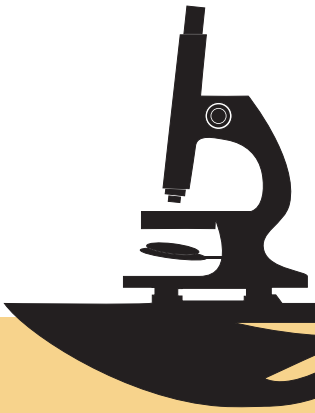
Food Safety Consortium

ANNUAL REPORT

Fiscal Year July 1, 2006 – June 30, 2007



- University of Arkansas
- Iowa State University
- Kansas State University

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- **Iowa State University**
- **Kansas State University**

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The Mission of the Consortium

The Food Safety Consortium consists of researchers from the University of Arkansas, the University of Arkansas for Medical Sciences, Arkansas Children's Hospital, Iowa State University and Kansas State University. The FSC was established by Congress in 1988 through a special Cooperative State Research grant to conduct extensive investigation into all areas of poultry, beef and pork meat production, from the farm to the consumer's table. The purpose of the Consortium, as defined by Congress, is fourfold:

- To develop technology for rapid identification of infectious agents and toxins;
- To develop a statistical framework necessary to evaluate the potential health risks;
- To determine the most effective intervention points to control microbiological or chemical hazards;
- To develop risk monitoring techniques to detect potential hazards in the distribution chain.

After the FSC was established, it expanded its mission to include three additional tasks:

- To develop risk assessment and interdiction actions in hazard reduction and control;
- To develop technology to reduce the hazards and improve the quality of animal food products, which will complement the development of HACCP programs by USDA;
- To develop, complement and maintain an aggressive technology transfer system that effectively communicates the work of the Consortium to consumers, industry, government and other scientific investigators.

Each of the university members of the Consortium is primarily performing research associated with the specific animal species for which that university is uniquely qualified: poultry at the University of Arkansas, pork at Iowa State University and beef at Kansas State University. Research projects are coordinated with scientists at the University of Arkansas for Medical Sciences and Arkansas Children's Hospital.

The Consortium is the synthesis of three specialized, interdisciplinary research program centers, all dedicated as a team to the investigation, development and transfer of credible, timely and objective information and technology relative to the safety of food products from animals. The results of this work are relayed to media personnel, to members of the poultry, beef and pork industries and to federal government regulatory agencies through the public information office of the Consortium.

The Consortium is dedicated to the development and utilization of advanced research techniques; to the coordination of research programs to share information and eliminate duplication of efforts among its research members, and to the production of research and research products that, upon implementation, will assist in the enhancement of consumer, industry and government confidence and satisfaction in the safety of food products from animals. ■

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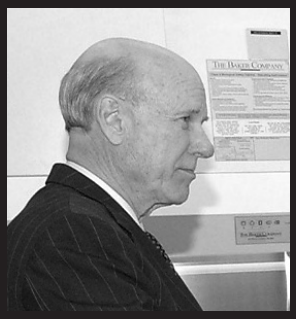

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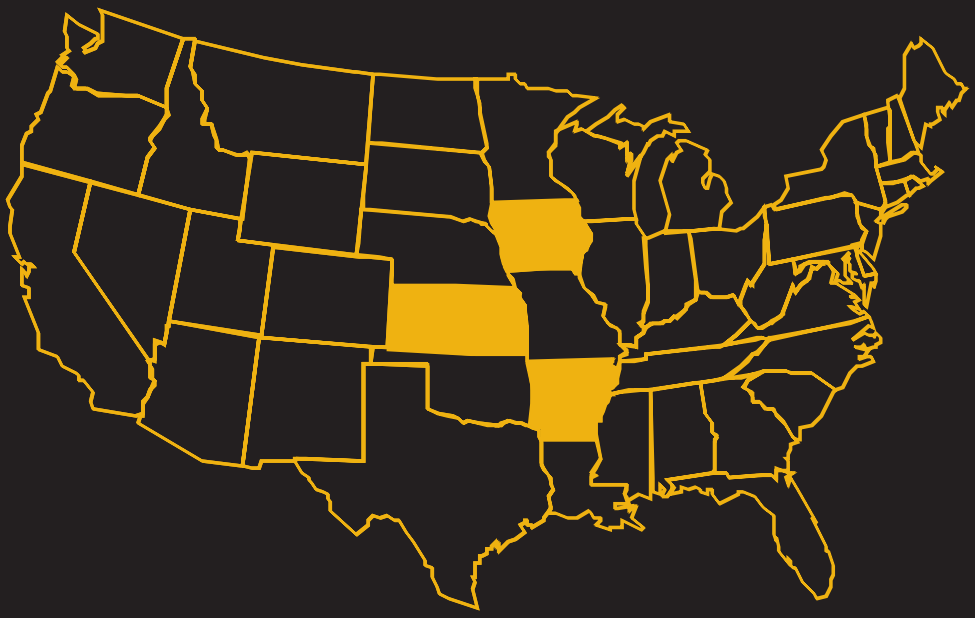

Iowa State University
Ames

Kansas State University
Manhattan

University of Arkansas
Fayetteville

University of Arkansas for Medical Sciences and Arkansas Children's Hospital
Little Rock

Steering Committee

The Consortium Steering Committee is responsible for overseeing the food safety program of the three-state Consortium to ensure that it is progressing in a satisfactory manner toward meeting its purpose as outlined in the congressional mandate. The committee meets at least once each year to review research progress and to recommend, if necessary, changes that may be required to accomplish the congressional mandate.

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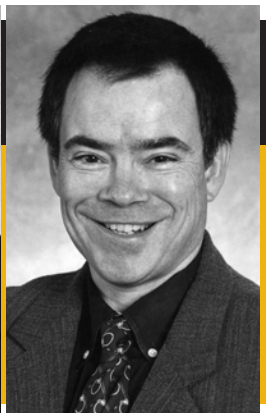
RESEARCH HIGHLIGHTS

University of Arkansas

Michael G. Johnson
and Steven C. Ricke



The fall of 2006 brought significant challenges to the FSC. The technical committee is tasked with the role of working with our administration and congressional representatives to keep the FSC alive and well in the coming fiscal years. Because of limited funds in this carryover year, no formal research meeting is planned for the fall of 2007. Let's hope everyone is on the same page and that the necessary congressional funding support can be found to support and sustain this important research activity in 2008 and beyond.

On another note, the many fine presentations papers presented at the October 2006 meeting are in the final stages of being drafted by the principal investigators and edited by our very capable head editor, Mr. Dave Edmark. These will then be incorporated as comprehensive reviews into a hardbound book as a proceeding. Many thanks to Dave, Steve and all the PIs for making this possible and to the University of Arkansas Press for doing the printing and binding.

Summarized below are some of the brief updates on research projects directed toward enhancing and improving the safety of poultry products from "farm to table." These are excerpts from investigators' reports based on their pre- and post-harvest research projects funded by multi-year grants, as reported for the fiscal year 2006-07 funding cycle.

Pre-Harvest

Promising results were obtained in continuing work with two natural proteins termed bacteriocins and produced by two beneficial bacteria belonging to the genus *Bacillus*. These bacteriocins were earlier shown able to prevent colonization of young commercial turkeys by the pathogen *Campylobacter*. Microscopic studies suggested that these two compounds gave this benefit by reducing the niches (called "intestinal crypts and goblet cells") in which this pathogen likes to set up shop.

