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INSIDE:

AAFP Conference Covers Local, Global
Food Supply – 2

AAFP Poster Award Winners
Announced – 3

Center Hosts S-1033 Research Group
Meeting – 5

NIFSI Project to Improve Traceability –
6

Pasture Poultry Production Target of
Study – 7

Impact of *Salmonella* Influenced by Its
Virulence – 8

Arkansas Research Alliance Reviews
Food Safety Efforts – 9

Center Personnel Co-Authors of Most
Downloaded Article in Journal – 10

Bacteriology Research Journal Debuts;
CFS Personnel Serve Key Roles – 11

Research on Orange Peels' Impact
Profiled in ARS Magazine – 11

Soybean Board Supports Diabetes-
Focused Research Project - 12

Muthaiyan Taking New Position at
Loyola – 13

Contribute to Johnson Fund - 13

Workshops and Publications – 14

Fall 2011

Vol. 2, No. 4

Center Researchers Examining Beaver Lake Pathogens



Beaver Lake (Photo by U.S. Army Corps of Engineers)

The Center for Food Safety's expertise in pathogenic bacteria and viruses is being called into service to examine their impact on Beaver Lake swim beaches and to identify the sources of fecal pollution in the lake.

Kristen Gibson, a postdoctoral associate in food science, is leading a year-long study with the support of a \$21,000 grant from the Arkansas Water Resources Center, a unit of the UA Division of Agriculture similar to the Center for Food Safety.

The study was prompted by the closure of two swim beaches at Beaver Lake during the summer of 2010 because of the detection of elevated levels of generic *Escherichia coli*. The Prairie Creek beach was closed for 12 days and the War Eagle beach was closed for 22 days.

"Elevated levels of *E. coli* – an indicator of potential human pathogens such as pathogenic bacteria, enteric viruses and protozoan parasites – could be a health risk to those using the lake for recreational purposes," Gibson said. "Fecal contamination can originate from both direct and indirect inputs into Beaver Lake."

(Continued on page 2)

Center for Food Safety

Fall 2011 Vol. 2, No. 4

Center Researchers Examining Beaver Lake Pathogens (Continued from page 1)



Kristen Gibson

The current standard methods for evaluating microbial water quality use generic bacterial indicators such as the levels of total coliform, fecal coliform and *E. coli*. Gibson said these indicators do not provide enough information to determine the source of the fecal contamination. Identification of the source can better direct future mitigation strategies that would seek to prevent future lake closures.

The Center for Food Safety research project has been under way since July 2011. Researchers are collecting water samples twice a month from four of the nine swim beaches at the lake (including War Eagle and Prairie Creek) in collaboration with the Beaver Water District. The plan is to collect large-volume water samples from the lake over all four seasons and develop a microbial population database.

"By doing this, we can provide information to help guide recommendations and policy for protection of the Beaver Lake reservoir from microbial insults which lead to degradation of water quality and swim beach closures," Gibson said. "In addition, by targeting pathogenic microorganisms along with standard bacterial indicators, we will have a better understanding of the actual risk to public health since the presence of bacterial indicators often doesn't correlate with the presence of human pathogens."

AAFP Conference Covers Local, Global Food Supply

A lineup of speakers from around the nation covered a range of topics centering on the theme of "Enhancing the Safety of the Food Supply From Global to Local" during the third annual education conference of the Arkansas Association for Food Protection. The conference, which was held Sept. 13-14, 2011, at Tyson Foods corporate headquarters in Springdale, attracted about 100 participants.

Natalie Dyenson, senior director supplier for food safety at Walmart Stores, led the speakers' lineup with an explanation of the significance of the Global Food Safety Initiative, which was founded several years ago by several European food company executives in a collaborative effort to reduce risks and manage costs.

Center for Food Safety

Fall 2011 Vol. 2, No. 4

Walmart has adopted GFSI standards, which Dyenson said are a perfect fit with the company's business philosophy to reduce risk, audits and costs. She noted that a consumer study conducted by the University of Arkansas Division of Agriculture evaluated GFSI's cost effectiveness based on survey responses from 174 suppliers. The suppliers reported that implementation of GFSI resulted in a more thorough documentation of food safety risk assessment and noted that using GFSI standards improved the safety of their products. Dyenson said Walmart supports a broader acceptance of GFSI standards in industry.



