DIVISION OF AGRICULTURE
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Kwon Expands Pursuit of *Salmonella* Research

Young Min Kwon

It was in a lab at Texas A&M University where Young Min Kwon, then a doctoral student in poultry science under Professor Steven Ricke, that Kwon began looking in depth at *Salmonella*, which was Ricke's major research interest. After graduating from Texas A&M, he remained in College Station to work for the U.S. Department of Agriculture Agricultural Research Service as a postdoctoral associate on *Salmonella* projects covering preharvest control. Kwon then came to the University of Arkansas in 2002 to join the poultry science faculty, where today he serves as an associate professor.

Ricke joined the UA faculty in 2005 as director of the Center for Food Safety, in which Kwon is also a faculty researcher. At Arkansas, Kwon has continued working on *Salmonella*.

"That has remained as a focus of my research since I came here," Kwon said. "I had an interest in the genetics and genomics of *Salmonella*, so I added those components to my research program. I'm doing the same focus but I'm doing research on *Salmonella* using different approaches."

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Kwon Expands Pursuit of *Salmonella* Research

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Kwon, who also earned bachelor's and master's degrees in animal science from Seoul National University in South Korea, pursued *Salmonella* research for several years under grants from the tri-state Food Safety Consortium funded through a USDA grant. Since that grant ended, he has obtained support from the Arkansas Biosciences Institute, the National Institutes of Health and private companies.

Kwon also serves as an adjunct faculty member in the university's multidisciplinary Cell and Molecular Biology Program. In that capacity his *Salmonella* research and his teaching uses molecular microbiology, genomics and bioinformatics approaches.

"I created the new graduate course on molecular analysis of foodborne pathogens," Kwon said. "I wanted to give the students updated information in terms of molecular analysis technologies that can be applicable to the study of foodborne pathogens and food safety applications."

Kwon explained that the molecular analysis techniques were developed from a medical perspective and applied to the study of bacterial pathogens. "I see those same things can be used to study bacterial pathogens from a food safety perspective. I want to help the students get the benefit of those technologies available," he said.

In his 10 years at the UA, Kwon has been working on different aspects of *Salmonella* and is looking ahead to other ways to explore the pathogen. One area is the development of a vaccine for poultry that would use *Salmonella* as a vehicle to deliver foreign antigens of infectious agents. His other area, *Salmonella* functional genomics, is more basic research but also has practical implications for food safety.

"The genome sequence has been determined for a lot of isolates, so we have lots of information about genes and gene sequence in *Salmonella*," Kwon said. "We are behind in understanding the function of each gene. There are many genes that should be important in a food safety perspective because they have the ability to survive the animals and the food processing before they come to the customer. Once we have an understanding of how *Salmonella* can survive in different stressful conditions in poultry products, we will have a better idea of how to develop an effective strategy for how to control them."

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Center for Food Safety, Vivione Biosciences Expand Collaboration

Representatives of the UA Center for Food Safety and Vivione Biosciences met recently in Fayetteville to discuss plans for continued collaboration between the two entities. Present at the meeting were (from left) Steven Ricke, Center for Food Safety director; Briam Umberson, Vivione Biosciences director of business development; Kevin Kuykendall, Vivione Biosciences chief executive officer; Steve Roon, Vivione Biosciences senior vice president for sale and marketing; and Philip Crandall, Center for Food Safety professor.

Leadership of Vivione Biosciences LLC and the University of Arkansas System Division of Agriculture Center for Food Safety met recently in Fayetteville to expand the scope of their collaboration and to implement third-party confirmation of the RAPID-B™ system's test for *Salmonella*. The Center for Food Safety in Fayetteville with Vivione Biosciences LLC, a Little Rock-based biotechnology company with extensive laboratory facilities at the Pine Bluff Arsenal, announced last year that they had agreed to a public-private collaboration to develop research into food contamination issues, particularly from *Salmonella ,Listeria, Campylobacter* and *E. coli.*

Vivione placed its RAPID-B™ system at the Center for Food Safety's research facilities in Fayetteville, where the equipment is used to pinpoint specific bacteria faster and more accurately than other current methods. Dr. Steven Ricke, director of the Center for Food Safety, noted that the RAPID-B™ system augments university facilities that serve as a service center for industries seeking to conduct trials of their procedures for rapid testing of pathogenic bacteria.

