NEWS

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E. coli O157:H7 Detected Most Often on Cattle Hides, Study Shows

Colorado State Research Suggest Optimal Sampling Methods

Newly completed AMI Foundation funded research shows that *E. coli* O157:H7 can be found in much greater prevalence on the hide of cattle rather than in feces or on carcasses.

The research, done by Keith Belk, Ph.D., and his colleagues at Colorado State University, suggests that proper hide removal is a critical step in preventing pathogens on carcasses and in meat. It also underscores the effectiveness of slaughter intervention strategies in eliminating *E. coli* on carcasses.

All samples were collected in October and November of 2000. Of the total 150 hide samples collected for detection of *E. coli* O157:H7, 27 samples or 18 percent were positive. Of the total fecal samples, 6.7 percent were positive. No carcass samples were positive for *E. coli* O157:H7.

The presence of *Salmonella* was higher than *E. coli* O157:H7. Sixty-eight or 45.3 percent of 150 hide samples tested positive for *Salmonella*. In addition, 8.3 percent of all fecal samples and 1.7 percent of all carcass samples were positive for *Salmonella*. When samples were analyzed by lot (defined as animals from a common source), 16.7 percent had at least one fecal sample and 6.7

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AMI Foundation Takes Leadership Role on Animal Disease Issues

The AMI Foundation assumed a leadership role in the first half of 2001 on animal disease prevention and risk management amid a flurry of publicity surrounding bovine spongiform encephalopathy (BSE) and foot-and-mouth disease (FMD).

Animal Disease Briefings

A Foundation-sponsored BSE briefing in March drew 250 industry members, scientists and policymakers to Washington for a full day of the latest information about the BSE crisis in Europe and U.S. efforts to safeguard domestic herds.

William Hueston, DVM, Ph.D., of Virginia-Maryland Regional College of Veterinary Medicine and formerly head of USDA's Animal and Plant Health Inspection Service, pointed out the distinct differences between U.S. and U.K. livestock demographics, rendering and feeding practices that have impacted the development and spread of BSE.

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Inside this Issue...

Animal Welfare Issues Assume Higher Profile In U.S. Meat Industry

Animal welfare issues and training are becoming higher priorities among U.S. meat packers and processors and the results are positive, according to government and industry surveys.

Grandin Survey Data

World-renowned animal handling expert Temple Grandin, Ph.D.. assistant professor at Colorado State University, who audits meat plants for U.S. and foreign governments and for McDonald's Corporation, released audit results at the AMI Foundation's Animal Handling and Stunning Workshop in February 2001. According to Grandin, animal handling and stunning in U.S. beef and pork packing plants show continued improvements. In compiling the data, she and a team of auditors visited 49 federally inspected beef plants in 12 different states and 19 federally inspected pork plants in eight different states.

In 1996, Grandin wrote objective criteria endorsed by AMIF in its *Good Management Practices for Animal Handling and Stunning* that help to evaluate handling and stunning in plants. The AMIF GMPs encourage plants to monitor factors like the number of times livestock slip or fall, how frequently livestock vocalize (which can indicate stress) and how successful the stunner operator is in making an animal insensible to pain with a single activation of a stunner.

Stunning of livestock is required by the 1958 Humane Slaughter Act, a law which is enforced by U.S. Department of Agriculture inspectors that are present in packing plants during every moment of operation.

According to her 2000 audit, the average first activation stunning efficacy rate in beef cattle was 97.87 percent. In pork plants, 17 of the 19 plants induced instant insensibility in pigs. Problems identified in two of the 19 plants were corrected, according to Grandin.

In 2000, 80 percent of the beef plants passed the vocalization audit with three percent of cattle vocalizing. In 1999, 71 percent of the plants passed. None of the plants received a "serious problem" rating, which is assigned when more than 10 percent of cattle vocalize. According to Grandin, improvements in pig handling have greatly reduced squealing during handling of pigs. Her data show that 94 percent of plants had acceptable or excellent levels of squealing compared to 73 percent in 1999.

Also this year, 45 percent of beef plants received excellent scores on electric prod use – scores given when zero to five percent of cattle are prodded. Sixty-eight percent of plants had eliminated the use of electric prods in the crowd pen. Four plants had completely eliminated electric prods in the entire system. Grandin has promoted alternatives to the use of prods, like sticks with grocery bags that rustle and large flags which prompt animals to move forward without causing pain or stress.