Steven Ricke (left), 2010-11 AAFP president, and Hillary Hagan, 2011-12 president.

The conference opened with a welcome from Mark Cochran, University of Arkansas vice president for agriculture, who quoted studies that indicate the world will need to increase its food supply by 70 percent in coming years. That poses challenges to research faculties at the UA and other institutions that will need to find more funding sources to pursue solutions to those challenges, Cochran said.

The conference included a dinner at Grub's Uptown Bar and Grille in Fayetteville and breakfast and lunch catered by Jason's Deli. Corporate sponsors of the conference were Tyson Foods, SGS, Sunsweet Ingredients and

Safe Foods Corp., all at the gold level; Sensitech at the silver level, and Presto-X, Mocon and Alchemy at the bronze level.

New officers for 2011-12 were installed at the conference. They are:

Hillary Hagan, Tyson Foods, President
Jeri Lynn Pickett, Tyson Foods, President
Brian Umberson, Litmus Rapid B, Vice President
Dave Edmark, University of Arkansas, Secretary
Jennifer Ford, Tyson Foods, Treasurer

AAFP Poster Award Winners Announced

The Arkansas Association for Food Protection conference featured a poster session that included an awards competition. The judges were Karen Beers of Safe Foods Corp., Steve Foley of the National Center for Toxicological Research and Betty Martin of the University of Arkansas. The winners, all from the University of Arkansas food science department, are as follows:

Center for Food Safety

Fall 2011 Vol. 2, No. 4

Award for Food Safety Research Sponsored by SGS: Dinesh Babu, “Are There All-Natural Antimicrobials that are Effective Against *Listeria monocytogenes*.”

Award for Food Safety Research Sponsored by Safe Foods Corp.: Sabelo Masuku, “An Assessment of the Efficiency of Three Cloth Types and One Sanitizer on Hard Surface Areas in a Deli Environment.”

Award for Food Safety Research Sponsored by Sunsweet Ingredients: Nathan Jarvis, “Using Dried Plum Products to Replace Phosphates in Chicken Marinades.”

Certificate of Merit: Kristen Gibson, “Removal and Transfer of Viruses from Stainless Steel and Formica Food Contact Surfaces Using Various Cleaning Cloths.”

Certificate of Merit: Arun Muthaiyan, “Hydrolyzed Casein Macropeptide Conjugated Galactooligosaccharides as Prebiotics to Lactobacillus Strains.”



AAFP Poster Award Winners: Jerri Lynn Pickett, AAFP president-elect, hands poster award certificates to three winners in the competition. They are (top left photo) Sabelo Masuku, (top right photo) Kristen Gibson and (bottom left photo) Nathan Jarvis.

Center for Food Safety

Fall 2011 Vol. 2, No. 4

Center Hosts S-1033 Research Group Meeting



Jeff LeJeune of Ohio State University leads the S-1033 research group discussion during its meeting at the UA.

Food safety researchers in the multistate S-1033 group brought their annual meeting to the University of Arkansas in September for two days where the Center for Food Safety hosted their work. The S-1033 group is a USDA-supported project with collaborators from 19 universities investigating control of foodborne pathogens in pre- and post-harvest environments.

Several participants at the meeting also attended the Arkansas Association for Food Protection annual conference in Springdale that began near the

end of the S-1033 meeting and also delivered presentations there.

S-1033 researchers provided summary reports of their project work on their respective campuses. Steven Ricke, director of the UA Center for Food Safety, reported on the Arkansas efforts that focus on developing an integrated approach to reduce *Salmonella* contamination of natural and organic poultry. Ricke noted that almost no university research has focused on small-scale poultry production systems or their food safety issues. At Arkansas, the Center for Food Safety is comparing natural live production and processing, monitoring foodborne pathogen appearance during production and processing and characterizing strains and serotypes of foodborne pathogen isolates.

"These results and their corresponding profiles will provide us with a better idea where foodborne pathogens are occurring and what factors contribute to their prevalence," Ricke said.

Phil Crandall, UA professor of food science, reported on a project to minimize *Listeria monocytogenes* cross-contamination by in-store deli meat slicers of ready-to-eat meats. Crandall said red food dye was effective in locating potential contamination of meat and fat on the deli food surfaces and that Glo Germ could be used as tool in training deli employees on the ease of spreading contaminants throughout the deli environment.