"The collaboration with the University of Arkansas has given us access to world class food processing knowledge and resources," said Vivione Biosciences CEO Kevin Kuykendall. "The availability of the 10,000-square-foot pilot processing plant provides us with unique access for live processing trials and other "real world" product development activities. The university's diverse expertise in protein, processed foods, row crops, fruit and produce offers us diverse product development opportunities." Kuykendall added, "It is refreshing how

the Center for Food Safety has an existing relationship between the growers, processors, retailers and distribution networks, which has made the Center a proactive partner with all of us in making our food safer."

The Center for Food Safety recently expanded its regular industry workshops in microbiology to include six seats in the class reserved for Vivione invitees to include demonstrations of the RAPID-B™ equipment and systems. The sessions also covered elements of market research that probed industry leaders' views on rapid detection methods. The regular workshops are offered by the Center for Food Safety for food industry personnel and attract people from around the nation seeking current information in laboratory procedures.

"The workshops were very well received," Kuykendall said. "Processors in today's market need training for their employees and exposure to new technologies. We're giving industry personnel hands-on access to equipment."

Vivione and the Center for Food Safety will seek to confirm that the company's *Salmonella* environmental tests produce pathogen control results with enumeration of pathogens within 15 minutes. Full validation of the salmonella test is to follow soon after performance confirmation. Following the current emphasis on confirming and validating the salmonella test, the partners plan to concentrate on market research and further development of the RAPID-B™ system.

Links:
http://www.vivionebiosciences.com/

Vivione Biosciences to Take Over Lab Space at Pine Bluff Arsenal
http://www.arkansasbusiness.com/article.aspx?aID=131329.54928.143474&view=all

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Orange Oil Shows Impact Against Pathogens at Refrigeration Temperatures

Beef products are chilled after processors perform steps designed to reduce their vulnerability to contamination from *E. coli* O157:H7, but they still need to beware of potential contamination during the chilling that occurs from the plant to the store to the home refrigerator. That's when it's time to bring in the orange oils.

The orange essential oil known as cold processed terpenless Valencia orange oil (CPTVO) can do the job of inhibiting *E. coli* O157:H7 at refrigeration temperatures, according to research from UA Center for Food Safety personnel published recently in the *Journal of Food Science*. Authors Sean Pendleton, Philip Crandall, Steven Ricke and Corliss O'Bryan of the center collaborated with Lawrence Goodridge of the Colorado State University animal science department faculty in the project, which was supported by a grant from the National Cattlemen's Beef Association.

"Despite the food safety advances made in beef production, it is clear that meat products continue to become contaminated with *E. coli* O157:H7 and *Salmonella*," Goodridge said. "Newer interventions should be developed that could be employed as additional hurdles to support the current Hazard Analysis and Critical Control systems. The verification of antimicrobials that are effective at chilling temperatures would be particularly useful, since these antimicrobials could be used to decrease the concentrations of *E. coli* O157 and *Salmonella* on beef carcasses immediately before fabrication."

Prior to this research, there were no antimicrobial agents designed to specifically reduce foodborne pathogenic bacteria during storage or fabrication at low temperatures. The researchers turned to essential oils, which have been used for centuries as pharmaceuticals and later fragrances and flavors. Essential oils were found in the late 19th century to have antimicrobial properties. Last year, the research team explored the effects of CPTVO on *E. coli* O157:H7 and *Salmonella* on beef at 4 degrees Celsius, the temperature for beef chilling, and concluded that the oil could be used as an intervention against the pathogens at that temperature.

The researchers expanded their work to determine the effects of temperature abuse on the oils' ability to inhibit *E. coli* O157:H7. They found that a solution of 1 percent CPTVO can inhibit the pathogen at refrigeration temperatures and will remain effective if the beef carcasses experience temperature abuse up to 37 degrees Celsius.

Other factors remain to be learned, however, before essential oils can be routinely used in foods to control bacterial growth, the research team said. Scientists still need to determine

how the oils' compounds interact with various physical and chemical components of food and how those interactions affect the oils' ability to decrease the pathogens' presence.