Notably, Grandin found limited differences in scores when audits were announced versus unannounced. In 1999, when auditing first began, Grandin found much greater differences.

New Ideas

Based on her findings, Grandin suggested a number of improvements in plants, including improving flooring to eliminate slippage in stunning boxes, which can complicate stunning; redesigning noisy gates that frighten cattle causing them to balk; using caution not to overload equipment and improving pig stunning procedures through workstation and stunner redesign and modifications to slaughter procedures.

Grandin attributes the continued improvements she has observed to a number of factors. First, industry customers have made animal welfare a top priority. In an effort to respond to customer concerns, meat companies have embraced handling and stunning training and the concept of self-audits – actions which translate into documented improvements.

In February 2001, AMIF offered its third annual Animal Handling and Stunning Workshop to an overflow crowd of 150 attendees. The course will be offered again in February 21-22, 2002 in Kansas City.

"Efforts to improve animal handling and stunning in packing plants are good for animals and good for plants," Grandin said. "Humane handling is simply 'the right thing,' but it also has product quality and worker safety benefits."

"Management commitment to welfare programs is key if we are to sustain the type of continuous improvement as we have seen in the last few years," she added.

Grandin's complete data is posted at http://www.grandin.com.

AMI Survey Data

AMI this year surveyed members about a variety of animal welfare issues, including self audits, training and stunner use.

Ninety-three percent of beef plants and 92 percent of pork plants conduct animal handling and stunning self-audits. Twenty three percent of auditing beef plants and 32 percent of auditing pork plants

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Unique Organisms: Cornell Microbiologist Works to Fingerprint Pathogens Using DNA

What do soccer and subtypes have in common? At Cornell University, computer and mechanical engineers use the same image recognition technology that has brought the school's computerized soccer team fame to create detailed and searchable images of the genetic makeup of pathogens. The goal: to enhance understanding of the ecology and biology of bacteria that can cause human illness.

Isolates

This game of forensic microbiology plays out in a lab that is home to Martin Wiedmann, DVM, Ph.D. Since 1992, Wiedmann has painstakingly collected samples of various pathogens from food, animals and humans and has subtyped these isolates. Health Departments have been key contributors of human isolates. Animal isolates have come primarily from New York livestock, while food companies have contributed samples from products testing positive for pathogens.

Now, Wiedmann's database consists of more than 4,000 total isolates, half of which are *Listeria monocytogenes*. Other pathogens in the database include *Vibrio*, *Streptococcus agalactiae* and *Pseudomonas*. In the future, he plans to incoporate other species, like *E. coli*, into the database. Presently, Human sources account for 900 of the total isolates, while 800 were sources from foods and 300 from animals.

"But you need large data sets to find associations," Wiedmann says. Which leads him to call upon other researchers and food companies to submit samples for subtyping in his lab or to submit the actual fingerprint directly to his database to be used with the image recognition software named "Pathogen Tracker." Wiedmann expects the database will be available on the web later this year and will be searchable by users.

Wiedmann says companies needn't be overly concerned about confidentiality because his lab and his database use identifications on samples that cannot be tracked to plants.

Virulent vs. Non-Virulent

Martin Wiedmann, DVM, Ph.D.

While Wiedmann has not performed a characterization to determine whether each isolate in his database is virulent or non-virulent, he does know that some of the *L. monocytogenes* subtypes in his database are non-virulent.

"We clearly are not there yet with regard to having science-based regulations," he said. But Wiedmann believes a better understanding of subtypes of microorganisms can help improve regulations. He uses *E. coli* O157:H7 as an example of a subtype which is better understood and clearly virulent. Therefore food safety policies can be targeted at this dangerous pathogen, rather than at the entire species of *E. coli*.

To illustrate, Wiedmann notes that Chihuahuas and German Shepherds are the same species but clearly have distinct differences. So do bacteria and they must be studied and understood. *Listeria monocytogenes* is a species, yet it's various subtypes can carry threats as distinctly different as Chihuahuas and German Shepherds.

"By better understanding the ecology of these organisms, you can prevent and understand what causes human disease," he notes. And that will contribute to better food production technologies and better food safety policies to ensure the best possible public health outcome.

For more information on Dr. Wiedmann's work, call 607/254-2838 or email him at mw16@cornell.edu.