Center for Food Safety

Fall 2011 Vol. 2, No. 4

A common 100 percent terry cloth towel gave the greatest log reduction of *Listeria* contamination when using Barrier II as the sanitizer.

Others attending the S-1033 meeting were Michael Johnson of the UA, Elliott Ryser of Michigan State University, Cathy Cutter of Pennsylvania State University, Jeyam Subbiah of the University of Nebraska, Matt Taylor of Texas A&M University, Marlene Janes of Louisiana State University, Jeff LeJeune of The Ohio State University, Michelle Danyluk of the University of Florida, Jim Dickson of Iowa State University and Lawrence Goodridge of Colorado State University.

NIFSI Project to Improve Traceability

Researchers at the Center for Food Safety are participating in a federally-supported project to develop a traceability and marketing system for food products that provides a method to limit and remedy food safety outbreaks and biosecurity breaches. The system would be internet based and driven by stakeholders.

Arkansas is participating in a Whole Chain Traceability Consortium with Oklahoma State University, the lead institution; Michigan State University and North Dakota State University. The project is supported by a grant of \$600,000 through the National Integrated Food Safety Initiative (NIFSI) of the U.S. Department of Agriculture.

The Arkansas investigators in the project are Steven Ricke, director of the Center for Food Safety, and Philip Crandall, professor of food science. They will work directly with retailers and beef processors to identify appropriate stakeholders and will then gather information about the traceability system to share.

Product traceability systems have traditionally been burdened with disadvantages such as delays and lack of privacy. Recent research has suggested that whole-chain traceability can limit the economic loss of food safety outbreaks.

The NIFSI project aims to create a system that will enable producers and other stakeholders to control privacy in accessing data. Tracing food through a supply chain usually depends on the sharing of product information with competitors, so assurance of privacy controls would be essential to encourage participation.

"A stakeholder-driven and trusted system allows forward thinking industries a means of rapidly communicating with regulatory agencies and consumers," the consortium's proposal said. "From a traceability standpoint, the goal is to provide the necessary information needed to prove a company's or industry's products are safe in a rapid manner that will ultimately save market share and maintain consumer confidence in these products."

Center for Food Safety

Fall 2011 Vol. 2, No. 4

Pasture Poultry Production Target of Study

The Center for Food Safety is participating in a grant project that will determine the food safety risk of small on-farm poultry processing systems – known as pasture poultry production – and evaluate other aspects of their operations.



Steven Ricke (left), director of the UA Center for Food Safety, meets with Walid Alali, director of the University of Georgia Center for Food Safety. Alali is principal investigator for the pasture poultry production study, in which Arkansas is a cooperating institution.

Pasture poultry farms produce an average of 1,500 broiler birds a year and raise chickens in open-air moveable pens or in free-range environments. The birds are raised without growth promotion or therapeutic antimicrobials and are fed an organic diet certified by the U.S. Department of Agriculture.

The \$272,684 project is funded by the federally-supported Sustainable Agriculture Research and Education (SARE) agency. The University of Georgia is the lead institution for the two-year project. The University of Arkansas Division of Agriculture is serving as a cooperating institution focused on the food safety and

environmental components of the project. UA personnel working on the project are principal investigators Steven Ricke, director of the Center for Food Safety; Phillip Crandall, professor of food science, and Kristen Gibson, postdoctoral associate in food science. Other project participants from the UA are Casey Owens, associate professor of poultry science; Ellen Van Loo, former graduate student in food science; Andrew Sharpley, professor of soils and water quality, and Jessica Shabatura, an educational technology instructional design in agriculture specialist.

Producers use mobile processing units at small farms where birds are processed on site. Birds processed in this manner are exempt from USDA inspection requirements and do not receive USDA Inspected status. The lack of inspection status usually limits these farms' poultry sales to household consumers and only a few food service market venues. The

Center for Food Safety

Fall 2011 Vol. 2, No. 4

USDA Food Safety and Inspection Service makes available a compliance guidebook to small-farm processors who seek USDA inspection approval.

The SARE project seeks to determine the food safety risks associated with mobile processing units as compared to the risks at small USDA facilities. It also intends to assess the environmental impact of mobile processing units' waste disposal compared to the impact from other types of processing. The project will also assess the economic feasibility of pasture poultry production using the mobile processing units contrasted with other types of processing. Consumers' willingness to pay for pasture poultry products will also be evaluated.