The effects on turkey poults of exposure to *E. coli* or cold stress in subsequent development of knee joint infections/biofilms when challenged with *L. monocytogenes* were tested. Cold stress did not significantly increase *L.m.* cell isolation from joints. However, poults challenged with *E. coli* showed increased rates of isolation of *L.m.* from the knee joints of these poults. More positive joints (synovial tissue samples) were detected using real time PCR rather than using conventional culture methods. Thus, chronic or unapparent colonization of turkey knee joint tissues can constitute an unexpected source of *L.m.* contamination in processing plant environments for cross contamination to finished raw or cooked products.

A direct plating method was used to track persistence of ciprofloxacin resistance in *Campylobacter* present on raw retail carcasses in 2005 and 2006. Percents of carcasses with direct counts of total *Campylobacter* of below log 2, log 2-3 and log 3-4 or log 4-5 were about 8, 44, 41 and 4 percent respectively while the corresponding percentage of these counts that were ciprofloxacin resistant were about 4, 20, 14 and 3.6 percent respectively. Thus, there was some reduction in the incidence of antibiotic resistant isolates but the trend still persisted, despite the fact that the FDA approval for the use of the ciprofloxacin family of antibiotics for poultry management was withdrawn in 2005.

Work testing the ability of normal healthy bacteria, lactic acid bacteria and others when isolated from the gut of healthy chickens and introduced back to other poultry to suppress the growth and persistence of pathogens is continuing. The main such bacteria belong to the genera *Lactobacillus* and *Bacillus* and they help drive out pathogens by the competitive exclusion mechanism. This idea holds that there are basically only so many parking spaces in the poultry gut so if we take the spaces up with the good guys, there is less room for the pathogens to set up house-keeping. These good guys are also called a probiotic and one such *Lactobacillus* containing culture has been licensed with the code name of FM-B11™ and licensed by the University of Arkansas to a start-up company. This culture has been shown able to significantly reduce incidence of *Salmonella* Enteritidis positive birds in commercial flocks of

both broiler chickens and of turkeys. Increased performance under commercial conditions as compared to controls has also been reported. Other work is ongoing to isolate and evaluate *Bacillus* organisms that can provide the same benefit. The latter organism, being a spore former, promises to be easier to add in poultry management regimes.

Biofilms are formations of normal bacteria with their sticky outer surfaces binding together to trap food and water. These sticky bacteria can stick to one another and to inanimate surfaces. These sticky blobs can make cleaning equipment more difficult in the food processing plant. But more importantly, can these sticky blobs of mixed cultures of normal non-harmful bacteria serve as a hiding place for pathogenic bacteria like *Campylobacter*? Could this happen in chicken drinker units in grow-out houses, on live haul crates, or in processing plant drains environments? The answer is YES. These *Campylobacter* positive biofilms were detected using a molecular combination technique termed PCR-Denaturing Gradient Gel Electrophoresis (DGGE). Further results indicated that most biofilms, regardless of the organisms present can trap and serve as a harbor for this pathogen to cause contamination later.

Work continued comparing ability of control, non-starved cells, *L. monocytogenes* cells versus those starved for up to 180 days in phosphate-buffered saline to survive and model target gut Caco-2 cells. At a ratio of 1 to 1 of *L.m.* cells to target cell, the cells starved for 30-180 days produced about 5 million cells versus about 10 million for the control. The tiny holes termed plaques produced by the starved cells in target cell lawns were smaller and fewer than the controls, about 100 plaques versus 1,000 for the controls. Nevertheless, the results show that complete nutrient depletion in the form of starvation for this pathogen does not reduce its ability to cause extensive virulence in these model cell tests.

Yanbin Li with a prototype of a portable biosensor system for field use to rapidly detect the H5N1 bird flu virus

Post-Harvest

What happens to the virulence and ability of *Salmonella* cells to cause infections if they survive the scalding treatments given to raw poultry? That question was addressed recently using microarray technology to see what genes of this pathogen were turned on or off by sublethal heat treatments. Results indicated as many as 300 genes were turned on in their expression after such treatments. While the expected virulence genes were not up-regulated, one of the more interesting sets of genes up-regulated or turned on were those encoding for fimbrae synthesis. These are the short outside cellular appendages of this pathogen that help it stick to biological structures and thus enable it to stick to epithelial cells as the first step in host invasion and infection.

Cooked chicken breast strips were recontaminated with *L. innocua* as a surrogate for *L. monocytogenes* to give extremely high counts of about 10 million cells per gram and then packaged and heat pasteurized by immersing them in hot water baths. Results indicated that there were no pathogen survivors in such packages heated for the following temperature and time combinations: 30 minutes at 60° C (140° F); 10 minutes at 70° C (158° F); 7 minutes at 80° C (176° F), or 5 minutes at 90° C (194° F). From the data a model was developed that predicted survivor numbers from partial heating of products. The results indicated that such post-packaging treatments would be an effective intervention strategy to control recontamination by this pathogen on RTE poultry products, at least in smaller package sizes.

Work testing the effectiveness of edible protein films containing natural plant extracts to inhibit pathogens on poultry continued. A natural whey protein isolate was used as the film base into which were incorporated grape seed extract or green tea extract plus nisin (a bacteriocin) and malic acid and EDTA. Model disk pieces of these films were then challenged with about 10,000 cells of *Listeria monocytogenes*, *E. coli* O157:H7 or *Salmonella* Typhimurium and held at room temperature. Results indicated that the above full combination of ingredients reduced the counts of *L. monocytogenes* or *E. coli* O157:H7 to undetectable levels and the counts

of *S.* Typhimurium to less than 5 cells. Follow-up work with these agents without the whey protein isolate were tested as vacuum infusion treatments of raw poultry meat to reduce the growth of *L. moncytogenes* at 4° C. Green tea extract or grape seed extract alone did not inhibit this pathogen but the full combination of agents gave reductions in *L.m.* counts of about 2.3, 4.9 and 5.2 log cycles at malic acid concentrations of 0.15, 0.25 and 0.35 percent, respectively. Other food grade organic acids are being evaluated with the same above agents for their efficacy to control this pathogen

Solid progress in detection research strategies continued. A molecular method termed repetitive DNA sequence-based polymerase chain reaction (rep PCR for short) was evaluated to distinguish among different isolates of *Campylobacter* obtained from poultry versus humans. The results for rep PCR method, which is easier to perform, were compared with the gold standard PFGE method, which is more laborious and is used by the Centers for Disease Control for other pathogens. Results indicated the former method was as good as the latter in discrimination among isolates. Further work is underway to build relatedness diagrams ("dendograms") to show how closely related different isolates are in their rep PCR patterns and progress in this work will be reported soon.

To judge the relative virulence of pathogens isolated from poultry, researchers often use an *in vitro* tissue culture cell model instead of live animals. One such cell model is the HeLa cell line which in the presence of *Campylobacter* undergoes a dramatic change in cell shape. The toxin produced by this pathogen causing this cell change is termed a cytolethal distending toxin (CDT). While this activity makes for a useful tool to measure gross virulence, could the gene sequences encoding for this enzyme like activity be useful in differentiating among different *Campylobacter* isolates obtained from poultry or humans with *Campylobacter* infections? Subsequent work, unfortunately, showed that there was not a good correlation between the gene content of this region and the pathogenicity of the isolate because overall cytotoxicity of human isolates varied due to other markers besides the cdt gene.

