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Dear AMI Members and Stakeholders,

As we anticipate the challenges facing the industry during the coming months and years, I am pleased to report significant accomplishments that have delivered results for your investment in the American Meat Institute Foundation (AMIF). Our efforts have helped improve the safety of meat and poultry products, positioned our products as part of a healthy diet and provided the scientific underpinnings for science-based regulatory policies.

AMIF research on control of non-O157:H7 Shiga toxin-producing *Escherichia coli* (STEC) in beef products demonstrated that a food safety system in control for *E. coli* O157 is also a system in control for other STEC. This new data provided the necessary scientific support for plants to validate their HACCP plans and avoid unnecessary testing expenses associated with USDA's declaration of an additional six STEC as adulterants in non-intact beef products.

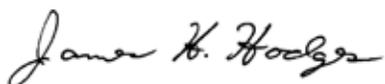
AMIF has worked closely with customers in the retail community to address *Listeria* control in service deli operations. Research funded by both AMIF and the Food Marketing Institute Foundation has documented the potential for cross-contamination during storage, preparation and handling. Both organizations are working cooperatively to investigate, develop solutions and communicate our findings to our industries and regulatory agencies.

A milestone regarding the safety of nitrite to cure meat and poultry products occurred in 2012. A team of international experts commissioned by AMIF published an updated review of ingested nitrate and nitrite and cancer. This peer-reviewed scientific journal article documents the profound beneficial effects of nitric oxide on human homeostasis and that human exposure to nitrite and nitrate should now be considered a normal and necessary part of human physiology.

The AMIF team is especially gratified by the coordination among our research partners at the National Cattlemen's Beef Association, National Pork Board, U.S. Poultry and Egg Association and USDA's Agricultural Research Service and the National Institute for Food and Agriculture. As we look forward to next year, we have embarked on a research priority setting process to address *Salmonella* control in meat and poultry products. Our probability of success is greatly enhanced through collaboration.

This *Year In Review* highlights 2012 AMIF accomplishments. We also encourage you to visit the AMIF website at www.amif.org to view the final research reports. We greatly appreciate your support and look forward to another successful year in 2013.

Sincerely,



James H. Hodges
President

The American Meat Institute Foundation (AMIF) is a non-profit research, education and information foundation established and funded by the American Meat Institute (AMI) to study ways the meat and poultry industry can operate more efficiently and produce the safest and most nutritious products possible. Since 1999, the AMI Foundation research program has directly sponsored nearly 100 food safety research projects at leading universities and research labs, totaling more than \$8.2 million.

AMIF's leaders set clear goals for the Foundation's food safety program: to reduce and ultimately eliminate Shiga toxin-producing *Escherichia coli* in fresh beef, *Listeria monocytogenes* in ready-to-eat meat and poultry products and *Salmonella* in meat and poultry products. In addition to these priority areas, AMIF has "Other Food Safety" research priorities that are designed to identify and address emerging topics of concern. AMIF publicly disseminates research findings, best practices and other educational materials on a broad range of food safety, worker safety, nutrition and consumer information projects.

AMIF is nearing the end of the 2012-2013 funding cycle. Research proposals were solicited on the 2012-2013 AMI Foundation Research Priorities and can be viewed here: <http://www.amif.org/about/research-priorities/>. New research funding will be awarded in January 2013.

Ongoing Research Projects

Salmonella



Development of Real-time PCR Methodology for the Rapid Enumeration of Low Numbers of *Salmonella* Gram of Ground Beef Without Enrichment

Robert Levin
University of Massachusetts

The goal of these studies will be to develop methodology to allow the Rti-PCR reaction to detect low numbers of *Salmonella* in ground beef within four hours without enrichment.

www.amif.org/research/11-300/

Mitigation of *Salmonella* in Lymph Nodes using Pre-Harvest Interventions

Mindy Brashears; Guy Loneragan; Chance Brooks; Mark Miller; Alejandro Echeverry; Kendra Nightingale; Sara Gragg; Dayna Harhay; Dan Schaefer; **Texas Tech University; USDA-ARS, Meat Animal Research Center; Cargill, Inc.**

The project will determine if supplementing cattle diets with *Lactobacillus acidophilus* NP51 will reduce *Salmonella* in lymph nodes at slaughter and if lymph node contamination increases the risk of carcass contamination and/or trim from the carcass.

www.amif.org/research/11-304/

Developing Validated Time-Temperature Thermal Processing Guidelines for Ready-To-Eat Deli Meat and Poultry Products

Jeffrey Sindelar; Kathleen Glass; Robert Hanson
University of Wisconsin; HansonTech