The project partly has its origins at a symposium for the 2008 Poultry Science Association annual meeting that was organized by Ricke and Frank Jones, who was then a poultry extension specialist in the UA Division of Agriculture. The symposium, "Current and Future Prospects for Natural and Organic Poultry," led to a follow-up conference in Berryville, Ark., in 2009 where Ricke and Jones led a discussion among Northwest Arkansas pasture flock poultry farmers on issues such as the shortage of available local poultry processing facilities and the need for comprehensive outreach information.

Impact of *Salmonella* Influenced by Its Virulence



Steven Ricke, director of the UA Center for Food Safety, discusses Salmonella during a seminar at the Department of Food Science.

Salmonella, known among the public for its role as a foodborne pathogen at the root of recent outbreaks, actually varies in its level of virulence that determines whether it will make someone sick. Its virulence level isn't always potent enough to cause disease except when the genes go into "warrior mode," said Steven Ricke during a Department of Food Science seminar on Oct. 3.

Ricke, director of the UA Center for Food Safety, explained that hosts try to

Center for Food Safety

Fall 2011 Vol. 2, No. 4

hold onto iron as a way to resist pathogens, but *Salmonella* can frequently overcome that and increase their virulence. Multiple factors in the gastrointestinal tract influence the behavior of *Salmonella*, which is adaptable to the situation. It can enter the human system as a non-pathogen and can then increase its virulence to a pathogenic level.

Seeking to effectively fight *Salmonella*, researchers realized by the middle of the past decade that they needed more genome information. That task was accomplished for some *Salmonella* serotypes, Ricke said, but the result was that scientists now have at their disposal an "overwhelming" amount of information to study and potentially more on the way.

"To use the genomic tool kit, you need well-formed questions ahead of time and you need to know what you're looking for," Ricke said.

Ricke said the industry should prioritize what levels of risk are acceptable and produce better models for applying the genomics of *Salmonella*. It is also necessary to design environmentally friendly feed and food additives and to combine those efforts with cost-control measures.

Food safety professionals must consider what are the limits of food safety to determine what is the public willing to pay for what acceptable level of risk and what can the industry deliver in response, Ricke said, adding that risk assessment is only as good as the data that it uses.

Arkansas Research Alliance Reviews Food Safety Efforts

Several UA Division of Agriculture personnel participated in the Food Processing and Safety track during a recent Arkansas Research Alliance conference. The ARA, a nonprofit



The Winthrop Rockefeller Institute at Petit Jean Mountain near Morrilton, Ark., site of the Arkansas Research Alliance conference.

economic development organization, has been holding a series of research conferences that bring together academic, government and business leaders in topic-specific tracks to review areas of mutual interest and potential collaboration.

Jean-Francois Meullenet, head of the UA Department of Food Science, served as chair of the Food Processing and Safety track for the Oct. 23-25 conference held at the Winthrop Rockefeller Institute at Petit Jean Mountain. Other participants from the Division of Agriculture were Steven Ricke, director of the Center

Center for Food Safety

Fall 2011 Vol. 2, No. 4

for

Food Safety; Phil Crandall, professor of food science; Fred Pohlman, professor of animal science; Billy Hargis, director of the Poultry Health Lab, and David Edmark, Agricultural Communication Services project director.

The track's final report to the conference noted that food safety research and innovation is still a key component that includes the need to increase the tools in the toolbox. Additional communication and collaboration is the key to more interaction among research institutions, federal agencies, state agencies and industry. With funding sources potentially decreasing, all parties need to align their interests, the report said.

The track participants reviewed emerging technologies produced through the Division of Agriculture, the Food and Drug Administration's National Center for Toxicological Research in southeast Arkansas, the Arkansas-based offices of the USDA Agricultural Research Service and the University of Arkansas for Medical Sciences.

Looking toward goals for the future, the track developed the first draft of a potential mission statement for a food safety alliance: "To improve food safety with increased sustainable research that generates fruitful projects, innovative ideas and transferable and commercially viable technology that develops more jobs and wealth to benefit the citizens of Arkansas."

Center Personnel Co-Authors of Most Downloaded Article in Journal

Three Center for Food Safety personnel served as co-authors of an article that was reported in October to be among the most downloaded articles on the *Journal of Food Science Education* website. The article, "Development of an Evaluation Tool for Online Food Safety Training Programs," appeared in the January 2011 edition of the journal and is online at <http://onlinelibrary.wiley.com/doi/10.1111/j.1541-4329.2010.00112.x/abstract>.

