract with the Beef Checkoff, will sponsor the Consumer Food Safety Education Conference March 6-8, 2019, in Orlando, FL. At this seventh in a series of food safety education conferences organized by the non-profit Partnership for Food Safety Education, attendees will explore influences on consumers, ways to affect behavior change and ways forward to better engage everyone in modeling proper food preparation and hand-hygiene practices. The Foundation will share beef safety resources during exhibit hours.

The 2019 conference is expected to draw 400 public and private sector professionals who are involved in educating people about food safety. Additional information on the conference is available at <https://cfsec2019.fightbac.org/>.



Recent Foundation Research Findings

Reducing *Salmonella* serotypes on Chicken Carcasses by Sodium Bisulfate (SBS) and Investigation into its Reuse to Reduce Water Consumption, University of Arkansas

This project tackled two issues associated with food safety and the poultry industry, namely the need for alternative acidifiers for poultry carcass treatment and the ability to generate safe poultry processing re-use water. To test the use of SBS as a sanitizer for chicken meat, investigators applied SBS at different concentrations and tested it against *S. Enteritidis*-inoculated drum sticks. Drumsticks were selected over carcasses because of industry feedback indicating greater interest in parts rather than carcasses for assessment of alternative sanitizers. This approach also allowed investigators to more easily expand the number of treatments compared within a specific trial. Research demonstrated that three percent SBS reduced *S. Enteritidis* over three days of storage and did not alter appearance of drumsticks after soaking.

The re-use of water by poultry plants is increasingly important given the cost associated with the production of potable water and environmental concerns in arid regions. Therefore, it is essential to develop cost-effective strategies to better utilize re-use water and decrease the bacterial load prior to re-use. Research demonstrated in this project that SBS was very effective in dramatically decreasing *Salmonella* Typhimurium inoculated into commercial re-use water and therefore could be used as an antimicrobial when recycling poultry processing water for reuse in processing.

Validation of lethality and stabilization processes for products with slow come up time: bacon and bone-in ham, Iowa State University, University of Wisconsin, HansonTech

Research determined the effect of slow come-up time and slow stabilization during the thermal processing of bacon and bone-in ham on the survival of *Clostridium perfringens*, *Staphylococcus aureus*, *Listeria monocytogenes* and *Salmonella* spp.

Ten cured-ham treatments were formulated to represent ranges of 55-75% moisture, pH 5.8-6.4, and 1.5-3.0% salt using a full factorial design. Raw treatments were inoculated with 3-log CFU/g *Listeria monocytogenes*, *Staphylococcus aureus*, *Salmonella* spp., or *Clostridium perfringens* spores and vacuum packaged. Samples were heated according to Appendix A (in 6 hours) or slow-cook (in 10 hours), and then continued heating until internal temperature of 70°C. Samples were slow cooled from 54 to 4°C in 25 hours (extended from Appendix B). Duplicate samples per treatment were assayed at 0-time and at internal temperatures 32, 54, 70, 54, 29, and 4°C by enumerating on appropriate selective agars.

All treatments inoculated with *L. monocytogenes*, *S. aureus*, *Salmonella* spp. or *C. perfringens* inhibited growth during control and slow cook. All three vegetative pathogens were inactivated by cooking to 70°C. No difference in survival was observed between Appendix A and slow-cook treatments. In contrast, *C. perfringens* increased 4.7, 3.0, and 1.7 log during the 25-h extended cooling in 75% moisture treatments with pH 6.4/1.5% NaCl, pH 6.4/3.0% NaCl and pH 5.8/1.5% NaCl, respectively. In addition, 55% moisture ham with pH 6.4 and 6.1 and low salt supported a >1.5 log increase. None of the other treatments supported growth during the 25-h extended cool.

This study confirms the critical nature of salt, pH and moisture for pathogen inhibition in cured meat during extended dwell times.

Foundation Education Programs Schedule of Events

Worker Safety Conference for the Meat and Poultry Industry

Co-located at the International Production and Processing Expo (IPPE)

Atlanta, Georgia

February 11-12, 2019

Environmental Conference for the Meat and Poultry Industry

Co-located at the International Production and Processing Expo (IPPE)

Atlanta, Georgia

February 11-12, 2019

For more information on these and other programs, please visit the events page at www.meatinstitute.org.