AMA Launches New Foodborne Illness Program for MDs and Patients

"Fight BAC!" Patient Information Released

The Partnership for Food Safety Education along with the American Medical Association, CDC, FDA and FSIS earlier this year announced a new campaign to educate physicians about diagnosing and treating foodborne disease.

"Diagnosis and Management of Foodborne Illnesses: A Primer for Physicians" was developed by the various groups as part of the 1997 President's National Food Safety Initiative. The document was created for primary care physicians and other health care providers most likely to see the first cases of potential food-related disease outbreak. It contains charts outlining different illnesses, the symptoms, treatment and foods with which it's associated. The primer also contains a Fight BAC! brochure for patients that explains who is at risk, the most common types of foodborne illness and simple steps for food safety.

At a January press conference in Washington, DC, Dr. J. Edward Hill, a family physician from Tupelo, MS, said the kit will be used as a teaching tool for the medical community. In fact, Hill said he already is using the primer with his residents at North Mississippi Medical Center. Fifteen thousand copies of the primer have been published for distribution. The primer also is available on the AMA web site at http://www.ama-assn.org/foodborne.

Physicians play a key role in the prevention as well as the early diagnosis of foodborne illness since they are most often in contact with the at-risk populations the illnesses can effect. Yet research has shown that many physicians are not fully informed about the symptoms, diagnosis and treatment of foodborne disease and are not clear about precisely who may be at risk. High risk populations vary for different foodborne diseases, but can include the very young, the elderly, the

immunocompromised and pregnant women.

The Partnership for Food Safety Education is a public-private partnership created to reduce the incidence of foodborne illness by educating Americans about safe food handling practices. AMI is a founding member of the Partnership for Food Safety Education. AMI's members believe food safety is a shared responsibility among industry, government and consumers.

The Fight BAC!™ brochure "should be in every kitchen in America," Hill said. "It's more than our grandmother's taught us about food safety."

E. coli Most Often on Hides

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percent hat at least one carcass sample that was positive for *Salmonella spp*.

As part of the testing, researchers used different sampling methods to assess which would be most effective in recovering the highest number of positive samples.

Five sampling methods were used on hides: three-site sponge sampling; hide excision; gauze sampling; hair clipping and hide washing with effluent collection. All hide sampling methods recovered both *E. coli* O157:H7 and *Salmonella*. For *E. coli* O157:H7, three-site sponge and hair clipping appeared to be the most effective. When a large population of cattle is tested, the three-site method is likely the most proficient, the researchers concluded. For *Salmonella* detection, the hide washing method appeared to be the most effective, although random limb movement following bleeding can create a worker safety hazard during effluent collection. The three-site sponge method was the second most effective method.

In feces, samples were collected using two methods: palpating the rectum and excising the colon. *E. coli* O157:H7 was isolated from at least one animal in 13 percent of the lots sampled in the present study. Neither sampling method was more effective than the other.

Four methods of microbiological sampling were

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AMIF Funds Key New Research to Prevent Pathogens

In the first half of 2001, AMIF funded five new research projects – two dealing with preventing and treating *E. coli* O157:H7 in live animals and three dealing with the elimination of foodborne pathogens in processing.

Probiotics

In a study titled "Testing of Probiotic Bacteria for the Elimination of *E. coli* O157:H7 in Cattle," Mindy Brashears of Texas Tech University aims to determine the effectiveness of feeding cattle probiotic lactic acid bacteria as a daily feed supplement. Researchers will monitor the effects of the substances in the shedding of the pathogen by the animals, contamination of the carcasses during slaughter and the effects on body weight gain and feed intake.

The cattle will be monitored for fecal shedding at a university feedlot. The cattle will be divided into two groups: those shedding *E. coli* O157:H7 prior to probiotic supplementation and those not shedding the pathogen. Cattle then will be divided into two more groups, one receiving probiotics, the other not receiving probiotics. Researchers also will monitor the body weight gain and feed intake of all the cattle during the supplementing period. The hides and carcasses of the cattle will be examined at various points during the slaughter process for presence of *E. coli* O157:H7 and other pathogens.

Bacteriophage

A second study, which will be performed by Dale Hancock at Washington State University, will examine whether a bacteriophage product specifically targeted for *E. coli* O157:H7 will reduce the probability of infection or the amount of the pathogen in fecal shedding in infected cattle. Bacteriophages are viruses that attack bacteria.