Gibson Joins Food Science Faculty

Kristen Gibson

Kristen Gibson, who joined the Center for Food Safety two years ago as a postdoctoral fellow with Drs. Steven Ricke and Phil Crandall, has moved to the faculty as an assistant professor of food science in molecular food safety microbiology. Gibson said she hopes to incorporate an emphasis on the public health and environmental aspects of food safety into a research program.

Gibson's workload will be 75 percent research, 15 percent teaching and 10 percent service. Her teaching duties will begin after her first year on the faculty although she will continue as
a guest lecturer in food microbiology classes. Her teaching plans include development of a graduate course in molecular biology with regard to food safety including viral and foodborne disease issues.

She holds a doctoral degree in environmental health sciences from the Johns Hopkins University Bloomberg School of Public Health and a bachelor's degree in microbiology and molecular biology from the University of Central Florida.

"My overall goal as both a public health and food safety researcher is to increase awareness of the complex issues surrounding our food systems," Gibson said. "I seek to contribute to the scientific knowledge critical to the development of better-informed public policies and to highlight the need to reduce and eliminate unsustainable patterns within our food production systems through the advancement of technology and scientific understanding."

Her research at the Center for Food safety has included an emphasis on the detection of foodborne viruses and viral surrogates in food and water. She has also been conducting research on the environmental impact and food safety aspects of on-farm poultry processing as compared to mobile processing units. She has participated in a project to integrate systems-based thinking skills into veterinary science education and an effort to isolate *Campylobacter*-specific bacteriophage from pastured poultry.

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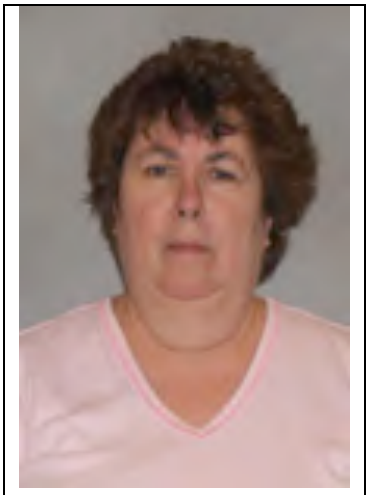
O'Bryan Named UA Employee of the Fourth Quarter



Corliss O'Bryan

Corliss O'Bryan, a postdoctoral associate in the Center for Food Safety, has been named the University of Arkansas Employee of the Fourth Quarter in the professional/non-faculty-administrative category. Employees of the Quarter represent staff who have gone above and beyond their normal job duties. Each quarter, five outstanding UA employees are selected for the award from nominations received from UA staff or faculty.

O'Bryan was nominated by professors Steven Ricke and Phil Crandall. "Corliss' responsibilities over the past 10 years have continued to expand and now including planning and conducting food safety research that will help minimize the risk of foodborne illness to consumers," Crandall wrote in his nomination form. "However, her passion for what she does and how she does it is exemplary! Dr. O'Bryan is appreciated for the pivotal role she plays in the food safety research and teaching program as well as the broader responsibilities Dr. O'Bryan shoulders for our overall food science research and teaching programs. I particularly appreciate her loyalty, which is among the best that I have known in my more than 30 years of academic research."

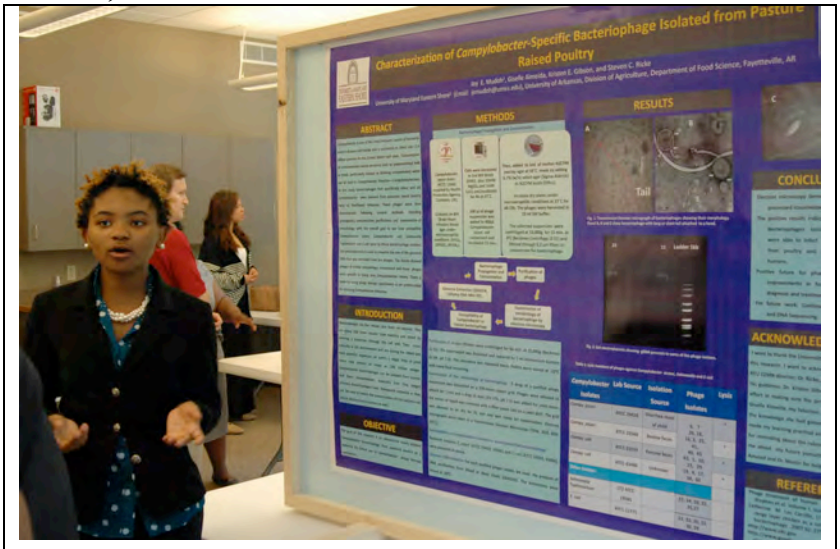
O'Bryan received a certificate and monetary award from the UA Staff Senate and is placed in the pool of candidates considered for the Employee of the Year award.