This study will focus on developing new Appendix A style time-temperature tables for non-beef ready-to-eat products such as turkey deli-breast and boneless ham. Researchers will also compare the baseline results from the original work that was conducted to develop Appendix A to the results of this study for *Salmonella* in roast beef and confirm the validity of its effectiveness for pathogenic *E. coli* and *L. monocytogenes* strains.

www.amif.org/research/10-304/

Shiga toxin-producing *Escherichia coli*

Identification of bovine reservoirs of human pathogenic non-O157 Shiga toxin-producing *E. coli*

Mick Bosilevac; Terrance Arthur; Norask Kalchayanand; Steven Shackelford; Tommy Wheeler
USDA-ARS, U.S. Meat Animal Research Center

This project will determine the prevalence, level, and types of non-O157 Shiga toxin-producing *E. coli* (STEC) in cattle from different production systems at harvest and determine if production system or regional variations in non-O157 STEC serogroups exist.

www.amif.org/research/11-129/

Effect of flagellin and intimin type expression on colonization of bovine intestine by non-O157 Shiga toxin-producing *E. coli* (STEC)

Rodney Moxley
University of Nebraska

The overall project goal is to determine mechanisms of intestinal colonization of STEC O26, O45, O103, O111, O121, and O145 to provide a basis for development of new and improved pre-harvest interventions for these organisms. This project will address the following hypotheses: STEC O26, O45, O103, O111, O121, and O145 isolates of varying flagellar and intimin type composition will significantly vary in their abilities to adhere to and induce A/E lesions in mucosal epithelial cells from different locations in the bovine small and large intestine.

www.amif.org/research/10-516/

Listeria monocytogenes



Evaluation of Control Strategies for *Listeria monocytogenes* in Retail Deli Environments with Evidence of High Prevalence

Haley Oliver
Purdue University

The project will evaluate control strategies for *Listeria monocytogenes* in retail delis identified as having a higher risk of *L. monocytogenes* prevalence and persistence. The proposed experiments will build on results from an ongoing AMIF, Food Marketing Institute Foundation (FMIF) and USDA funded study, which has identified niches in retail deli environments and utilized existing collaborations with retail chains.

Project is co-sponsored by the FMIF.

www.amif.org/research/11-214/

Listeria control ready-to-eat (RTE) meat and poultry industry: a white paper on the "seek and destroy" philosophy

Martin Wiedmann
Cornell University

The goal of this project is to develop a white-paper addressing the scientific support behind current *Listeria monocytogenes* process controls employed by the ready-to-eat meat and poultry industry. The "Seek and Destroy" strategy is a systematic approach to finding sites of persistent growth in food processing plants, with the goal of either eradicating or monitoring and mitigating effects of niches.

www.amif.org/research/11-213/

White Paper: Review on Epidemiology of Foodborne Listeriosis

Ellin Doyle
University of Wisconsin

This white paper will provide information on epidemiology of foodborne listeriosis and interventions for controlling this pathogen. Reports of human illness and outbreaks and on levels of contamination of meat and other foods will be gathered to demonstrate trends in recent years and identify foods and environments where contamination problems persist.

www.amif.org/research/11-221/

Listeria monocytogenes Continued

Reducing or Preventing Recovery of Injured *Listeria monocytogenes* on Ready-to-Eat Natural and Organic “Uncured” Processed Meats

Joseph Sebranek; James Dickson; Byron Brehm-Stecher; Stephanie Jung; Aubrey Mendonca
Iowa State University

Due to the concern for recovery of injured *L. monocytogenes* on natural and organic processed meats where many conventional antimicrobials cannot be used, a series of compounds with antimicrobial potential for use in these products combined with different post-lethality treatments will be evaluated for the most effective combinations. The primary objective will be to find the treatment with greatest initial lethality that also achieves sustained suppression of growth of injured and uninjured *L. monocytogenes* when combined with a compound or compounds that has potential application to natural and organic products.

www.amif.org/research/10-203/

Role of Protozoa in the Persistence of *Listeria monocytogenes* in a Ready-to-Eat Poultry Processing Plant

Richard Meinersmann; Mark Berrang; James T. Hollibaugh; Joseph Frank
USDA - Agricultural Research Service; University of Georgia

This research will determine if bacterivorous protozoa contribute to shaping bacterial communities in food processing plants and influence the survival of *Listeria monocytogenes* in floor drains. The proposed project is designed to identify *Listeria*-lytic protozoa and isolate them for further research in the use of naturally decontaminating floor drains.