2019 Board of Directors Named

The Foundation for Meat and Poultry Research and Education is governed by a Board of Directors, which provides scientific leadership and financial oversight, and acts upon recommendations from the Foundation's Research Advisory Committee. The North American Meat Institute's Executive Board members are afforded the opportunity to serve on the Foundation's Board of Directors or appoint a designee to serve on his or her behalf. In an effort to broaden the scope of influence and direction, representatives from the livestock (beef, pork, poultry and egg), retail, academic, government agency and consumer sectors, among others, are invited to serve on the Board of Directors. Terms are for one year. The 2019 Board of Directors are:

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Clemens Food Group	Maple Leaf Foods Inc.	Unibright Foods
Coast Packing	Meats by Linz	VPP Group LLC
Consumers Packing Co.	National Beef Packing Co.	Wasatch Meats Inc.
Evergood Sausage Company	North Country Smokehouse	Yosemite Meat Co. Inc.

Current Research Projects

Effects of Product Moisture and Process Humidity on Pathogen Lethality during Continuous Cooking of Meat and Poultry Products, Michigan State University

The overall goal of the project is to provide supporting scientific evidence to document compliance with Appendix A, particularly with respect to the impact of process humidity on *Salmonella* lethality in high-temperature, short-time cooking processes. Research will be conducted using beef patties; restructured chicken patties; breaded, chicken nuggets; whole-muscle chicken breasts; and whole-muscle steak strips.

Research funded in part by the Beef Checkoff, Beef Industry Food Safety Council and the U.S. Poultry and Egg Association.

Development and Validation of Dynamic Predictive Models for Growth and Toxin Formation by *Staphylococcus aureus* in Low Temperature Cooked Products, University of Georgia

The overall project goal is to develop and validate predictive models for growth and toxin formation of *Staphylococcus aureus* in uncured roast beef, bacon and hams.

Research funded in part by the Beef Checkoff and Beef Industry Food Safety Council.

Validating growth models for *Clostridium perfringens*, *Clostridium botulinum*, and *Bacillus cereus* during cooling of uncured meat and poultry products, University of Wisconsin

This project will develop data to determine the validity of the revised Option 2 cooling guidelines for uncured meat products, specifically to determine if Phase 1 cooling (from 120 to 80°F) can be extended from the currently outlined 1 hour limit. An uncured turkey breast meat will be used in the model.

Research funded in part by the Beef Checkoff, Beef Industry Food Safety Council and the U.S. Poultry and Egg Association.

Pathogen growth in alternatively cured ham and bacon during cooking, cooling, and process deviations, Iowa State University and Smithfield Foods

The overall goal of the project is to determine the inhibitory effect of nitrite from a natural source (i.e., pre-converted celery juice powder) in processed meat products with a natural label during “real world” cooking and chilling procedures, which often include instances of process deviation, as well as non-continuous cooling.

Maintenance for Literature Review: Efficacy of Interventions on Pathogens in Processed Meats and Poultry Products, University of Wisconsin

This project will update and expand the version 1 of the tabular summary of references describing antimicrobial interventions that have been tested in processed meat and poultry products. The key project objective is to provide small and very small establishments with an accessible, searchable, user-friendly tool to help them identify interventions and suitable scientific support to meet HACCP system validation requirements. *Funded in part by the Beef Checkoff.*

Intervention Validation: A Review — Continued Maintenance, Texas A&M University

This project will review newly identified and/or published literature that encompass multiple commercially applicable intervention strategies against biological hazards of concern for fresh meat and poultry. *Funded in part by the Beef Checkoff.*

Tests of *Salmonella* sub-unit proteins as vaccines for broiler chickens, USDA-ARS U.S. National Poultry Research Center

This project will identify the *Salmonella* protein antigens that are able to induce humoral immune response in broilers, and consequently these antibodies can prevent *Salmonella* colonization in the broiler gastrointestinal tracts.

Validation of post-harvest antimicrobial interventions to control *Salmonella* on market hog carcass surfaces and pork products, Kansas State University

This study will validate the efficacy of lactic acid, sulfuric acid sodium sulfate, bromine, 180°F water, and peracetic acid as post-harvest interventions against *Salmonella*, as well as the impact on product color attributes, on pork carcasses and trim.