If the bacteriophages targeted specifically for the pathogen work, researchers then will try to determine the most effective method of delivering the bacteriophage to the cattle.

Three studies newly funded by AMIF will deal with *Listeria monocytogenes*.

Antimicrobials for RTE Meats

A study by Jimmy Keeton at Texas A&M University will focus on the antimicrobial effects of surface treatments and ingredients on cured ready-to-eat products. Keeton will study the use of food grade "generally recognized as safe" or GRAS preservatives to determine if they will inhibit the growth of *L.m.* during vacuum packaged storage at 4.5 degrees C. Keeton will examine the preservative properties of $Safe_2O$™HOH + Lactic Acid (SWLA) or potassium lactate (KL) as ingredients for preserving quality and extending shelf life of vacuum packaged, cured, ready-to-eat (RTE) frankfurters. In addition, the research will examine the effectiveness of SWLA, KL and lactic acid, singly or combined, in preventing outgrowth of *L.m.*

A second study by Jack Losso and Kenneth McMillan at Louisiana State University will determine the antimicrobial effective of different levels of protamine on various pathogens. Researchers will examine the effects protamine, a protein that confers antimicrobial activity against bacteria, fungi and molds, on *Salmonella*, *E. coli* O157:H7 and *L.m.* Researchers also will evaluate the shelf-life and microbial status of precooked meats and poultry at "abusive temperatures" treated with protamine.

Literature Review

Finally, a literature review by Ellin Doyle at the University of Wisconsin aims to collect scientific literature relating to the possible growth of *Clostridium botulinum*, *C. perfringens*, heat-injured cells and other foodborne pathogens on heat-treated RTE meat and poultry products during cooling. Doyle also will collect literature published on the growth of pathogenic bacteria on raw meat and poultry during chilling and thawing.

E. coli Study

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used on carcasses: sponge sampling; tissue excision; swabbing the pattern-mark and thorax sponge. Because no *E. coli* O157:H7 was detected using any of these methods, the study could not suggest that one method was better than another, but did indicate that carcass excision and three-site sponge sampling recovered the most generic *E. coli*.

"As Dr. Belk and his colleagues noted in their conclusion, the research showed significant levels of pathogens on the surface of live animals. This tells us that technologies such as animal cleaning systems to minimize contamination as cattle enter plants may be a fruitful area of research as we seek new and better ways to reduce the microbial risk that live cattle present in our plants and on our products," said AMIF Vice President of Scientific Affairs Randy Huffman, Ph.D.

AMIF Contributes New Data To Enhance USDA/FDA *Listeria* Risk Assessment

AMIF has collected new data about how consumers store and prepare hot dogs in an effort to enhance a *Listeria* Risk Assessment, now drafted by USDA and the Food and Drug Administration (FDA).

In conducting the Risk Assessment, USDA and FDA are seeking to determine which ready-to-eat (RTE) foods pose the greatest risk of listeriosis to people. USDA and FDA examined 20 categories of foods, including hot dogs, dry and semi-dry fermented sausages, deli meats, pates and meat spreads, smoked fish, various cheeses, fruits and vegetables, and deli salads.

The risk assessment has been in progress for several years. The agencies have struggled to address major data gaps for certain categories of foods. AMIF had expressed concern about these gaps and sought to supply data to ensure the integrity of the risk assessment outcomes.

Consumer Reheating Practices

When analyzing the risk of consuming unreheated hot dogs, the Draft Risk Assessment notes that no data describing the extent of under-reheating of frankfurters has been published. The agencies estimated that somewhere between one and 14 percent of people consumed unreheated or under-reheated hot dogs.

AMIF contracted with leading pollster Wirthlin Worldwide to determine hot dog handling and reheating practices and to assess how long consumers store ready-to-eat meats. Approximately 1,000 randomly selected adults, chosen to represent the U.S. population demographics, were surveyed by telephone in April.

Seventy-two percent of respondents said they always reheat hot dogs before eating them. Only 15 percent said they personally have ever eaten hot dogs straight out of the package without reheating them. Another 11 percent said someone else in their household eats them right out of the package. More importantly, the study will provide new information on the frequency of this practice, which is not currently in the Draft Risk Assessment.

Respondents who indicated that they had consumed non-reheated hot dogs were asked to estimate how often did this occur. Forty-eight percent estimated that they do this less than nine percent of the time and only three percent responded that they would eat non-reheated hot dogs 100 percent of the time. Most often, those eating unreheated hot dogs were children (78 percent). Another 20 percent were other adults under the age of 60 living in the household. Three percent of those who consumed hot dogs right out of the package were over 60 years of age, a group that is at risk for listeriosis.