www.amif.org/research/08-207/

Other Food Safety

White Paper: *Clostridium difficile* as a Risk Associated with Animal Sources

Ellin Doyle
University of Wisconsin

The white paper will summarize all historical data on *C. difficile* infections in humans; evaluate epidemiological data on animals, non-animal sources, and foods that have the potential to cause human infections and factors that affect transmission of *C. difficile*; evaluate hospital acquired *C. difficile* infections; evaluate worldwide understanding of *C. difficile* infections and their sources; and identify the data gaps and discuss how these gaps influence the understanding of *C. difficile* and propose tasks needed to close the gaps.

www.amif.org/research/11-400/



Projects Completed in 2012

Antimicrobial interventions/application methods for the reduction of *Escherichia coli* O157:H7 and *Salmonella* in beef trimming and/or ground beef

Fred Pohlman; Steven Ricke; Palika Dias-Morse; Anand Mohan; Sara Milillo; Peggy Cook; Karen Beers
University of Arkansas; Safe Foods International

This research evaluated practical and cost-effective decontamination technologies for beef processors that can be rapidly implemented using antimicrobial properties of peroxyacetic acid, novel organic acids alone or in combination with ethoxylated glyceride on beef trimmings against *E. coli* O157:H7, O26, O103, O111, O121, O45, and O145 and *Salmonella* Typhimurium DT 104, Newport MDR-AmpC to achieve maximum ground beef product safety without altering product quality through effective treatment application technologies.

www.amif.org/research/10-107/

Development and Evaluation of Control Strategies for *Listeria monocytogenes* in Retail Deli Environments

Haley Oliver; Martin Wiedmann
Purdue University; Cornell University

The goals of this project were to develop and implement new control strategies for *L. monocytogenes* in commercial retail delis and to test the ability of these strategies to reduce and control *L. monocytogenes* contamination. Certain interventions strategies employed in this study significantly decreased *L. monocytogenes* prevalence in stores with moderate prevalence. Project is co-sponsored by the Food Marketing Institute Foundation.

www.amif.org/research/10-207/

Other Activities

Reaffirming Nitrite Safety

The International Agency for Research on Cancer (*IARC*) is part of the World Health Organization and its mission is to coordinate and conduct research on the causes of human cancer, the mechanisms of carcinogenesis, and to develop scientific strategies for cancer control. *IARC* is involved in both epidemiological and laboratory research and disseminates scientific information through publications, meetings, courses, and fellowships.

In July 2010, the *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*, Volume 94 (2010), *Ingested Nitrate and Nitrite and Cyanobacterial Peptide Toxins* was published with the overall evaluation "*Ingested nitrate or nitrite under conditions that result in endogenous nitrosation is probably carcinogenic to humans (Group 2A).*" In simple terms, *IARC* argued that ingestion of food and water that contain nitrate or nitrite (e.g. spinach, root vegetables, bread, beer, cured meat) in combination with amines and amides commonly found in food can react in the stomach to form nitrosamines and nitrosamides, which are known carcinogens. The 2010 monograph was developed based upon conclusions from a 2006 expert panel meeting. The AMI Foundation believed it was

important to the meat and poultry industry to challenge *IARC's* conclusion in order to reinforce the safety of nitrite as currently used as a meat curing agent.

In late 2010, the AMI Foundation convened a committee that included experts in nitrite physiology, toxicology, meat curing chemistry, and epidemiology to examine the current literature and to challenge *IARC's* conclusion. The committee developed a comprehensive review of the science since 2006 that discusses new gastric cancer epidemiology reports that contradict the *IARC* literature review. The review also addresses *IARC's* reinterpretation of the a 2000 National Toxicology Program animal bioassay (TR495), which concluded that nitrite did not cause cancer in laboratory animals and discusses nitrogen oxide physiology with a focus on nitrite. Their review was published in the October 2012 issue of the journal *Food and Chemical Toxicology*, which can be viewed at <http://www.sciencedirect.com/science/article/pii/S0278691512005406>. On September 19, the authors of the *Food and Chemical Toxicology* paper provided a copy to *IARC* leadership and suggested their classification needs to be changed.

AMI Foundation Education & Training Programs

Each year, AMIF conducts annual conferences and educational workshops to meet the needs of AMI members, others in the meat and poultry industry and their retail and foodservice customers. AMIF will continue to provide annual conventions and conferences for segments of the meat and poultry industry and to develop special workshops, seminars and other programs to meet needs as they arise.

Below is a brief summary of the objectives of the programs and the results of the training offered in 2012.