Maryland Student's Poster From Center for Food Safety Wins Top Award

Joy Mudoh, who was mentored by Center for Food Safety director Steven Ricke in a 10-week summer program in cell and molecular biology at the University of Arkansas, won first place in a poster competition among 10 undergraduate students from several states.

Mudoh, who will be a junior biology major this fall at the University of Maryland-Eastern Shore, won the award as a participant in this summer's Research Experiences for Undergraduates (REU), sponsored by the National Science Foundation through the UA Program in Cell and Molecular Biology. The summer program allows undergraduate majors, who will be juniors or seniors in the fall, to carry out research with a faculty member in the general area of applied biotechnology.

Mudoh's poster was titled "Characterization of *Campylobacter*-Specific Bacteriophage Isolated From Pasture Raised Poultry." She was the poster project's lead author with Giselle Almeida, a food science department research staffer; Kristen Gibson, assistant professor of food science, and Ricke.



Joy Mudoh explains her poster at the Research Experiences for Undergraduates competition.

"This is an important research topic for our group in both understanding the ecology of *Campylobacter* phage and how it might influence the prevalence of the foodborne pathogen *Campylobacter,*" Ricke said.

"I am truly blessed to have gotten a chance to participate in the REU program in Arkansas," Mudoh said. "I had such an amazing time learning the practical side of my major. My mentors were amazing especially Giselle; she is God sent. I also met awesome friends like Mariam, Indira, Dieudone (DJ), Errand, Joey, and others who made my home away from home comfortable, joyous and filled with laughter. I thank my parents for instilling education into my blood and for God's abundant grace."

"The University of Arkansas is fortunate to have a large group of highly qualified faculty that are willing to invest their time and laboratory facilities in programs such as the Cell and Molecular Biology NSF Research Experience for Undergraduates," said Douglas Rhoads, the UA professor of biological sciences who directed the summer program. "We are in our second year of this program and Dr. Ricke has participated both years. For both years, the undergraduates have produced wonderful results, and have raved about the experiences and education they have received working in Dr. Ricke's group. These programs are integral in transforming the University of Arkansas graduate programs into a highly diverse and culturally rich environment. We are grateful to Dr. Ricke for his commitment to this worthy effort. Joy Mudoh is a fine example of the transformative powers of these summer programs at the university."

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Former UA CFS Postdoc Milillo Joins Penn State Food Science Faculty

Sara Milillo

Sara Milillo, formerly a postdoctoral associate at the UA Center for Food Safety with director Steven Ricke, has accepted a faculty position as an instructor in food science at Pennsylvania State University. During the fall semester Milillo will be co-teaching Food, Facts and Fads with Bob Steele and Introduction to Food Science Practicum with Greg Ziegler. In addition, she will be working on a number of other student-related activities.

Millio's work at the UA was supported by a two-year National Research Initiative postdoctoral fellowship grant from the U.S. Department of Agriculture for research looking at new ways to reduce *Salmonella* contamination of poultry.

Millilio's new position at Penn State also has responsibilities as a student services coordinator in which she leads departmental recruiting efforts and serves as the central point of contact for current and prospective undergraduate students. She also serves as the primary student advisor for first- and second-year food science majors and serves as the primary advisor to student activities such as the Food Science Club and Product Development Team.

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 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."

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Donors may give to fund online by following these steps:

Michael G. Johnson

1. Go to the UA Office of Development online donor site at **https://onlinegiving.uark.edu**

2. Complete the online donation form. At the drop-down menu for "About My Gift," select the line for "Other Department or Program."