The co-authors from the Center are Phillip Crandall, professor of food science; Corliss O'Bryan, postdoctoral associate in food science, and Steven Ricke, director of the Center. The lead author is Jack A. Neal of the University of Houston Conrad N. Hilton College of Hotel and Restaurant Management. Other co-authors are Cheryl A. Murphy and Elizabeth Keifer, both of the UA College of Education and Health Professions Department of Curriculum and Instruction.

The objective of the study, according to the article's abstract, "was to provide the person in charge and food safety instructors an assessment tool to help characterize, identify strengths and weaknesses, determine the completeness of the knowledge gained by the employee, and evaluate the level of content presentation and usability of current retail food safety training platforms."

Center for Food Safety

Fall 2011 Vol. 2, No. 4

Bacteriology Research Journal Debuts; CFS Personnel Serve Key Roles



Cover of the print version of the new Agriculture, Food and Analytical Bacteriology journal.

Personnel from the UA Center for Food Safety are serving in key editorial positions for the new *Agriculture, Food and Analytical Bacteriology* journal. The journal, available in print and online, is a peer-reviewed scientific forum for the latest advancements in bacteriology research on a wide range of topics including food safety, food microbiology, gut microbiology, biofuels, bioremediation, environmental microbiology, fermentation, probiotics, and veterinary microbiology.

Steven Ricke, director of the Center for Food Safety, is editor-in-chief of the journal. Phillip Crandall, professor of food science, is an editor. Ellen J. Van Loo, a former graduate student in food science, is managing editor. Members of the editorial board include Michael Johnson, professor emeritus of food science, and Young Min Kwon, associate professor of poultry science.

The online edition and information about ordering print editions and submitting manuscripts are available at <http://afabjournal.com>. The first issue of Volume 1 was released in March 2011. It is the journal's intent to publish quarterly and to make available all its articles openly accessible on the website.

Research on Orange Peels' Impact Profiled in ARS Magazine

A collaborative research project exploring the impact of orange peels on reducing *Salmonella* in cattle was profiled in the November-December edition of *Agricultural Research*, a magazine published by the Agricultural Research Service of the U.S. Department of Agriculture. Steven Ricke, director of the UA Center of Food Safety, and Phil Crandall, professor of food science, are credited in the article for their collaborations with ARS personnel in identifying specific essential oils inside orange peels and pulp that kill pathogenic bacteria.

The article, "Cleaning Cows From Inside Out," is online in HTML format at <http://ars.usda.gov/is/AR/archive/nov11/cows1111.htm> and in PDF format at <http://ars.usda.gov/is/AR/archive/nov11/cows1111.pdf>.

Center for Food Safety

Fall 2011 Vol. 2, No. 4

The article explains a research project led by Todd Callaway, an ARS microbiologist at the USDA Food and Feed Safety Research Unit in College Station, Texas. Research by the group that included the UA personnel has shown that orange peel and pulp, when added to laboratory ruminal fluid fermentations, reduced *E. coli* O157:H7 and *Salmonella* Typhimurium,

Callaway will lead additional field trials of citrus byproducts in collaboration with researchers at the UA, ARS and the University of Florida. A research paper on their work, "Orange Peel Products Can Reduce *Salmonella* Populations in Ruminants," was published this year in Vol. 8, Number 10, of *Foodborne Pathogens and Disease* journal.

Soybean Board Supports Diabetes-Focused Research Project

A research team at the UA Center for Food Safety is leading a project aimed at producing a marketable food ingredient from soy that can help prevent chronic diseases such as Type 2 diabetes. The project, with funding support from the Arkansas Soybean Promotion Board, is led by Sun-Ok Lee, assistant professor of food science; Phil Crandall, professor of food science, and Steven Ricke, Center director. Tim Bowser and William McGlynn of Oklahoma State University are cooperating investigators.

The research will characterize the potential benefit of soy functional fibers on pure cultures of *Lactobacillus* and *Bifidobacteria* beneficial gut bacteria and the total microbial flora of human fecal bacteria. Consuming fibers in meals has been shown to decrease risk from Type 2 diabetes following consumption of foods such as bread, potatoes and others that are classified with high numbers in the Glycemic Index.