Advanced *Listeria monocytogenes* Intervention and Control

This year, *Listeria monocytogenes* Intervention and Control Workshop was offered as part of the AMI International Meat, Poultry & Seafood Industry Convention and Exposition in Dallas, Tex. This program, held on April 30-May 1, 2012 attracted more than 40 attendees from across the globe to learn about the latest developments in *Listeria* control, including: sanitation best practices, sanitary equipment and facility design, and new case studies on heat sanitation and sanitation verification using total place count.

Ground Meat and Poultry Production for Safety

In this workshop, industry experts shared their experiences and knowledge on the production of ground meat and poultry products within a preventive food safety system. During the workshop, participants heard detailed case studies about ground meat and poultry production and food safety challenges and how companies have tackled them. The workshop agenda was structured to permit extensive discussion between attendees and instructor. The workshop took place March 13-14, 2012, in Kansas City, Mo., with 40 registrants.

Animal Care and Handling Conference

The Animal Care and Handling Conference was held October 17-18, 2012, in Kansas City, Mo. Timely presentations included a customer perspective on animal welfare, an update on a systematic approach to animal handling; new research on balking, and talks about transport of barrows and immunologically castrated pigs. With Temple Grandin, Ph.D., as the featured instructor, this year's conferences attracted w registrants.





Annual Meat Conference

The Annual Meat Conference, co-sponsored by AMIF and the Food Marketing Institute, was held February 19-21, 2012, in Orlando, Fla., at the Rosen Shingle Creek. Nine hundred registrants attended educational sessions that provided practical, useful information on varied topics including global meat department trends, consumer choices, store innovation strategies, and

the impact of the economy on the meat and poultry industry. This year's attendance increased by almost four percent and the annual Product Tasting Reception and Innovation Technology Solutions Exhibits were premier events during the conference.

Conference on Worker Safety, Human Resources and the Environment

The Conference on Worker Safety, Human Resources and the Environment, held March 14-15, 2012, at the Westin Crown Center in Kansas City, Mo., continued to keep attendees ahead of the curve on key safety and environmental issues specific to the meat and poultry industry. Nearly two hundred registrants attended sessions covering maintenance and sanitation safety, water regulation, employee behavior, resource conservation, and plant security. This year pre-conference workshops were offered on Six Sigma for Human Resources and Ammonia Refrigeration for Worker Safety Professionals, which attracted almost fifty registrants. Both the Environmental and Worker Safety Recognition Awards were presented at the Awards Ceremony on March 14, 2012.



AMI Foundation Education & Training Programs Continued

Environmental Recognition Award Program



The Environmental Recognition Awards are administered by the Education and Professional Development Department in conjunction with the Environmental Affairs Committee. The four-tier awards program was developed to provide recognition of a company's dedication to continuous environmental improvement, as witnessed by the development and implementation of Environmental Management Systems (EMS). AMIF recognized 116 award winners at the joint Awards Ceremony on March 14, 2012. This year, 7 plants were recognized for completing Tier 1; 11 for Tier 2; 59 for Tier 3 and 39 for Tier 4.

Safety Recognition Award Program



The primary goals of the safety recognition award program, administered by the National Safety Council, are to motivate employers to improve their safety performance through the establishment of sound safety and health programs at the plant level and to recognize those plants that have achieved a high level of safety performance as part of a continuing effort to reduce occupational injury and illness.

AMIF recognized the 115 safety award winners in a joint awards ceremony with the Environmental Recognition Awards on March 14, 2012. AMI Chairman Larry Odom, president of Odom's Tennessee Pride Sausage, Inc. and AMI President and CEO J. Patrick Boyle were on hand to distribute the awards and congratulate the award recipients.

2013 Calendar of Events

AMIF offers conferences, educational workshops and timely briefings throughout the year on topics including food safety, worker safety, human resources, animal welfare and the environment.

Annual Meat Conference

February 24-26, 2013
Nashville, Tennessee

Conference on Worker Safety, Human Resources and the Environment

March 20-21, 2013
Kansas City, Missouri

Animal Care and Handling Conference

October 16-17, 2013
Kansas City, Missouri

Advanced *Listeria monocytogenes* Intervention and Control Workshop

Fall 2013

Research Advisory Committee

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Bob Evans Farms

Cynthia Austin
Kraft Foods/Oscar Mayer

Sharon Beals
Maple Leaf Consumer Foods

Dane Bernard
Keystone Foods LLC

Wafa Birbari
Hillshire Brands Co.

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Thomas Powell
American Meat Science Association

Stephen Quickert
Kraft Foods Global, Inc.

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