3. In the box for "Other Department or Program," type in "Michael Johnson Endowed Fund in Food Science." Type your donation in the "Gift Amount" box.

4. After completing the information in the "About Me," "About My Spouse" and "About My Employer" categories, go to the "For Memorial/Honorary Gift" category. Under the choice of "This gift is being made:" select "In honor of" and type "Michael Johnson" on the box.

5. Leave blank the line for "Who should we notify of this gift?" The UA Office of Development will notify Dr. Johnson of donations to the fund.

6. Proceed with the credit card donation procedures.

To discuss major contributions, contact Trina Holman at the UA Dale Bumpers College of Agricultural, Food and Life Sciences, at tfholman@uark.edu or 479-575-2179.

Workshops at the UA Institute of Food Science and Engineering

Microbiological Laboratory Logistics and Fundamentals - This workshop will be held on several dates (August 14-16, September 11-13 and October 9-11, 2012). See http://www.uark.edu/ua/foodpro/Workshops/Micro_Lab.html

Better Process Control School – There will be a regular Better Process Control School at Oklahoma State University June 12-14, 2013 in Stillwater. Contact William McGlynn for details. (william.mcglynn@okstate.edu).

University of Arkansas – This 3.5-day workshop will be held the first week of November (Nov. 6-9, 2012) at the UA. For more information and registration form, go to http://www.uark.edu/depts/ifse/bpcsrev1.html

Food Protection Workshop - This workshop will be held in June 2013 in Fayetteville. It

involves both Food Safety and Food Defense. For more details and registration, go to http://www.uark.edu/ua/foodpro/Workshops/Food_Safety_Defense_Workshop.html

The UA Center of Excellence for Poultry Science
CONTACT - Dr. John Marcy – Extension Food Scientist jmarcy@uark.edu

Culinary Arts for Food Technologists Series - The U of A CEPS offers a series of three 40-hour culinary arts classes in conjunction with the Research Chefs Association to fulfill the 120-hour requirement for Certified Culinary Scientist. Each year we offer Culinary Arts Fundamentals, Advanced Culinary Arts and Baking Arts Fundamentals. Registration is through the U of A CEPS at http://www.uark.edu/ua/culinary/

Advanced HACCP - The U of A CEPS offers this program geared toward meat and poultry operations dealing with FSIS HACCP regulations in cooperation with Bob Galbraith of the HACCP Consulting Group. The Fall 2012 dates have not been set.

CFS Publications and Presentations

Publications

Pinder, R.S., Patterson, J.A., O'Bryan, C.A., Crandall, P.G., Ricke, S.C. 2012. Dietary fiber content influences soluble carbohydrate levels in ruminal fluids. J Environ Sci Health Part B 47: 710-717.

Crandall, P.G., Ricke, S.C., O'Bryan, C.A., Parrish, N.M. 2012. *In vitro* effects of citrus oils against *Mycobacterium tuberculosis* and non-tuberculous *Mycobacteria* of clinical importance. J Environ Sci Health Part B 47: 736-741.

Jarvis, N., Clement, A.R., O'Bryan, C.A., Babu, D, Crandall, P.G., Owens, C.M., Meullenet J-F, Ricke, S.C. 2012. Dried plum products as a substitute for phosphate in chicken marinade. J Food Sci 77: S253-S257.

Pendleton, S.J., Crandall, P.G., Ricke, S.C., Goodridge, L., O'Bryan, C.A. 2012. Inhibition of *Escherichia coli* O157:H7 isolated from beef by cold pressed terpeneless Valencia orange oil at various temperatures. J Food Sci. 77: M308-M311.

Božic, A.K., Anderson, R.C., Ricke, S.C., Crandall, P.G., O'Bryan, C.A. 2012. Comparison of nitroethane, 2-nitro-1-propanol, lauric acid, Lauricidin® and the Hawaiian marine algae, *Chaetoceros*, for potential broad-spectrum control of anaerobically grown lactic acid bacteria. J Env Sci Health Part B 47: 269-274.

Milillo, S.R., Friedly, E.C., Saldivar, J.C., Muthaiyan, A., O'Bryan, C.A., Crandall, P.G., Johnson, M.G., Ricke, S.C. A review of the ecology, genomics and stress response of *Listeria innocua* and *Listeria monocytogenes*. Crit Rev Food Sci Nutr 52: 712-725.

