# Know Your Risk: Bovine Spongiform Encephalopathy (BSE) and Foot and Mouth Disease

By Lynn Knipe

BSE (alias "mad cow disease") and foot and mouth disease are quite different issues, even though western Europe currently is dealing with both. There is a great deal we can learn from the western European experience with both diseases. BSE is a food safety problem, while foot and mouth is not a risk to humans.

**BSE**

In spite of what happened in England, BSE has not been found in some 12,000 suspect cattle that were tested in the United States since the USDA BSE surveillance program began in the 1980s. This surveillance program is directed by OSU veterinary school graduate Dr. Linda Detwiler. There are some major differences in how cattle were raised and how ground beef and sausage are made in England compared to the United States, which might further suggest that BSE is less likely to be a problem in the United States.

First of all, BSE in cattle is one example of several types of "wasting diseases" currently known to exist. Humans ages 55-75 have been diagnosed with classical Creutzfeldt-Jakob disease (CJD) for many years. The cause is not clear, and 85 percent of these cases are called "sporadic CJD."

BSE has affected cattle in England since the mid 1980s, and is believed to be caused by the consumption of meat and bone meal made from scrapie-infected sheep. Scrapie was first seen in British sheep over 250 years ago, but the first scrapie cases seen in the United States were in 1947. As a result, the United States banned imports of sheep and goats from England in the 1950s. While there is no evidence that scrapie is a health risk to humans, consumption of feed made from scrapie-infected sheep is known to cause BSE in cattle.

BSE cannot be destroyed by typical meat cooking temperatures. Researchers found that consumption of brain or spinal cord tissue from BSE-afflicted cattle can cause a new form of CJD, called variant CJD (vCJD). They also found that some people are more susceptible to the vCJD than others. Over 80 young people have died from vCJD in England since 1995.

**BSE Risk in England vs. the United States**

Cattle feeding practices are much different in England and western Europe than in the United States, since they do not have the abundance of soy protein to feed as a protein supplement like we do here. As an alternative, meat and bone meal was used to a much greater extent there, which accounts for the connection between scrapie-infected sheep and BSE cases. In 1989, the United States prohibited the importation of ruminants (cattle, sheep, goats, etc.) and most ruminant byproducts from any country affected with BSE. In 1997, the U.S. FDA prohibited the feeding of most mammalian protein to ruminant animals.

Also, sausage and ground beef manufacturing in England differs from that in the United States. First of all, mechanically deboned beef (MDB) was used prior to 1990 at a much greater extent than in the United States. Here, use of MDB in ground meat products is rare due to the calcium restrictions that USDA FSIS has imposed on that product. Spinal cord tissue would have been in MDB used as a raw material in making sausage and ground beef until it was banned in the United Kingdom. Also, it was the cull dairy cows of England (known to have the highest percentage of BSE incidences) that were the most likely source for MDB and trimmings used in ground beef, sausage, and baby foods—foods consumed in greater quantity by young people in England during the 1980s.

**Traveling to Europe soon?**

The CDC (U.S. Centers for Disease Control) website advises travelers to Europe to consider:

1) Avoiding beef and beef products altogether (i.e., eat pork or lamb), or
2) Selecting beef or beef products that are solid pieces of muscle meat (versus ground beef products such as burgers and sausages), which have a reduced opportunity for contamination with tissues that might harbor the BSE agent.
3) Milk and milk products from cows are ***not*** believed to pose any risk for transmitting the BSE agent.