The research also found that almost twice as many men (21 percent) as women (10 percent) say they have eaten a hot dog without reheating it in the past year. This is significant because of the risk that *Listeria* can pose to pregnant women.

Deli Meat Storage

AMIF also asked consumers about deli meats storage times. Three-fourths of respondents say they store deli meats for seven days or less. Four in ten say they eat custom sliced deli meats in one to three days. Just three percent keep custom sliced deli meats for eight to ten days, while only one percent say 11 to 14 days is more typical. These storage times are significantly shorter than the storage times assumed by USDA and FDA in the Draft Risk Assessment.

AMIF has supplied the data to Novigen Sciences, which is running computer models to see how these variables impact the assessment and ranking of risks posed by various food categories. The outcomes of these computer models will form the basis for AMIF's comments, due July 18.

"In AMIF's view, the Draft Risk Assessment confirms our belief: it is not consumption of high risk foods that pose a risk to human health, but it is the consumption of certain foods by specific groups of at-risk people," said AMIF Vice President of Scientific Affairs Randy Huffman, Ph.D. "It is critical that people who hear about this risk assessment understand that listeriosis is one of the rarest - but certainly most serious - foodborne diseases."

He noted that at-risk consumers include the elderly, the unborn and infants to 30 days of age, pregnant women and those who are immune-compromised, like people who are HIV positive or undergoing cancer treatment. Young children over 30 days of age typically are not at risk for listeriosis, in contrast to other foodborne diseases that do pose a risk to young children.

"Helping consumers understand who is at risk and what they can do to minimize those risks is critical," he added.

Animal Disease Issues

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According to Hueston, in the UK, there are far more sheep than cows, while in the U.S., there are far more cows than sheep. In addition, the UK is roughly the size of Oregon, but has a much higher livestock density. (See chart 1). In addition, in the UK, oil seed meals are less available for animal feeds so rendered animal proteins are used in much higher quantities than in the U.S. According to Hueston, if all rendered mature sheep protein went to dairy cows, UK cows would consume 3.4 pounds per head while U.S. cows would consume 2.8 ounces per head.

"Can BSE happen here?" Possibly... However, it is highly unlikely because of striking differences in cattle and sheep demographics, feed ingredients and feeding practices," Hueston said.

Hueston noted that USDA has conducted ongoing risk assessments and has taken many actions, as knowledge about BSE expanded, that have sequentially strengthened U.S. firewalls. These actions include the 1997 ban on the import of ruminants and ruminant products from Europe and the ban on feeding most mammalian products to ruminants.

"Zero risk is unachievable," he said. "Risk analysis demonstrates the need for multiple and redundant safeguards."

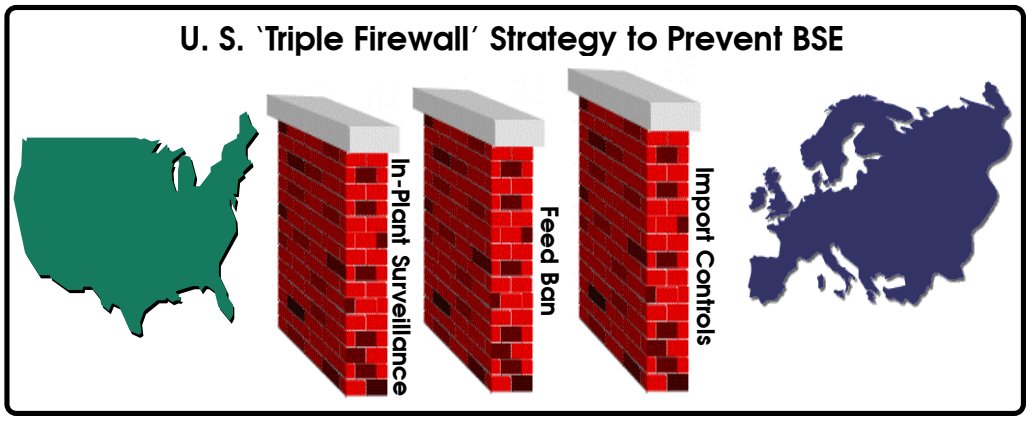

Chart 1

The U.S. and U.K.:

Key Differences that Impact Animal Disease Control

	United Kingdom	United States
Population	58,744,000	276,219,000
Square Miles	93,784	3,615,275
Cattle	11,000,000	97,000,000
Hogs	5,948,000	59,300,000
Sheep	27,600,000	6,900,000
Livestock Density (per Square Mile)	475	45
Foot-and-Mouth Disease (FMD) Cases	1,635	0
Animals destroyed due to FMD outbreak	3,030,000	0
Bovine Spongiform Encephalopathy Cases	177,905	0
Human vCreutzfeldt-Jakob Disease Cases	99	0

Note: Livestock population figures as of Dec 2000. Disease cases as of May 2001.

Sources: USDA, National Agricultural Statistics Service,
UK Ministry of Agriculture, Fisheries and Food and UK Dept of Health

FMD Briefing

More than 70 people attended an AMIF June Briefing on Foot and Mouth Disease. During the briefing, Alfonso Torres, DVM, deputy administrator at the Animal and Plant Health Inspection Service, said the U.S. has taken significant steps to prevent FMD and other foreign animal diseases from entering U.S. borders.

Torres said those steps have been ongoing for several decades. While the most recent FMD outbreak in the United Kingdom has garnered significant media attention and heightened U.S. vigilance against the disease, outbreaks occur arround the world every year and the U.S. has successfully prevented FMD since 1929.

BSE Hearing

Capitol Hill is watching BSE issues carefully. AMI Foundation staff have participated in House and Senate Briefings about BSE and FMD to help educate lawmakers and their staffs about the diseases and U.S. government and industry efforts to prevent them.

In testimony before the Senate Subcommittee on Consumer Affairs, Foreign Commerce and Tourism in April, AMIF President Jim Hodges said the U.S. is well positioned to continue to prevent BSE in U.S. cattle herds.

"Policymakers must recognize this fact in setting

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AMIF Leadership on Animal Disease Issues

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policy and reject the hysteria that has swept Europe" he said. He underscored the fact that the U.S. is in the advantageous position of preventing a disease that has not occurred here, while Europe must seek to control a disease that has already swept its cattle population.

"The British problem - now shared by 12 other European nations – has provided strong incentive for the U.S. government and U.S. beef industry to take aggressive actions to prevent this devastating animal disease in U.S. herds," Hodges said. "In fact, we took action so early that some people now seem to question why we aren't announcing major new efforts today. The answer: we took swift, science-based actions early on that have protected our livestock and given us the coveted distinction of being a BSE-free nation."

Hodges described the U.S. approach to BSE prevention as a "triple firewall" strategy. Because BSE is not present in U.S. herds, the first critical firewall in protecting U.S. cattle involves protecting U.S. borders. As early as 1989, the U.S. Department of Agriculture (USDA) banned the import of cattle and beef from countries with BSE.

The second critical firewall involves careful surveillance. Veterinarians are present at every U.S. meat packing plant and check cattle for signs of any disease - including BSE. No animal can be processed for meat without inspection. Additionally, USDA routinely conducts laboratory tests for BSE. For a country in which BSE is not endemic - has never been detected in the native cattle population - the U.S. has one of the most statistically sound and comprehensive surveillance programs in the world. Of the roughly 12,000 animals tested for BSE by the U.S. government, none have been positive.

Hodges said the third critical firewall involves controlling what cattle are fed. Evidence indicates that BSE may have been spread in the U.K. and Europe by contaminated feed. Even though the U.S. has no BSE in cattle, the feeding of any protein derived from ruminant animals (cow, sheep, goat or deer) to cattle has been prohibited in this country.

According to Hodges, there is a growing trend within the beef industry to require certification from producers that cattle have met all Food and Drug Administration (FDA) requirements. AMI has provided its members with model certification language and the Institute understands it is beginning to be widely used, he said.

"Taken together, these efforts provide the best possible assurance that U.S. cattle will remain BSE-free and that U.S. consumers will not be exposed to any related health risks," Hodges said.

"While our media have begun to mirror British tabloid coverage of BSE, our cattle herds are, and will remain, very different from those in the U.K. and Europe. Our policies must reflect these differences and be supported by the best available science lest we head down the slippery slope of creating our own hysteria."