Van Loo, E., Babu,. D., Crandall P., Ricke, S. 2012. Screening of commercial and pecan shell–extracted liquid smoke agents as natural antimicrobials against foodborne pathogens. J Food Prot 75: 1148-1152.

Khatiwara, A., T. Jiang, S.-S. Sung, T. Dawoud, J.N. Kim, D. Bhattacharya, H.-B. Kim, S.C. Ricke, and Y.M. Kwon. 2012. Genome scanning for conditionally essential genes in *Salmonella*. Appl. Environ. Microbiol. 78: 3098-3107.

Van Loo, E.J., S.C. Ricke, C.A. O'Bryan, and M.G. Johnson. 2012. Chapter 24. The future of organic meats. In: S.C. Ricke, E.J. Van Loo, M.G. Johnson and C.A. O'Bryan (Eds.), Organic Meat Production and Processing. Wiley Scientific/IFT, New York, NY pp. 425-430.

Presentations

Babu, D., Crandall, P.G., Hurd, S., Brown, L., Martin, E., Pelkki, M., Carrier, D.J. The extraction of high value phytochemicals in the context of a biorefinery: Sweet gum as a possibility. Presentation at Bio-refinery conference, Spring 2012. Copenhagen, Denmark.

Gibson, K., Koo, O., O'Bryan, C.A., Ricke, S., Crandall, P.G. Observational assessment and relative quantification of cross-contamination within a mock retail deli environment. Presentation at IFT Annual Meeting, Las Vegas, NV, June 26-28, 2012.

Koo, O.K., Mertz, A.W, Sirsat, S.A., Neal, J.A., Ricke, S.C., Crandall, P.G. Microbial ecology of deli meat slicers. Presentation at IFT Annual Meeting, Las Vegas, NV, June 26-28, 2012.

Masuku, S.M., Babu, D., Martin, E.M., Koo, O.K., O'Bryan, C.A., Crandall, P.G., Ricke, S.C. Decontamination efficacy of blended cellulose/cotton cloths and silver dihydrogen citrate on food contact surfaces. Presentation at IFT Annual Meeting, Las Vegas, NV, June 26-28, 2012.

Jarvis, N., O'Bryan, C.A., Babu, D., Crandall1, P.G., Owens, C.M., Ricke, S.C. Dried plum products' effects on water holding capacity in marinated chicken breast fillets compared to phosphate. Presentation at IFT Annual Meeting, Las Vegas, NV, June 26-28, 2012.

Davis, M.L., P.G. Crandall, C.A. O'Bryan, and S.C. Ricke, 2012. Processing locally grown poultry and livestock in a safe and affordable manner. Conference on Research and Regulatory Aspects of Food Safety at the FDA's Jefferson Laboratories, National Center for Toxicological Research and Arkansas Regional Laboratory, Jefferson, AR, Apr. 11, 2012.

Ricke S.C. "Food Industry Perceptions on Rapid Detection Methods" Vivione Biosciences, Dept. of Food Science, University of Arkansas, Fayetteville, AR, June 14, 2012.

Ricke S.C. "Overview of UA Center for Food Safety Research Program" Albemarle Corporation, 451 Florida Street, Baton Rouge, LA, June 18, 2012.

Ricke S.C. "Development of Novel Strategies for Controlling *Salmonella* in Poultry Production", Keynote Symposium – Tomorrow's Poultry: Sustainability and Safety, Poultry Science Association Annual Meeting, Athens, GA, July 9, 2012.

Ricke S.C. "Application of Genomics and Metabolite Analysis to Assess Gastrointestinal Ecology in Alternative Poultry Production Systems", Symposium - Next Generation Sequencing Tools: Applications for Food Safety and Poultry Production, Poultry Science Association Annual Meeting, Athens, GA, July 10, 2012.

Ricke S.C "Antimicrobials for *Salmonella* in Dog Food", Anitox, Lawrenceville, GA, July 11, 2012.

Ricke S.C "*Campylobacter* in Pasture Flock Poultry", REU-NSF program, University of Arkansas, Fayetteville, AR, July 16, 2012.