**BSE Websites**:

Council for Agricultural Science and Technology
www.cast-science.org

Centers for Disease Control (CDC)
http://www.cdc.gov/travel/madcow.htm

World Health Organization (WHO)
http://www.who.int/emc/diseases/bse/

USDA-APHIS
http://www.aphis.usda.gov/oa/bse/

**Foot and Mouth Disease**

Foot and mouth disease, also called hoof and mouth disease, is caused by a virus that infects only cattle, pigs, sheep, goats, deer and other cloven-hoofed, cud-chewing ruminants, but generally does not pose a risk to humans. This is not the same as hand, foot and mouth disease that is common in children. The big concerns with foot and mouth disease is that it causes the animals to have difficulty eating and walking, so they are not able to grow and produce milk as normal, but perhaps more importantly, this disease is very contagious. The contagiousness of the disease is the reason that large numbers of animals are destroyed and that infected farms are quarantined to prevent spread by people, equipment, etc. Travelers to countries with the virus who have visited farms are expected to disinfect their shoes and to stay off U.S. farms for a minimum of five days. Foot and mouth disease has been eradicated from the United States since 1929, but recent outbreaks have occurred in Britain and Taiwan (1996).

# Verification of HACCP Plans

By Lynn Knipe

Verification is one of the most important parts of a HACCP plan, but often one of the least understood. Verification involves three parts: validation, verification and reassessment of HACCP plans.

**Validation**
Validation involves demonstrating that your HACCP plan is theoretically sound and adequate to ensure process control of identified hazards. It also involves demonstrating that you can implement the plan and prevent, reduce or eliminate identified hazards to acceptable levels. Validation is one requirement of the HACCP systems basic compliance checklist.

For establishments under inspection prior to the implementation deadline in 2000 and earlier, initial validation of a HACCP plan was typically done by trial implementation of the plan prior to its official implementation. Now that all existing inspected establishments have implemented HACCP, new establishments coming under inspection or existing establishments that wish to produce new products not covered by an existing HACCP plan have a conditional grant of inspection for a period not to exceed 90 days to validate a new HACCP plan. This trial period allows employees and the HACCP writing team an opportunity to determine the feasibility of the written plan, as well as how effective the plan is in controlling identified hazards. During this validation period, you need to do repeated tests to determine the adequacy of the CCPs, critical limits, monitoring, record keeping and corrective action procedures that you wrote into your HACCP plan. Validation would include reviewing records that you have generated as you implemented your HACCP plan on a trial basis.

**Verification**
Ongoing verification involves procedures to demonstrate that your HACCP plan is working the way you intended it to work. Verification is to a HACCP plan what monitoring is to a CCP. Your inspectors will also be verifying your HACCP plan with their checks to determine that your HACCP plan is working properly. Verification is very important to pre-shipment review, even though your pre-shipment review may be more frequent than your verification procedures.

Verification of a HACCP plan must include at least the basic points of record review, direct observation of monitoring and corrective actions, and calibration of monitoring equipment, but it may include additional procedures.

The frequency of verification is determined by the establishment, and does not need to be as frequent as monitoring. But it is expected that more frequent verification would result in fewer problems found during pre-shipment review. You may prefer to verify your plans as infrequently as possible, but you would need records from your validation process to support less frequent verification procedures. However, with each verification procedure, record review is expected to include all records since the previous verification procedure.

**Reassessment**
HACCP plans should be reassessed at least annually after implementation, or when any processing changes occur that might affect the HACCP plan or potential hazards in the process. Process changes which might trigger a reassessment include changes in raw materials (meaning a change in ingredients or suppliers), product formulation, slaughter or processing methods, production volume, personnel, packaging method, distribution system, and/or intended users or consumers of the final product. Reassessment shall be performed by a person trained in accordance with 417.7, and the HACCP plan shall be modified immediately whenever a reassessment indicates that a plan is no longer adequate. Changes (modifications) in a single part of the total HACCP plan without a total reassessment of the plan does not count as a reassessment.