Some additional monoclonal antibodies, MAb, for *Campylobacter* were screened recently. Three of these MAb, 234E11, 222C3 and 233E4 reacted with both *C. jejuni* and *C. coli* while two others, 209B11 and 221C9 reacted only with *C. jejuni* and not *C. coli*. MAb 209B11 is under evaluation for its suitability to detect *C. jejuni* in poultry washes

A special biosensor device using a microfluidic flow cell with interdigitated array microelectrodes was coupled with a magnetic nanopraticle bound to an antibody specific for *L. monocytogenes*, *S.* Typhimurium or *E. coli* O157: H7 cells. Lastly, these conjugates were tagged with quantum dots. This device was able to detect *L. monocytogenes* at levels as low as 10 cells in 1.5 hours. For the other two pathogens the minimum detection limits were 1 to 10,000 cells in 1.5 hours.

Conclusions

Given the flurry of foodborne pathogen outbreaks that were reported this year in the national news, there is still much public concern over the continuing threat of foodborne disease. However, we have had a banner year and are continuing to make progress — as this year's above results point out — in developing and applying technologies that will help limit initial pathogen establishment in live poultry and inhibit their proliferation in post-harvest settings. More effective detection tools are becoming a reality and this in turn will augment our surveillance capabilities. These advances are made possible because we are also developing a better understanding of the mechanisms that these pathogens use to circumvent and/or overcome the adversity of food production and processing environments. Better understanding of these mechanisms will translate into "smarter weapons" to combat these highly adaptable foodborne pathogens. ■

RESEARCH HIGHLIGHTS

Iowa State University

James S. Dickson

The Iowa State University component of the Food Safety Consortium funded four research projects, two equipment grants and two diversity graduate assistantships in 2006-07. Research scientists representing several academic departments at the university, as well as USDA-ARS and HHS-FDA, were involved. The primary basis for research under this research program has been the enhancement of the safety of pork and pork products. The research projects encompassed many aspects of food safety as it is currently viewed, from the farm to the consumer.

Diversity Graduate Assistantships

Recognizing the need to enhance diversity in the field of food safety, the Iowa State University portion of the Food Safety Consortium funded two diversity assistantships in 2006-07. This support was of the typical assistantship, with the major professor supplying the matching funds and tuition funding. The two students receiving support were Ph.D. students, one working in the area of risk assessment and the other in animal science.

Equipment Grants

Equipment purchases are necessary to maintain and enhance research capabilities, and to allow the researchers to remain competitive by having access to the latest technology. The Iowa State University portion of the Food Safety Consortium provides up to 50 percent of the cost of the purchase of new equipment, with the investigator providing the matching portion for the purchase. In 2006-07, the Food Safety Consortium provided funding for the purchase of a tri-gas incubator for the cultivation of *Campylobacter* and an image analysis system for the evaluation of a variety of applications, from disk diffusion assays to electrophoresis gels.

Research Grants

Risk based analysis of *Salmonella* in pork

Drs. Jensen and Hurd addressed the question of how changes at various points in the pork production process affect the predicted number of human salmonellosis cases attributable to pork and the costs of alternative control interventions. These resulting change estimates (quantitative mitigation elasticity) and relative costs will provide meat industry management and food safety policy makers a tool to evaluate and determine priority areas for intervention that are indeed "risk-based" and cost effective.

Antimicrobial resistance of *Campylobacter* in swine

Drs. Zhang and Wesley (USDA-ARS, NADC) evaluated the antimicrobial resistance of *Campylobacter* found in live pigs. During the past year, they investigated the antimicrobial resistance profiles of fecal *Campylobacter coli* isolates cultured from two Iowa swine farms at different production stages. Using the standard agar dilution test, each isolate was tested against five different antibiotics including erythromycin (a macrolide), doxycycline (a tetracycline), ciprofloxacin (a fluoroquinolone), gentamicin (an aminoglycoside) and meropenem (a penicillinase-resistant beta-lactam). No resistance to meropenem or gentamicin was demonstrated; however, isolates resistant to erythromycin, doxycycline and ciprofloxacin were observed. Ciprofloxacin resistance was only detected at Farm A and was present in 14.7 percent of the isolates. Comparing resistance to the production stage from which the isolates were derived, no apparent correlation could be seen for ciprofloxacin, doxycycline or erythromycin on either farm.

Quantitation of *Salmonella* in swine during transport and lairage

Dr. Harris and his research associate Mr. Gaul developed a quantitative PCR method which was reliably able to detect 10^4 colonies of *Salmonella* from the concrete floor and results of swine holding pens. Samples that contained less than 1,000 cells could not be detected using qPCR. Of the nine pens tested, three were positive before wash-

Deland Myers, food science and human nutrition professor at Iowa State University (center), mentors seniors in the food product development class Ivan Wibowo and Shelly Tomlinson.

ing, one pen remained positive after washing, and all pens became negative after subsequent sanitation. While more pen sampling is needed to validate these results and increase significance, these data suggest that currently used procedures at Slaughter Plant A reduced *Salmonella*-contaminated feces transmission between groups at lairage. This reduction in transmission between groups could result in a reduction of contaminated carcasses, and it also allows one to determine if on-farm and transport methods are reducing *Salmonella* fecal incidence at lairage pens.

Safety of "naturally cured" pork products

Dr. Sebranek's research has focused on the production of nitrite from natural sources. Preliminary work has focused on processing procedures to assure an appropriate level of nitrite produced under various manufacturing circumstances. Additional work is ongoing, examining the microbiology of the culture used to convert nitrate to nitrite.

Consumer Information

It is imperative that the information developed in the research laboratory be transferred to the general public in a format which is accessible to them. The Consortium continues to help fund the food safety web page designed and maintained under the direction of Mr. Jason Ellis. The Food Safety Consortium consumer web site project continues to receive a significant number of site visits and be recognized for its work. More than 597,000 visitors have accessed the food safety web site home page or one of its links over the past year. Visitors accessed our site with an average of approximately 10 minutes per visit. ■

RESEARCH HIGHLIGHTS

Kansas State University

Curtis Kastner

The focus on microbial food safety by the K-State food microbiology group continues to be on methods development and validation studies. That work continues to be transferred to end users through efforts such as the Rapid Methods and Automation in Microbiology Workshop. The chemical food safety effort continues to attract recognition because of work on ammonia contamination, heterocyclic amines and methods for measuring irradiation of beef. Along with the long standing emphasis on microbial and chemical food safety has been transfer of that information through distance education initiatives. Additionally, the economics, policy, and trade implications of food safety as well as food security are also reported. This farm-to-table, information and transfer approach — covering food safety as well as security — including the integration of the economic, trade and policy aspects, has positioned the Food Safety Consortium to lead to the future in a comprehensive way relative to scientific discovery, technology transfer and education.

Microbial Food Safety

The jerky compliance guideline from the U.S. Department of Agriculture Food Safety and Inspection Service recommends that water activity (a_w) be used for the determination of drying and safety rather than only moisture-protein-ratio. However, no standardized sample preparation method was included in the guideline for analyzing water activity levels in jerky. Two sample preparation methods were examined for whole muscle (WM) and chopped and formed (CF) beef jerky. One half of a strip of commercial WM or CF beef jerky was cut into an intact hexagonal shape with a diameter of approximately 3.2 cm (Treatment 1), while the second half of each strip was diced into pieces approximately 0.4 cm X 0.4 cm (Treatment 2). The intact hexagonal shape or diced pieces were placed in an a_w sample cup so that the bottom of the cup was thoroughly covered. An intact hexagonal shape of WM jerky had a higher average a_w by 0.01 units ($P<0.001$) than diced pieces of jerky. No significant differences ($P>0.001$) in a_w levels were observed between Treatment 1 and 2 for CF beef jerky. Results indicate that processors should use the intact hexagonal shape method for WM jerky to obtain a more conservative a_w level especially if a_w values are near 0.80, a margin of safety.