Ricke S.C. "Current Perspectives on Antibiotic Resistance in *Salmonella,*" Poultry Processing & Safety Workshop, Extension Food Science Training Facility, University of Georgia, Athens, GA, July 25, 2012.

Park S.H., I. Hanning, A. Perrott, E. Alm, S. Pendleton and S.C. Ricke. 2012. The gastrointestinal microflora profiles in poultry are modified by supplementing feed with prebiotics. XXIV World's Poultry Congress, Bahia Convention Center, Salvador-Bahia, Brazil, Aug. 5-9.

Gibson, K. E., I. Mojica, B. Putman, and S. C. Ricke. 2012. Presence of fecal indicator bacteria and pathogenic microorganisms at recreational beaches in Beaver Lake in Northwest Arkansas. Amer. Soc. Microbiol. General 112th Annual Meeting, San Francisco, CA, June 16-19.

Park, S., M. Munro, I. Hanning, W. Gilbert, L. Devareddy, and S.C. Ricke. 2012. Different gastrointestinal microflora of obese mice by adding fresh or aged blackberry powders to feed. Amer. Soc. Microbiol. General 112th Annual Meeting, San Francisco, CA, June 16-19.

Schielack III, V., M.D. Buser, B.Adam, S.C. Ricke, and P.G. Crandall. 2012. Concept of a stakeholder-driven whole-chain traceability system for agricultural products. ASABE Annual International Meeting, Dallas, TX, July 29-Aug.1.

Koo, O.K., M. Munro, S.A. Sirsat, A.Muthaiyan, and S.C. Ricke. 2012. The physiological and genetical responses on *Salmonella* Typhimurium exposed to sublethal thermal stress. Institute of Food Technologists Annual Meeting and Food Expo, Las Vegas, NV.

Koo, O.K., A.W. Mertz, S.A. Sirsat, J. Neal, S. C. Ricke and P. G. Crandall. 2012. Microbial ecology of deli meat slicers. Institute of Food Technologists Annual Meeting and Food Expo, Las Vegas, NV.

Gibson, K., O. Koo, C.A. O'Bryan, S. Ricke, and P.G. Crandall. 2012. Observational assessment and relative quantification of cross-contamination within a mock retail deli environment. Institute of Food Technologists Annual Meeting and Food Expo, Las Vegas, NV.

Jarvis, N., C.A. O'Bryan, D. Babu, P.G. Crandall, C.M. Owens, and S. C.Ricke. 2012. Dried plum products' effects on water holding capacity in marinated chicken breast fillets compared to phosphate. Institute of Food Technologists Annual Meeting and Food Expo, Las Vegas, NV.

Kalpana, K., F.W. Pohlman, S.C. Ricke, P..N. Dias-Morse, and D. Babu. 2012. Effect of octanoic acid treatments applied using conventional and electrostatic spray methods on microbial and colr characterstics of ground beef. Institute of Food Technologists Annual Meeting and Food Expo, Las Vegas, NV.

Masuku, S.M., D. Babu, E.M. Martin, O.K. Koo, C.A. O'Bryan, P.G. Crandall, and S.C. Ricke. 2012. Decontamination efficacy of blended cellulose/cotton cloths and silver dihydrogen citrate on food contact surfaces. Institute of Food Technologists Annual Meeting and Food Expo, Las Vegas, NV.

Kalpana, K., F.W. Pohlman, P.N. Dias-Morse, D. Babu, P.G. Crandall, and S.C. Ricke. 2012. Antimicrobial effect of peroxyacetic acid and/or pyruvic and octanoic acids with surfactant on beef trimmings inoculated with *E. coli* O157:H7 and *Salmonella* spp. Reciprocal Meat Conference.

Ricke, S.C. 2012. Development of novel strategies for controlling *Salmonella* in poultry production. Keynote Symposium, Poultry Science Association Annual Meeting, Athens, GA.

Ricke, S.C. S.H. Park, I. Hanning, A. Perrott, B.J. Bench, and E. Alm 2012. Application of genomics and metabolite analysis to assess gastrointestinal ecology in alternative poultry production systems. Symposium - Next generation sequencing tools: Applications for food safety and poultry production, Poultry Science Association Annual Meeting, Athens, GA.