## Meat Industry Calendar

**September 22, 2001**
**Ohio Association of Meat Processors Fall Tour and Board of Directors Meeting**
118 Parker Food Science Building, 2015 Fyffe Court
Ohio State University, Columbus, OH 43210
Contact Valerie Parks at Val@oamp.org

**October 18-21, 2001**
**American Meat Institute's International Meat, Poultry and Seafood Expo**
http://www.worldwidefood.com/ami_about.htm

**December 5-7, 2001**
**Beef 509**
117 Animal Sciences Building
Ohio State University, Columbus, OH 43210
Contact Henry Zerby (614) 688-4584 or zerby.8@osu.edu
or Elizabeth Harsh (614) 873-6736 or eharsh@ohiobeef.org

**February 20-21, 2002**
**Food and Dairy Industries Conference**
Sponsored by the OSU Extension and the Department of Food Science and Technology
Wyndham Dublin Hotel, watch website for details:
http://www.ag.ohio-state.edu/~meatsci/calendar.html

**March 5-7, 2002**
**Thermal Processing of Ready-to-Eat Meat Products**
Holiday Inn on the Lane, 328 West Lane Avenue
Columbus, OH 43201
Registration Deadline: February 14, 2002
Contact: Lynn Knipe (614) 292-4877, knipe.1@osu.edu
Website: http://www.ag.ohio-state.edu/~meatsci/NEW_Thermal_Procsg_REVD.pdf
For more information about the registration scholarships for Ohio companies, contact OSU Continuing Education at (614) 292-8571 or conf@gate.ce.ohio-state.edu

**March 8-9, 2002**
**Ohio Association of Meat Processors Convention**
Holiday Inn, Dayton Mall
31 Prestige Plaza Dr., Miamisburg, OH 45342

## Meat Lab Bones Became Part of COSI's 'Dino Summer'

By Martha Filipic

When Mary Ann Wojton, senior director of special programs at COSI, started planning the science center's "Can You Dig It?" weeklong camp offerings this summer, she decided she needed some bones. After all, what's a paleontological dig with no bones? So, she contacted Henry Zerby at the college's meat lab.

"We process meat looking at things a bit differently—muscle quality, palatability, food safety, that sort of thing," Zerby said. "We also have a class on how to harvest animals. But she was looking for bones to replicate into full skeletons, so for this project, we did things differently, trying to keep the bones intact."

Zerby gave Wojton bones from a beef carcass, a lamb carcass and a pork carcass, which she picked up in early June. Meat lab manager Gary Dunlap even boiled the bones down to remove all the meat and connective tissue. Wojton did some further processing—bleaching the bones to remove any residual grease, and drying them in a warm oven—before the projects began.

The projects are designed to mesh with COSI's "Dino Summer," starring a 41-foot long articulated cast skeleton of "Sue," the largest, best preserved and most complete Tyrannosaurus rex ever discovered. Different projects are designed for Fossil Finders (children in grades 1-3), Explorers (grades 4-6), and Curators in Training (grades 7-8). However, they'll all do some of the basics: Some of the bones will be buried in COSI's small dig site, which will be graphed off with twine much like a real excavation site. "This will give the campers a feeling of what it's like at an actual dig site," she said. "They'll be brushing off small rocks, marking down where they found the bones, things like that." But Wojton realized that this part of the project isn't very authentic: Dinosaur bones are found in stone, not loose dirt. That's when she came up with the next part of the project.

Some bones will be placed in a mixture of paraffin and sand. "They'll have to use a chisel to get the bone out, and possibly a dental instrument to clean the finer pieces," she said. This part of project will replicate how paleontologists remove the ancient bones from rock.

The campers will then wrap the bones in tissue and plaster of Paris for protection, just like paleontologists would when preparing to send bones back to the lab.

Finally, the campers will remove the bones from their protective wrappings and try to fit them together into a skeleton, making some educated guesses along the way. "They'll have to speculate how the bones go together, much like scientists do when they put dinosaur bones together," Wojton said.

It doesn't matter too much if they don't have all the bones originally in the carcass, she said.

"Sue is an exception to the rule—they recovered about 90 percent of her bones. Usually with dinosaurs, they're lucky if they find 50 to 60 percent."