The efficacy of four plating methods for enumerating BioBall bacterial cultures was evaluated. Overall, the spread plate method using nutrient agar plates was determined the most effective plating method and the spread plate method using selective agar plates was the least efficient method for enumeration using BioBall bacterial cultures. It was determined that BioBall bacterial cultures are precise, rapid, and easy-to-use standard reference and training materials for media quality control standards, positive controls, challenge studies and method validation.

Pathatrix is a unique, large volume, recirculating immunomagnetic capture system that selectively concentrates low levels of target microbial pathogens from complex food matrices. Pathatrix was used to evaluate *Escherichia coli* O157:H7 in broth and yogurt. Oxyrase enzyme, which can maintain oxygen-limited conditions and stimulate growth of some anaerobic and facultative bacteria, was added into broth that was inoculated with *E. coli* O157:H7 to accelerate growth of this facultative anaerobic microorganism. After enrichment, the broth was processed using the Pathatrix system that utilizes paramagnetic beads coated with antibody to facilitate the specific capture of *E. coli* O157:H7 from broth. Then the beads were resuspended in 100µL of 1 percent peptone water. 50µL of them were used to spread onto sorbitol-MacConkey agar for conventional detection of the pathogen and incubated at 37 degrees C for 24 hours in duplicate. It was shown that the colonies of *E. coli* O157:H7 with the Oxyrase was 0.34 Log CFU/mL more than that of control. Homemade yogurt that was inoculated with circa

10^2 CFU/mL *E. coli* O157:H7 was also evaluated by Pathatrix. *E. coli* O157:H7 were gradually decreased and could not be detected after 12 days. The finding indicated the Pathatrix system has applications for rapid and precise detection of *E. coli* O157:H7.

The Food Safety Consortium is a supporter of the International Workshop on Rapid Methods and Automation in Microbiology, because of the unique technology transfer opportunities through the workshop. Since 2005, it has been a project within the Kansas State University Food Science Institute system. This workshop has attracted about 4,000 participants from 60 countries since 1981. Many Food Safety Consortium professors, scientists and students have come to the workshop as participants in the past many years. The 28th workshop will commence from June 13-20, 2008. All Food Safety Consortium personnel will have a 50 percent discount fee for the 2008 workshop (50 percent of $2,255) in registration fee to come to the eight-day, 12-hours-per-day workshop.

Chemical Food Safety

Heterocyclic amines (HCAs), a group of chemicals formed during high temperature cooking of meat and fish, are potent mutagens and are suspected to play a role in various cancers in humans. A previous study conducted in our lab suggests that marinating steaks with different commercial powder marinades can offer a practical way to reduce HCAs formation. Three different powder marinades were investigated in the study. The objective of the study was to evaluate the effects of the base materials used to formulate the marinades on HCA formation in grilled beef steaks. A second objective was to investigate any effects of commercially available barbeque and marinade sauces on HCA levels in grilled beef steaks. The results show that the bases did decrease the HCAs slightly, but the effect was not as pronounced as the marinades themselves. This indicates that the main HCA-reducing effect was due to the herbs and spices contained in the marinade. The barbeque and marinade sauces decreased the HCAs to undetectable levels which presents a easy practical method by which the consumer can reduce HCA levels in grilled meats. The addition of the rosemary extracts is an important factor in decreasing carcinogenic compounds in meat products.

Different types of frozen meat, vegetables, eggs and pizza were evaluated after being exposed to ammonia refrigerant at two cold storage warehouses. All pH values were measured on a 1:10 dilution of food and the ammonia concentration was measured using the ammonia ion selective electrode (ISE). The ammonia concentrations in exposed products were corrected depending on the background determined in normal products. The organoleptic evaluation for ammonia odor was observed during sampling and grinding of the food samples. No ammonia odor was detected during sampling or grinding, and the pH values of the exposed samples were within the normal range. Only eight samples out of the 50 beef samples from a Topeka cold storage warehouse showed positive results for ammonia (50-198 ppm). Because no ammonia odor was noticed and the pH values and the ammonia concentrations were within the FDA limits, we recommended the release of the food products.

An alternative method for the extraction of 2-dodecylcyclobutanone (2-DCB) from irradiated ground beef was evaluated. Ground beef was blended with acetonitrile and the extract was dried with a rotary evaporator. Hexane was then added and the extract was applied to 2 g of silica cartridge previously conditioned with 10 ml of hexane. The 2-DCB was eluted from the cartridge with diethylether in hexane, concentrated and analyzed by gas chromatography-flame ionization detection (GC-FID) or gas chromatography-mass spectrometry (GC-MS). Samples spiked with 2-DCB were used to determine percentage recovery. Commercially irradiated ground beef burgers were also analyzed for 2-DCB using this extraction method combined with GC-FID and GC-MS detection.

The percentage recovery for this extraction method was above 80 percent for both detection methods, GC-FID or GC-MS. The results indicate that this extraction method is suitable for analyzing irradiated ground beef. The amount of 2-DCB in the commercial samples was 0.03 ± 0.01 ppm as detected by GC-FID and 0.04 ± 0.003 ppm as detected by GC-MS. Previous studies have used GC-MS for the detection of 2-DCB, but this study indicates that GC-FID can be used as well.

Distance Education

Nine credit courses in food science and food safety have been developed for distance education. These courses integrate interactive components to create an experiential learning environment similar to on-campus courses. Many of these courses have been captured with an enhanced media system while faculty are teaching students on campus. Student evaluations of the courses have been positive and supportive for the future creation of additional interactive components and courses as part of a food safety and security curriculum. The courses integrate results from the Consortium along with research from other sources.

Economic Implications of Avian Influenza, Food Security and Trade Policy

The highly pathogenic avian influenza (HPAI) is a contagious viral disease affecting wild birds and domestic poultry. Objectives were to: 1) describe the North American broiler industry, and the potential impacts of HPAI; 2) develop a conceptual model for

Sen. Pat Roberts of Kansas (left) is the namesake of the new Biosecurity Research Institute building that was dedicated in the fall of 2006 on the Kansas State University campus. Roberts received a guided tour of the facility with KSU President Jon Wefald (center) and Jim Stack, BRI director.

assessing the economic impact of bird flu in North America, and 3) begin to quantify those economic impacts. Three response scenarios to the discovery of HPAI in North America were analyzed: a) depopulation with continuing trade, b) depopulation with trade restrictions and c) the additional impact of a reduction in domestic demand.

Scenario 1 — Depopulation with trade

If HPAI were to be discovered in a U.S. commercial flock, the response would involve culling/depopulation of infected flocks. While the scale of depopulation would depend on the size and location of the outbreak, given the integrated structure of the U.S. broiler industry this approach could involve a significant reduction in market supply. Because the U.S. is a large exporter (accounting for 27 percent of global exports), reduced U.S. supply will lead to higher world prices absent any demand reduction.