The results are expected to provide needed information on the interaction between soy fibers and healthy gut-promoting bacteria as well as their physiological influence on microbial composition in human fecal *in vitro* cultures. Tests will determine how individual gut bacteria metabolize the soluble and insoluble fibers.

The project's objectives include manufacturing of four prebiotic fibers from soybeans' carbohydrate components and documenting the fibers' functional characteristics. The fibers' ability to function as prebiotic and to promote pure cultures of healthy bacteria in the gut will be tested. Prebiotic fibers will be obtained from human subjects to determine their fermentation patterns.

Center for Food Safety

Fall 2011 Vol. 2, No. 4

Muthaiyan Taking New Position at Loyola



Arunachalam Muthaiyan

Arunachalam Muthaiyan, who has been a postdoctoral associate at the UA Center for Food Safety since 2007, is leaving to take a new position in December as a research associate at the Loyola University Stritch School of Medicine in Chicago.

Muthaiyan, who came to Arkansas from a postdoctoral associate's position at Illinois State University, said that at Loyola he would be responsible for a specific focus and for developing novel methods in bacterial spore decontamination. He will analyze sporicidal chemistries on spore function and survival using molecular and biochemical analyses.

It will be different from the work he has done at Arkansas, which has positioned him in a wide variety of food safety research issues. He has worked extensively on the impact of orange essential oils against *Staphylococcus* and has collaborated with students and Center personnel on *Salmonella* and *Listeria* projects. Muthaiyan trained and supervised eight students and two postdoctoral associates and published 13 articles, one book chapter and 17 abstracts. He also served as a principal investigator or co-principal investigator for three funded grants and contributed on eight successful proposals to obtain a total of \$480,000 in grants from several agencies.

Muthaiyan also developed standardized protocol for transcriptomic studies to use in various food safety-related research projects that helped develop successful international research collaborations from Spain. He obtained \$150,000 worth of microarrays as research support material from the J. Craig Venter Institute to establish genomic research at the Center for Food Safety.

Contribute to the Michael G. Johnson Endowed Fund in Food Science

The Arkansas Association for Food Protection has established the Michael G. Johnson Endowed Fund in Food Science at the University of Arkansas in honor of Dr. Michael G. Johnson, emeritus professor of food science. Johnson, who retired in 2009, joined the food science faculty in 1984. He served as research coordinator for the Arkansas component of the Food Safety Consortium.

When establishment of the scholarship was announced at an AAFP meeting, Johnson was honored by testimonials from colleagues and former graduate students. In his remarks to the audience, Johnson said mentors should direct their time to people who are working their

Center for Food Safety

Fall 2011 Vol. 2, No. 4

way up. This “spirit of investing” prepares the next generation of researchers to pass their skills along to future students, he said. He advised researchers to be proactive in food protection issues and to “take what works for you and pass it on.”

Donors may give to fund online by following these steps:



1. Go to the UA Office of Development online donor site at <https://payments.bankofamerica.com/otp/StartAction.do?UAR> and enter your phone number.

2. Complete the online donation form. At the drop-down menu for "Designate Gift 1," select the line for "Other--type in description below."

3. At the line for "Other Specific Department or Program," type in "Michael Johnson Endowed Fund in Food Science."

4. At the line for "Is this an honor/memorial gift?" select "Honor."

5. At the line for "Honor/Memorial Designee," type in "Michael Johnson."

6. Leave blank the line for "Designee Address (for notification purposes)." The UA Office of Development will notify Dr. Johnson of donations to the fund.

7. Proceed with the credit card donation procedures.

To discuss major contributions, contact Blake Bard, director of development for the UA Dale Bumpers College of Agricultural, Food and Life Sciences, at bsbard@uark.edu or 479-575-2270.

Workshops at the UA Institute of Food Science and Engineering

Sensory Evaluation of Foods – This workshop will be held June 2012. For details and registration information, see

http://www.uark.edu/ua/foodpro/Workshops/Sensory_Evaluation_Workshop.html

Center for Food Safety

Fall 2011 Vol. 2, No. 4

CFS Publications and Presentations

Publications

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Center for Food Safety

Fall 2011 Vol. 2, No. 4

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Center for Food Safety

Fall 2011 Vol. 2, No. 4

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Center for Food Safety

Fall 2011 Vol. 2, No. 4

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Center for Food Safety

Fall 2011 Vol. 2, No. 4

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Center for Food Safety

Fall 2011 Vol. 2, No. 4

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