Zerby said he occasionally gets requests from the vet school or med school for bones, but "we don't get a whole lot of requests from the public. But if you look at it, what we're doing and what COSI is doing is really a pretty good fit. We both promote science and education. In the end, we're after the same objectives."

*Martha Filipic is technical editor with the College of Food, Agricultural, and Environmental Sciences at The Ohio State University.*

## Winston Bash Retires

After 18 years as director of the Wilbur Gould Food Industry Center at The Ohio State University, Dr. Winston Bash retired August 31, 2001. Winston Bash served as a mentor, teacher, consultant and authority on just about all issues related to food processing and safety. In the classroom and pilot plant, over the food safety information line, and in countless other ways, Dr. Bash's wealth of knowledge, straightforward style, and sense of humor have enhanced many lives—and likely saved a few too! Among other things, Winston coordinated the Better Process Control School, judged the OAMP Product Competition for many years, and helped with the judging of the Ohio State Fair food entries.

## HACCP Training

Please let us know if you have employees that need further HACCP training. Also, let us know if your employees need the Introductory HACCP Training Course or if they are interested in an Advanced HACCP Course (Verification and Validation).

### *Wanted: E-mail Addresses*

***If you have an e-mail address, but are still receiving a paper copy of this newsletter by mail, please send your e-mail address to: knipe.1@osu.edu, Likewise, encourage others at your company to send us their e-mail addresses as well. With the current budgetary situation, we can send many more copies of newsletters by e-mail than by U.S. mail.***

# Sausage Links: Using Phosphates in Meat Products

By Lynn Knipe

Are you using phosphates in your brines or sausages? If so, do you know which kind of phosphates you are using and why you are using that kind? If not, don't feel left out. Many processors have used phosphates for years, but haven't had the time or opportunity to learn much about this ingredient.

There are a number of different phosphates that can be used in meat products, and each one has unique functional properties. Since all phosphates are white, and look alike, it is often assumed that they are all alike! Phosphates are quite different from other ingredients conventionally added to meat products. There are eleven different phosphates that have been approved for use in meat products, and each is somewhat different from the rest in its functional properties in meat. The following discussion focuses on some of the properties of phosphates.

Most phosphates will raise the pH of meat products, which is good for maximizing the water-holding capacity of meat. However, two commonly used phosphates have either no effect on pH or actually lower the meat pH. Sodium acid pyrophosphate lowers the pH of meat products, and was originally approved for improving the cured color formation of chopped or emulsified products in which there was little time between the chopping procedure and cooking. Hexametaphosphate is very often used in meat products, but is known to be a neutral phosphate and has little effect on pH or water-holding capacity. These phosphates that do not raise the pH of meat are better for cured color development, as a higher meat pH is detrimental to the cure color reaction.

Furthermore, polyphosphates are hydrolyzed and/or converted to other forms in meat systems. This hydrolysisis is enhanced by enzymes in meat. What this means to processors is that given sufficient time, polyphosphates will be hydrolyzed to the orthophosphate form, which has been shown to result in a surface "snow" and efflorescence on phosphate-treated meat products.

Polyphosphates also bind to or "tie up" divalent cations (calcium, magnesium or iron) in hard water supplies. While this allows phosphates to serve as water conditioners or softeners, once phosphates have "tied up" cations, their capacity to increase water-holding capacity in meat is reduced. This suggests that deionized or softened water should be used with phosphates. Magnesium ($Mg^{++}$) is chelated to a much greater extent than calcium ($Ca^{++}$) by phosphates and is best chelated by tetrasodium pyrophosphate. In addition, the chelation of $Ca^{++}$ is much greater than that of iron ($Fe^{++}$), and is accomplished best by hexametaphosphate. If distilled or deionized water is not available, the type of water available may dictate the type of phosphate added to the meat.