Scenario 2 — Trade restrictions

A U.S. case of HPAI would be followed by trade restrictions from importing countries. Assuming a total ban for a period of one year, the total loss in export revenue is estimated at around $2 billion with domestic consumers benefiting from lower domestic prices. World market prices would increase benefiting producers in HPAI-free countries.

Scenario 3 — Demand reduction

While proper cooking kills the bird flu virus and would protect consumers if the disease was found in the U.S., it is likely that some reduction in domestic demand would accompany an announcement of bird flu's discovery in this country. For example, poultry consumption in Indonesia dropped by 20 percent and continues to drop in other Asian countries following the outbreak (FAO, 2004). Any reduction in demand will place downward pressure on prices and exacerbate producer losses.

The Food Safety Consortium, by strategically integrating the appropriate disciplines, can paint truer pictures of today's food safety challenges and solutions. Indeed, food safety researchers should consider multiple academic disciplines when performing their work. (Smith and Phillips, 2000). The *Frontier* program seeks to help accomplish this important multidisciplinary task.

Policy analysis, historical-studies and multidisciplinary-synthesis research has appeared in a variety of formats during the last year. In addition, the *Frontier* website — http://frontier.k-state.edu — has been revamped, featuring not only research content but also multimedia and podcasting features. Research proposals, publications and other outputs from 2006-2007 include such themes as the history of food safety standards, regionalization and compartmentalization for food security and trade, border security, cross-border cooperation in food safety and security, and international political economy. ■

Research Projects

by University and Principal Investigator – 2006-07

University of Arkansas

Pre-harvest intervention with bacteriocins reducing the incidence of *Campylobacter* in poultry. **Dan Donoghue**

Public information and technology transfer. **David Edmark**

Evaluation of repetitive-DNA-sequence-based PCR fingerprinting for characterizing *Campylobacter jejuni* isolates. **Kathleen Eisenach**

Selected herbal and plant extracts and nisin incorporated edible films to inhibit growth of *Listeria monocytogenes* (V7 serotype 1/2a, 1/2c separately), E. coli O157:H7 and *Salmonella* Typhimurium (DT 104) on raw and cooked ready-to-eat poultry meat. **Navam Hettiarachchy**

Quality preservation and enhanced safety of raw and cooked ready-to-eat poultry meats infused with selected plant extracts during electron beam irradiation and after storage. **Navam Hettiarachchy**

Development of lactoferrin and malic/lactic acid incorporated antimicrobial soy and whey protein coatings for inhibiting *Listeria monocytogenes* 1/2a and 1/2c, *Salmonella* Typhimurium DT 104, *Escherichia coli* O157:H7 and *Campylobacter jejuni* in raw and cooked ready-to-eat chicken and turkey. **Navam Hettiarachchy**

Monoclonal antibodies specific for *Campylobacter jejuni* and permitting differential enumeration of *C. jejuni* among other *Campylobacter* present on poultry. **Michael Johnson**

Quantitation of *Listeria monocytogenes* and its persistence/survival/multiplication under starvation and/or GRAS antimicrobial treatments and virulence difference in *L. monocytogenes* that persist. **Michael Johnson**

Quantitation of total *Campylobacter* load and total ciprofloxacin-resistant *Campylobacter jejuni* load in rinses from raw chicken carcasses and their virulence differences. **Michael Johnson**

A microfluidic immunosensor for rapid detection of *Listeria monocytogenes* in poultry products. **Yanbin Li**

Thermal inactivation and risk assessment of *Listeria monocytogenes* in ready-to-eat products during poultry processing. **Yanbin Li**

Capture, survival and virulence of *Campylobacter jejuni* in a poultry biofilm community. **Michael Slavik**

Prevalence and comparison of the cytolethal distending toxin B-subunit in *Campylobacter jejuni* isolated from humans, chickens and turkeys. **Michael Slavik**

Project coordination. **Mark Cochran**

Iowa State University

Utilizing innovative technologies to disseminate food safety information on the World Wide Web. **Jason Ellis**

Diversity graduate assistantship support for underrepresented students. **Joseph Sebranek**

Diversity graduate assistantship support for underrepresented students. **Jeff Wolt**

Equipment grant: Purchase of a tri-gas incubator for culturing *Campylobacter*. **Aubrey Mendonca**

Equipment grant: Purchase of a multipurpose biological imaging cabinet for food safety applications. **Byron F. Brehm-Stecher**

Antimicrobial-resistant *Campylobacter* in swine. **Qijing Zhang**

Development of quantitative real-time PCR for detection of *Salmonella* in swine during transport and lairage. **D. L. "Hank" Harris**

Assessment of the safety of naturally cured pork products. **Joseph G. Sebranek**

Kansas State University

Antimicrobial treatment of beef subprimals and cuts intended for non-intact (blade tenderization or restructuring) processes. **James L. Marsden and Daniel Y.C. Fung**

Controlled phase carbon dioxide treatment of beef trimmings: effects on quality attributes and pathogen populations. **James L. Marsden, Daniel Y.C. Fung and C. Tanus**

Effects of relative humidity for controlling *Salmonella* spp. and *E. coli* O157:H7 in chopped and formed beef jerky. **Kelly J.K. Getty and Elizabeth A.E. Boyle**

Jerky validation for small and very small meat and poultry businesses. **Kelly J.K. Getty and Elizabeth A.E. Boyle**

Investigation and determination of antimicrobial resistance of generic *Escherichia coli* cultures collected from bovine feedlot lagoons. **Mindi Russell and Daniel Y.C. Fung**

Evaluation and analysis of meat products contaminated by low levels of ammonia from refrigerant leaks. **Faraj Hijaz and J. Scott Smith**

Prevalence of mycotoxins in Kansas field corn. **J. Scott Smith and Kristin A. Altwegg**

Effect of antioxidants glutathione and garlic extracts on the formation of 2-alkylcyclobutanones (2-ACBs) during irradiation of ground beef patties. **J. Scott Smith and A. Kumar**

Metabolism of 2-alkylcyclobutanones generated in foods by radiolysis of fatty acids. **J. Scott Smith, A. Kumar and Priydarshin Gadgil**

Prevention of heterocyclic amine production in grilled ground beef and steaks by marinating with commercial spices. **J. Scott Smith and R. Ameri**

Avian influenza: risks and implications for the U.S. meat industry. **John A. (Sean) Fox**

Historical studies of border security, food safety, and trade policy. **Justin Kastner**

Development and enhancement of technology mediated food safety and security educational materials. **Deanna Retzlaff and Kelly J.K. Getty**

Improving technology transfer by the KSU rapid microbiology methods group. **Daniel Y.C. Fung and Beth Ann Crozier-Dodson** ■

Published Research

in Fiscal Year 2006-07 by University Affiliation

■ University of Arkansas
Journal Articles & Book Chapters

Bennett, E., T. Sivarooban, N.S. Hettiarachchy and M.G. Johnson. 2006. Combined inhibitory effect of nisin with EDTA against *Listeria monocytogenes* in soy protein edible coating on turkey frankfurters stored at 4 and 10 degrees C. Discovery (The Student Journal of the Dale Bumpers College of Agricultural, Food and Life Sciences), 7 (Fall): 8-13.

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University of Arkansas
Papers, Presentations & Abstracts

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Kozak, C.C., J.S. Dickson, B.W. Sheldon, E. Lenchenko and O. Scliarov. 2007. Comparison of Russian and U.S. official methods of analysis of poultry for *Salmonella* (in Russian). International Veterinary Poultry Congress, April 10-13, 2007, Moscow.