AMIF Materials

In an effort to help media, lawmakers and policymakers understand both BSE and FMD, AMIF has developed helpful fact sheets on the two animal diseases, as well as a BSE graphic that depicts the actions taken at each point in the beef production chain to prevent BSE. All three documents are available on www.meatami.com.

High Profile for Animal Welfare Issues

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said they had observed strong improvements in handling and stunning through their audits. Seventy percent of auditing beef plants and 73 percent of auditing pork plants reporting modest improvements in animal handling and stunning.

Eighty-two percent of beef plants and 85 percent of pork plants said their animal handling and stunning programs and training efforts have resulted in some improvements in product quality. Fifteen percent of pork plants said the improvements were dramatic. No beef plants reported dramatic quality improvements.

Seventy-nine percent of beef plants and 81 percent of pork plants had hired a consultant to resolve animal handling and stunning problems. Ninety-three percent of beef plants and 89 percent of pork plants said they had purchased special equipment like a restrainer to improve handling and/or stunning.

In terms of equipment used to stun animals, 50 percent of beef plants use pneumatic captive bolt stunners while 71 percent use cartridge fired captive bolt stunners.

Seventy-three percent of pork plants use manually operated head to body stunners; 38 percent use captive bolt; 15 percent use automatic electric stunners; 8 percent use CO2; 4 percent use head only electric stunners.

AMI Resources

Additional animal welfare resources, including AMI's animal welfare training materials, are available on www.meatami.com.

Ongoing Research

Listeria monocytogenes

Investigator	Institution	Project Title	Expected Completion Date
Amy C. Lee Wong	University of Wisconsin-Madison	Reduction of *Listeria monocytogenes* Biofilm Formation in RTE Meat Processing Environments	October 2001
Joseph G. Sebranek	Iowa State University	Use of Pediocin with Other Barriers for Control of *L.m.* in RTE Processed Meats	September 2001
Kalidas Shetty	University of Massachusetts	Elite Herb Extracts Containing High Rosmarinic Acid and Inhibition of *Listeria monocytogenes* in Meat and Poultry Products	March 2002
James Dickson	Iowa State University	Optimum radiation dose to eliminate *Listeria monocytogenes* in packaged RTE processed meats	January 2001
James Dickson	Iowa State University	Survival of *Listeria monocytogenes* in RTE Processed Meats after Irradiation Processing	January 2002
Harshavardhan Thippareddi	Kansas State University	Control of *Listeria monocytogenes* in Ready-to-Eat Meats Using Cetyl Pyridinium Chloride (CPC) and Shelf Life Extension of RTE Meats Treated with CPC	July 2001
Michael Doyle	University of Georgia	Control of *Listeria monocytogenes* in Food Processing Facilities by Competitive Exclusion Microorganisms	July 2002

E. coli O157:H7

Investigator	Institution	Project Title	Expected Completion Date
Andrew Benson	Univeristy of Nebraska	Distribution of Virulent & Avirulent Subclones of *E. coli* O157:H7 in the U.S.	January 2002

Newly Funded Research

Listeria monocytogenes

Investigator	Institution	Project Title	Timeline
Jimmy Keeton	Texas A&M University	Antimicrobial Effects of Surface Treatments & Ingredients on Cured RTE Meat Products	December 2001
Jack Losso	Louisiana State University	Pathogen Inhibition and Shelf-Life of Raw and Precooked Meat with Protamine	January 2002
Ellin Doyle	Food Research Institute University of Wisconsin	Review of Scientific Literature Related to Survival of Pathogenic Foodborne Bacteria during Cooling of Heat-treated, RTE Meat and Poultry Products and Thawing of Frozen Raw Meat and Poultry	July 2001

Newly Approved Research

E. coli O157:H7

Investigator	Institution	Project Title	Timeline
Mindy Brashears	Texas Tech University	Testing of Probiotic Bacteria for the Elimination of *Escherichia coli* O157:H7 in Cattle	December 2002
Dale Hancock	Washington State University	Evaluation of Efficacy of a Bacteriophage System in Preventing or Modulating *E. coli* O157:H7 Infection of Cattle	January 2002

Upcoming AMIF Events

October 16 – 17, 2001
Meat Industry Research Conference,
The Palmer House, Chicago, IL

November 2001
Implementing *Listeria* & Intervention Control Workshop,* Milwaukee, WI

Feburary 21-22, 2002
Animal Handling and Stunning Workshop*,
Kansas City, MO

**Dates and/or Location to be arranged.*

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