One other phosphate effect allows increased chopping time with less temperature rise. We have demonstrated that emulsions made with the addition of tetrasodium pyrophosphate require more chopping time to reach a specified temperature than emulsions made without it; this extra chopping time could further increase emulsion stability by increasing protein extraction. This is probably due to decreased emulsion viscosity, which would decrease the rate of emulsion temperature rise. Decreased emulsion viscosity would be advantageous when pumping emulsions over long distances. However, a decrease in temperature rise, per pass through emulsifiers may result in less stable emulsions if the final emulsion temperature is not carefully monitored.

Salt (both sodium chloride and potassium chloride) is very important to the action of phosphates. At the levels of addition to which phosphates are limited, the addition of salt has a major effect on ionic strength and more specifically, the chloride ion serves a valuable role in causing electrostatic repulsion of muscle proteins. Emulsion stability of phosphate-treated emulsions is dramatically reduced in the absence of salt. At lower salt levels (0.75 percent and lower), the maximum allowable level of 0.5 percent phosphate would further enhance emulsion stability. At conventional salt levels (2 – 2.5 percent), we see no additional value in adding phosphates at more than about 0.3 percent of the finished product weight. In addition, the effect of phosphates on increasing yields of emulsified product is less than with whole muscle products.

Researchers who studied the order in which salt and phosphates are added to the chopper found no difference in protein solubility or emulsion stability, regardless of whether salt was added before, after or simultaneously with phosphate.

For more information about the use of phosphates in meat products, see our website at:

http://www.ag.ohio-state.edu/~meatsci/archive/phoschap.html

Fecal Matters

# Fecal Detection System Scans Carcass Beef for *E. Coli 0157:H7*

By Dan Murphy

A fecal detection system capable of scanning an entire beef carcass for pathogens such as *E. coli* O157:H7 is under development as part of a partnership between USDA's Agricultural Research Service and eMerge Interactive, Inc. of Sebastian, Fla., according to a news release. In a recent trial of a prototype at the Food and Agricultural Products Research and Technology Center at Oklahoma State University in Stillwater, the detection system revealed trace levels of contamination prior to and after trimming. The prototype was also successful in evaluating fecal decontamination on carcasses subjected to high-temperature steam from steam vacuums or steam pasteurization cabinets. This is a common practice used for microbial intervention in the beef slaughter industry. The fecal detection technology, designed to scan each side of a beef carcass for potential fecal contamination was developed and patented by ARS scientists Thomas A. Casey and Mark A. Rasmussen, in collaboration with Iowa State University chemist Jacob W. Petrich. It has been exclusively licensed by eMerge and is being further developed under a cooperative R&D agreement.
For more information, log onto the ARS National Animal Disease Center in Ames, Iowa, at http://www.ars.usda.gov/is/pr/2001/010814.htm

*Dan Murphy is editor of* Meat Marketing and Technology *magazine.*

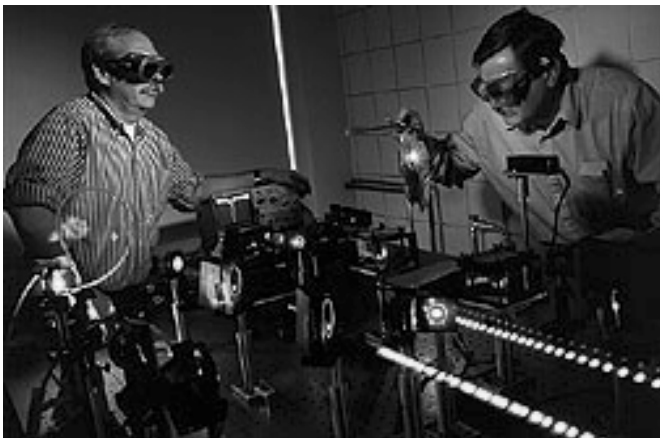

*Photo by Keith Weller*

***Microbiologists Tom Casey (left) and Mark Rasmussen evaluate a new laser for use in their fecal contamination detection system for meat carcasses. They are working in the laser lab of an Iowa State University collaborator, photochemist Jacob Petrich.***

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