Kudra, L.L., J.G. Sebranek, J.S. Dickson, A.F. Mendonca, K.J. Prusa, E. Larson and J.C. Cordray. 2007. Control of *Listeria monocytogenes* on pre-cooked pork chops by irradiation combined with modified atmosphere packaging. Reciprocal Meat Conference, June 2007, Brookings, S.D., Abstract 49, 28.

Lin, J., Y. Chang and Q. Zhang. 2006. The emergence of erythromycin-resistant *Campylobacter* in chickens fed with a tylosin-containing growth promoter. Abstract, 46th Annual Interscience Conference on Antimicrobial Agents and Chemotherapy, American Society for Microbiology, Sept. 27-30, 2006, San Francisco.

Lin, J., Y. Chang and Q. Zhang. 2006. Long-term use of tylosin as growth promoter select for erythromycin-resistant *Campylobacter* mutants in chickens. Conference of Research Workers in Animal Diseases, Dec. 3-5, 2006, Chicago, Abstract P42.

Musquiz, T.M., L.M. Lucia, E. Cabrera-Diaz, J. S. Dickson and G.R. Acuff. 2006. Use of fluorescent surrogate organisms for enteric pathogens in validation of carcass decontamination treatments. International Association for Food Protection Annual Meeting, Aug. 13-16, 2006, Calgary, Alberta, Canada.

Sahin, O., P.J. Plummer, K. Sulaj, S. Pereira, S. Robbe-Austerman, D.M. Jordan, L. Wang, M.J. Yaeger, L.J. Hoffman and Q. Zhang. 2007. *Campylobacter jejuni*-associated abortion in sheep from Midwest states in the United States. American Society for Microbiology Annual Meeting, May 21-25, 2007, Toronto, Abstract, 731.

Patton, B.S., W.R. Cast, M.E. Kocher, J.O. Matthews, R.W. Griffith, H.S. Hurd and J.S. Dickson. 2006. The effect of swine production system on bacterial prevalence and antibiotic resistance. International Association for Food Protection Annual Meeting, Aug. 13-16, 2006, Calgary, Alberta, Canada.

Sebranek, J.G. 2006. Effectiveness of transdermal, needle-free injections for reducing pork carcass defects. Allen D. Leman Swine Conference, September 2006, Minneapolis.

Sebranek, J.G. 2006. Processing, packaging and ingredient innovations. Meat Industry Research Conference, October 2006, Hollywood, Fla.

Sebranek, J.G. 2007. Quality and safety issues associated with the "naturally cured" natural and organic cured meats. World Food Logistics Organization, April 2007, Phoenix.

Singh, M., and J.S. Dickson. 2006. Effects of acid adaptation on thermal tolerance of *Escherichia coli* O157:H7 and *Salmonella* in ground beef. International Association for Food Protection Annual Meeting, Aug. 13-16, 2006, Calgary, Alberta, Canada.

Sneed, J., C.H. Strohbehn and S. Gilmore. 2006. Food safety practices and HACCP implementation in assisted living for the elderly. USDA Food Safety Conference: Reaching At Risk Audiences and Today's Other Food Safety Challenges, September 2006, Denver.

Strohbehn, C.H., J. Sneed, S. Gilmore and D. Henroid. 2006. Food safety educational materials for foodservice staff and residents in schools and assisted living facilities for the elderly. USDA Food Safety Conference: Reaching At Risk Audiences and Today's Other Food Safety Challenges, September 2006, Denver.

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Vu Khac, H., A.F. Helgerson and N.A. Cornick. 2006. Transmission of *E. coli* O157:H7 amongst swine does not require direct contact. Food Safety Consortium Symposium, Oct. 1-3, 2006, Fayetteville, Ark.

Wang, L., J. Byeong, O. Sahin and Q. Zhang. 2007. Genetic mechanism of arsenic resistance in *Campylobacter jejuni*. American Society for Microbiology General Meeting, May 21-25, 2007, Toronto, Abstract, 22.

Kansas State University
Journal Articles & Book Chapters

Ackleson, J., and J. Kastner. The security and prosperity partnership of North America. The American Review of Canadian Studies, 36 (2) (Summer 2006): 207-232.

Capellas, M., D.Y.C. Fung and J. Yuste. 2006. Metodes rapids i automatitzacio en microbiologia alimentaria. Actualitat, perspectives i reptes. TECAC Associacio Catalana de Ciencies de (Alimentacio) Nolo, Desembre 2006, 11-16.

Edwards, J.R., and D.Y.C. Fung. 2006. Preventive and decontamination of *Escherichia coli* O157:H7 on raw beef carcasses in commercial beef abattoirs. Journal of Rapid Methods and Automation in Microbiology, 14 (1): 1-95.

Fung, D.Y.C. 2007. Rapid methods and automation in pharmaceutical samples. American Pharmaceutical Review. 4 (3): 82-86.

Fung, D.Y.C. 2007. Spanish rapid methods and automation in food microbiology: A star is born. Alimentaria, May 2007, 84-85.

Gadgil, P., and J.S. Smith. 2006. Metabolism by rats of 2-dodecylcyclobutanone, a radiolytic compound present in irradiated beef. Journal of Agriculture and Food Chemistry, 54: 4896-4900.

Getty, K.J.K., A. Synoground and M.N. Roberts. 2006. Validation of *Escherichia coli* O157:H7 in direct acidified beef summer sausage. Journal of Food Safety, 27: 275-285.

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Hijaz, F., J. S. Smith and C.L. Kastner. 2007. Evaluation of various ammonia assays for testing of contaminated muscle food products. Journal of Food Science, 72, 5: 253-257.

Kastner, J., and J. Ackleson. 2006. Chapter 6: Global Trade and Food Security: Perspectives for the Twenty-First Century. *In:* Homeland Security: Protecting America's Targets (Volume 1: Borders and Points of Entry), James J.F. Forest (ed.), 98-116. Westport, Conn., and London: Praeger Security International.

Lai, W.H., Y. Xu, D.Y.C. Fung and Y.H. Xiong. 2007. Development of a lateral-flow assay for rapid screening of the performance-enhancing sympathomimetic drug clenbuterol used in animal production; food safety assessments. Asia Pacific Journal of Clinical Nutrition, 16 (Suppl. 1), 106-110.

Tsen, S.Y., F. Ameri and J.S. Smith. 2006. Effects of rosemary extracts on the reduction of heterocyclic amines in beef patties. Journal of Food Science, 71: C496-C473.

Wu, V.C.H., and D.Y.C. Fung. 2006. The investigation of microbial succession and comparison among PCA, EMB, MRS and Kang-Fung medium: Chinese pickles with different salt concentrations. Journal of Rapid Methods and Automation in Microbiology, 14 (4): 325-336.

Wu, V.C.H., and D.Y.C. Fung. 2006. Simultaneous recovery of and detection of four heat-injured foodborne pathogens in ground beef and milk by a four-compartment thin agar layer plate. Journal of Food Safety, 26: 126-136.

Yuste, J., D.Y.C. Fung and M. Capellas. 2007. Metodos rapidos y automatizacion microbiologia alimentaria monografico. V Workshop MRAMS, Alimentaria, Mayo 07, 78-80.