Research Priority Setting Meeting for Certain By-Products

There is limited research on the impact of rendering on foodborne pathogens, particularly with the implementation of the Food Safety Modernization Act. The Foundation will work with allied stakeholders in the rendering, pet food and cosmetic industries throughout North America to assemble a meeting where industry standards can be discussed to better inform future research priorities and projects. There is a dearth of critical parameters for this type of research.

Research to Determine Susceptibility of *Salmonella* to Antimicrobials Published

Research funded in part by the Foundation was recently published in PLOS ONE. The abstract follows:

Poultry and meat products contaminated with *Salmonella enterica* are a major cause of foodborne illness in the United States. The food industries use a wide variety of antimicrobial interventions to reduce bacterial contamination. However, little is known about *Salmonella* susceptibility to these compounds and some studies have shown a concerning link between biocide resistance and antibiotic resistance. To investigate this, a 96 well panel of 17 common household and commercially used biocides was designed to determine the minimum inhibitory concentrations (MIC) of these compounds for *Salmonella*. The panel contained two-fold serial dilutions of chemicals including Dodecyltrimethylammonium chloride (DC), Benzalkonium chloride (BKC), Cetylpyridinium chloride (CPC), Hexadecyltrimethylammonium bromide (HB), Hexadecyltrimethylammonium chloride (HC), Acetic acid (AA), Lactic acid (LA), Citric acid (CA), Peroxyacetic acid (PXA), Acidified sodium chlorite (ASC), Sodium hypochlorite (SHB), 1,3 dibromo, 5,5 dimethylhydantoin (DBH), Chlorhexidine (CHX), Sodium metasilicate (SM), Trisodium phosphate (TSP), Arsenite (ARI), and Arsenate (ARA). The assay was used to test the susceptibility of 88 multidrug resistant (MDR) *Salmonella* isolates from animal sources. Bacteria are defined as multidrug resistant (MDR) if it exhibited non-susceptibility to at least one agent in three or more antimicrobial categories. The concentration of biocide at which $\geq 50\%$ of the isolates could not grow was designated as the minimum inhibitory concentration or MIC₅₀ and was used as the breakpoint in this study. The MIC₅₀ ($\mu\text{g ml}^{-1}$) for the tested MDR *Salmonella* was 256 for DC, 40 for BKC, 80 for CPC. HB and HC, 1,640 for AA, 5664 for LA, 3,156 for CA, 880 for PXA, 320 for ASC, 3.0 for CHX, 1,248 for DBH, 3,152 (6%) for SHB, 60,320 for SM, 37,712 for TSP, 56 for ARI and 832 for ARA. A few isolates were not susceptible at the MIC₅₀ breakpoint to some chemicals indicating possible resistance. Isolates with MICs of two 2-fold dilutions above the MIC₅₀ were considered resistant. Biocides for which resistant isolates were detected included CPC (n = 1 isolate), HB (1), CA (18), ASC (7), CHX (22), ARA (16), and ARI (4). There was no correlation detected between the biocide susceptibility of *Salmonella* isolates and antibiotic resistance. This assay can determine the MICs of bacteria to 17 biocides in a single test and will be useful in evaluating the efficacy of biocides and to detect the development of resistance to them.

Humayoun SB, Hiott LM, Gupta SK, Barrett JB, Woodley TA, Johnston JJ, et al. (2018) An assay for determining the susceptibility of *Salmonella* isolates to commercial and household biocides. PLoS ONE 13(12): e0209072. <https://doi.org/10.1371/journal.pone.0209072>.



SAVE THE DATE
2019 Beef Industry Safety Summit
March 5 - 7, 2019
Kansas City Marriott Downtown

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Save the Date for the 2019 Beef Industry Safety Summit

The Beef Industry Safety Summit has been established as the premier event that brings industry leaders and safety professionals together from all sectors of the beef industry to focus on strategies to improve beef safety. The 2019 Beef Industry Safety Summit will take place March 5-7 in Kansas City, MO. The meeting promises to deliver the latest research information and access to safety experts. Please "Save the Date" for this event. For more information, visit www.bifSCO.org.

Foundation Research Advisory Committee

Members of the NAMI Health and Wellness Advisory Committee also served on the Committee in 2018.

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