Kansas State University
Papers, Presentations & Abstracts

Altwegg, K.A., and J.S. Smith. 2006. Prevalence of mycotoxins in Kansas field corn. AOAC International Annual Meeting, Sept. 17-21, 2006, Minneapolis.

Capellas, M., D.Y.C. Fung and J. Yuste. 2006. Metodes rapids i automatitzacio en microbiologia alimentaria. Actualitat, perspectives i reptes. TECAC Associacio Catalana de Ciencies de (Alimentacio) Nolo, Desembre 2006, 11-16.

Crozier-Dodson, B.A. 2007. Director of the 3rd Sino-U.S. Workshop on Rapid Methods, May 20-21, 2007, Shanghai, China.

Crozier-Dodson, B.A. Invited chairperson. The Insider's Guide to Rapid and Automated Microbiology conference session, Food Safety World Expo, March 8, 2006, Washington.

Crozier-Dodson, B.A. 2006. Invited speaker. The Microbiology of Infant Formula conference session, AOAC International Meeting, Sept. 21, 2006, Minneapolis.

Crozier-Dodson, B.A. 2006. Invited speaker. Rapid Methods in Automation in Microbiology Workshop, Oct. 14-17, 2006, River Falls, Wis.

Crozier-Dodson, B.A. 2006. Moderator. International Conference for Food Safety and Quality, Nov. 7-8, 2006, San Francisco.

Fung, D.Y.C. 2006. Director of the Kansas State University XXVI International Workshop on Rapid Methods and Automation in Microbiology, July 14-21, 2006, Manhattan, Kan.

Fung, D.Y.C. 2007. Director of the XXVII Kansas State University International Workshop on Rapid Methods and Automation in Microbiology, June 15-22, 2007, Manhattan, Kan.

Fung, D.Y.C. 2007. Food Safety World Conference and Expo, April 18-20, 2007, Washington.

Fung, D.Y.C. 2006. International Association for Food Protection Annual Meeting, Aug. 12-16, 2006, Calgary, Alberta, Canada.

Fung, D.Y.C. 2006. Keynote speaker. IV Congress in Food Safety [Centro de Investigacion y Asistancia de Technologica y diseno de Estado de Jalisco A.C. (CIATEJ)], Aug. 23-26, 2006, Guadalajara, Mexico.

Fung, D.Y.C. 2007. Keynote speaker. Missouri Milk, Food and Environmental Health Association Annual Educational Conference, April 4-6, 2007, Columbia, Mo.

Fung, D.Y.C. 2006. Keynote speaker and principal lecturer. V Spanish Workshop. Rapid Methods and Automation in Food Microbiology. Nov. 21-24, 2006, Autonomous University of Barcelona, Spain.

Fung, D.Y.C. 2006. Keynote speaker on rapid methods and microbiology. Canadian Meat Council Symposium in Advanced and Rapid Methods of Quality Control of Meat and Meat Products, Aug. 10-11, 2006, Calgary, Alberta, Canada.

Fung, D.Y.C. 2006. Keynote speaker on rapid methods and automation in microbiology. XIII International World Congress of Sciences and Technology Meeting, Sept. 17-26, 2006, Nantes, France.

Fung, D.Y.C. 2006. Lecturer. Ontario Food Protection Association Annual Meeting, Nov. 9-10, 2006, Mississauga, Ontario, Canada.

Fung, D.Y.C. 2007. Meat safety from abattoir to consumer. Feb. 14-25, 2007, Valencia, Spain.

Fung, D.Y.C. 2006. Rapid methods laboratory procedures. IV Spanish Rapid Food Microbiology Workshop Manual. *In:* Yuste, J. and M. Capellas, (eds.), Autonomous University of Barcelona, Nov. 21-24, 2006, Barcelona, Spain.

Getty, K.J.K. 2007. Review of FSIS compliance guidelines for the production of safe meat and poultry jerky products in small and very small plants. Seminar broadcast via Net Conferencing, USDA/FSIS, Washington.

Harper, N.M., K.J.K. Getty and E.A.E. Boyle. 2007. Evaluation of sample preparation methods for determination of water activity levels in whole muscle beef jerky. Reciprocal Meat Conference, June 17-20, 2007, Brookings, S.D., Abstracts, 27.

Kastner, C.L. 2007. Agriculture research and education serving the nation: protecting the homeland. National Association of State Universities and Land-Grant Colleges, Feb. 28, 2007, Washington.

Kastner, C.L. 2006. Biosecurity at K-State: ebola, mad cow disease, anthrax, food security and more. Community Readiness Communications: Accurate Messages in Times of Crises. Kansas State University, Nov. 8, 2006, Manhattan, Kan.

Kastner, C.L. 2006. Distance education initiatives, Kansas State University. Annual Meeting of Council of Food Science Administrators, Nov. 12-14. 2006, Washington.

Kastner, C.L. 2007. Farm safety awareness. KSU Agricultural Research Center-Hays, March 7, 2007, Hays, Kan.

Kastner, C.L. 2007. Food safety and security – Kansas State University. Food Defense Education: Post 9/11; National Center for Food Protection and Defense. A Homeland Security Center of Excellence, Michigan State University, April 16-17, 2007, East Lansing, Mich.

Kastner, C.L. 2007. Food safety and security programs at Kansas State University. Presidential Lecture Series, April 24, 2007, Butler County Community College, El Dorado, Kan.

Kastner, C.L. 2007. Food Science Institute mission, organization, operational model and sustainability. DMP Seminars Series — Kansas State University, April 12, 2007, Manhattan, Kan.

Kastner, C.L. 2006. Introduction for conference. Further Defining and Validating an Interdisciplinary Model for University Food Safety and Security Initiatives, Kansas State University, Sept. 22, 2006, Manhattan, Kan.

Kastner, J. 2007. Food safety policy. Invited lecture to Advanced Application of HACCP Principles class, Kansas State University Department of Animal Sciences and Industry, April 18, 2007, Manhattan, Kan.

Kastner, J. 2007. History, veterinary public health, and K-State. Guest lecture to Zoonoses and Preventive Medicine class, Kansas State University Department of Diagnostic Medicine/Pathobiology, March 11, 2007, Manhattan, Kan.

Kastner, J. 2006. International aspects of food science. Invited lecture to Introduction to Food Science class, Kansas State University, Aug. 30, 2006, Manhattan, Kan.

Kastner, J. 2007. International aspects of food science. Invited lecture to Introduction to Food Science class, Kansas State University, Jan. 26, 2007, Manhattan, Kan.

Kastner, J. 2007. Opportunities for Kansas at the state-market interface. Kansas Department of Conmmerce-Kansas State University food safety and security meeting, June 21, 2007.

Kastner, J. 2007. Transmissible spongiform encephalopathies, trade, and international relations. Invited lecture to Zoonoses and Preventive Medicine class, Kansas State University Department of Diagnostic Medicine/Pathobiology, March 9, 2007, Manhattan, Kan.

Kastner, J., and J. Ackleson. 2007. Policy research and public scholarship at disciplinary frontiers. Partnerships for Preparedness Joint Symposium of the Association of Schools of Public Health and the Association of American Veterinary Colleges, April 2007, Atlanta.

Kastner, J., and J. Ackleson. 2007. Observations from the frontier. K-State Interdisciplinary Roundtable Workshop, Sept. 22, 2006, Manhattan, Kan.

Kastner, J., and A. Nutsch. 2007. Demonstrating and documenting critical thinking across disciplines. Invited lecture to Contemporary Issues in Animal Science and Agriculture class, Kansas State University Department of Animal Sciences and Industry, Jan. 29, 2007, Manhattan, Kan.

Kastner, J., and A. Nutsch. 2006. Kansas State University's interdisciplinary model for food safety and security. Kansas State University, Sept. 22, 2006, Manhattan, Kan.

Kastner, J., and A. Nutsch. 2007. Kansas State University's interdisciplinary model for food safety and security. University of Buffalo, March 21, 2007, Buffalo, N.Y.

Pickrell, J.A., W. Goins, J. Yagerline, J. Kastner and C.L. Kastner. 2007. Best practices, quality and a good problem lever student talent development. KSU Annual Teaching Retreat, Jan. 8, 2007, Manhattan, Kan.

Retzlaff, D. 2006. Distance course development, enhancement and management for an interdisciplinary food science program, a T.E.A.M. approach. Mid-America and Great Plains Joint Regional University Continuing Education Association Annual Conference, Oct. 19-21, 2006, Kansas City, Mo.

Retzlaff, D. 2007. Distance learning perspectives. K-State Online Distance Learning Video Gallery (R. McHaney, ed.). Kansas State University Center for Advancement of Teaching and Learning, May 2007.

Thomson, D., D. Retzlaff, C. Reinhardt, D. Montano and B. Ward. 2006. Bilingual feedlot training modules. Module titles: Beef Production Industry; Employee Hygiene in the Feedyard Setting; Feedyard Microbiology 101; Best Management Practices for Pathogen Control in the Feedlot.

Thomson, D., D. Retzlaff, C. Reinhardt, D. Montano and B. Ward. 2006. Development of training and compliance modules for Spanish and English speaking animal caretakers. Veterinary Teaching Hospitals and the Future of Clinical Veterinary Education Symposium, Association of American Veterinary Colleges, Nov. 9-11, 2006, Kansas City, Mo. ■

Honors & Awards

University of Arkansas

Brittany Adams — Won third place in the Gamma Sigma Delta oral competition, undergraduate student category, University of Arkansas, Feb. 27, 2007; Navam Hettiarachchy, adviser.

Vidya Chitturi — Won third place in the Gamma Sigma Delta poster competition, Ph.D. student category, University of Arkansas, Feb. 27, 2007; Navam Hettiarachchy, adviser.

Ann Donoghue, ARS Poultry Production and Product Safety Research Unit, Fayetteville; **Billy Hargis, Dan Donoghue** and **Guermillo Tellez**, UA Center of Excellence for Poultry Science — Won 2007 Federal Laboratory Consortium, National Excellence in Technology Transfer Award and 2006 Federal Laboratory Consortium, Mid-Continent Region, Excellence in Technology Transfer Award, both for "Novel technology to reduce human foodborne pathogens in poultry."

Alice Donya — Won second place in the Gamma Sigma Delta poster competition, master's student category, University of Arkansas, Feb. 27, 2007; Navam Hettiarachchy, adviser.

Yanbin Li — Was named Tyson Endowed Chair in Biosensing Engineering, University of Arkansas, and also received Bao Yugang Visiting Professor Scholarship, Zhejiang University, China.

Ixchel Reyes Herrerra — Recognized for Outstanding Graduate Student Presentation and received the Nicholas Turkey Research Award for outstanding research involving turkey, both for the paper "*Campylobacter* colonization reduced and gastrointestinal architecture is altered in turkey poults fed bacteriocins" presented at the 2007 Poultry Science Association annual meeting in San Antonio.

William E. Huff – Elected Fellow of the Poultry Science Association in 2006.

Michael Johnson — Received a plaque from Dr. Neal Apple, Tyson Foods vice president of food safety and research, on behalf of Tyson in a May 2007 Food Science Department faculty meeting in recognition of "over 20 years of invaluable service to Tyson Foods and the food industry."

Fei Liu — M.S. student, won the second place award of the 2006 AOC (Association of Overseas Chinese Agricultural, Food and Biological Engineers) Student Paper Competition, July 12, 2006, Portland, Ore. Her presentation title was "Detection of *E. coli* O157:H7 using QCM immunosensor with nanoparticle amplification." (ASABE Paper No. 067119). The same presentation also won Liu third place in the Graduate Student Poster Competition at the Food Safety Consortium Annual Meeting, Oct. 1-3, 2006, in Fayetteville, Ark.

Bwalya Lungu — Delivered an invited student oral presentation for Division P, Food Microbiology Division of the American Society for Microbiology General Meeting on May 22, 2007, in Toronto. She was one of eight graduate students from across the U.S. who were invited by the division chair to give a 15-minute oral presentation about their respective poster papers. Lungu's presentation was "The role of protein synthesis in the starvation survival responses of *L. monocytogenes* 10403S and *sigB* mutant." She was mentored by Drs. Michael Johnson and Steven Ricke.

Abani Pradhan — Ph.D. student, won the Student Merit Award of the Society for Risk Analysis Annual Meeting, Dec. 3-6, 2006, in Baltimore. His poster title was "Exposure assessment simulation for microbial behavior of *Salmonella* during poultry processing."

Steven C. Ricke — Received American Egg Board Research Award, Poultry Science Association, 2006.

Madhukar Varshney — Ph.D. student, won first place of the Graduate Student Poster Competition in the Food Safety Consortium Annual Meeting, Oct. 1-3, 2006, in Fayetteville, Ark. His presentation title was "Impedance biosensor based on interdigitated microelectrode coupled with nanoparticle-antibody conjugates for rapid detection of *E. coli* O157:H7."

Yun Wang — M.S. student, won the first place of the 2007 Student Research Presentation Poster Competition (M.S. students) sponsored by the Arkansas Chapter of Gamma Sigma Delta, Feb. 27, 2007, in Fayetteville. Her presentation title was "Interdigitated array microelectrode based immunosensor for detection of avian influenza virus."

Iowa State University

Byron Brehm-Stecher — Appointed to the editorial board of the Journal of Microbiological Methods and appointed to the Institute of Food Technologists Science Reports and Emerging Issues Committee.

Mayumi Fukota — Graduate student in Dr. Qijing Zhang's laboratory, won the outstanding poster presentation award in the section of Enteric Diseases, Conference for Research Workers in Animal Diseases, Dec. 3-4, 2006, in Chicago.

Joseph Sebranek — Elected Fellow of the American Society of Animal Science, July 2006.

Kansas State University

Daniel Y.C. Fung – Was named Distinguished Professor, Universitat Autonoma de Barcelona, Spain, in 2006. Received the Professorial Performance Award from Kansas State University in 2007. Was named Outstanding Educator in Food Safety, receiving the inaugural award presented by Food Safety Magazine and ConAgra Foods at the International Association for Food Protection meeting in June 2007 in Orlando, Fla.

Patents

University of Arkansas

Hettiarachchy, N.S., and S. Eswaranandam. 2007. **Organic acids incorporated** edible antimicrobial films. U.S. Patent No. 7,160,580, B2 issued on Jan. 9, 2007.

Li, Y., C. Ruan and L. Yang. 2007. Rapid and automated electrochemical method for detection of viable microbial pathogens. U.S. Patent No. 7,238,496, July 3, 2007.

Ye, Z., and Y. Li. 2007. Software for capillary optical and electrochemical biosensors. Invention disclosure of the University of Arkansas, March 22, 2007. ■

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