



The Food Safety Consortium Newsletter

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To Find *Campylobacter jejuni*, Look in the Biofilms

C*ampylobacter jejuni* is a pathogen found in chickens and is the nation's leading cause of foodborne bacterial diarrhea, so poultry producers look for ways to control it before the birds go to processing. The good news is that the bacterium is susceptible to stress and is vulnerable. So what keeps it going?

Here's one way: the bug latches onto other colonies of bacteria — biofilms — and uses them as places to thrive in ways the *Campylobacter jejuni* would be less likely to do on their own.

"The capture of *C. jejuni* could be correlated to the amount of biofilm present," said Irene Hanning, a post-



Irene Hanning explores biofilms as hiding places for Campylobacter jejuni.

doctoral associate in food science at the University of Arkansas System's Division of Agriculture who investigated the issue for the Food Safety Consortium. "This makes control of all biofilms critical because the communities have a strong potential to capture high levels of *C. jejuni*."

First, it's important to consider how biofilms work. Many bacteria have an ability to form a biofilm, which Hanning described as an assemblage of bacteria encased in a sticky substance.

Biofilms are complex structures that adhere to surfaces and consist of colonies of bacteria.

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Online Food Safety Messages Mindful of the Generations

To bring food safety awareness to Generations X and Y and those who are employed in retail food-services, Iowa State University Extension has turned to video online, with an eye toward making sure food safety messages reach all audiences.

"We're moving away from traditional communications of text-based food safety messages," said Catherine Strohbahn, a Hotel, Restaurant and Institutional Management specialist at ISU. She explained that another way for online viewers to look at food safety information includes increased visuals.

"Our food safety project team developed a 'Yuck Photo Gallery,'" Strohbahn said. "For example, agar plates illustrate microbial growth from people that have

dried their hands on an apron and then touched the agar plate. There are also photos that show microbial growth from hands that have touched refrigerator door handles. The point is for people to think, 'Yuck! Don't touch my food!'"

They hope that young people who work in food service, or those who have trouble reading big blocks of text, will get the food safety message. The Yuck Photo Gallery and other food safety resources are posted online at <http://www.extension.iastate.edu/foodsafety>.



Catherine Strohbahn

Strohbahn, who manages the site with support from the Food Safety Consortium, is seeking to increase the use of podcasts and streaming videos that were first loaded on the site to show a televised guide to food safety. The video covered employee practices, time and temperature abuse and sanitization.

"We thought about trying to capture the youth market or the college-age student," she said. "We tried putting it on podcasting to get feedback from the students on whether this was useful. Their general response was they

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To Find *Campylobacter jejuni*... continued

Being in a biofilm is an advantage to bacteria. The biofilm provides protection from antibiotics and other threats to bacteria's existence.

C. jejuni has had a major disadvantage in that unlike many other bacteria, it doesn't do well at making its own biofilm. So it may have found the next best thing to do: it moves into biofilms that are already protecting other bacteria. *C. jejuni* becomes a secondary colonizer.

Most biofilms should be considered as having the potential to promote and harbor C. jejuni.

The host colonizers can be any of several bacteria, but *C. jejuni*'s most prevalent host turns out to be *Pseudomonas*, which also serve as the main spoilage bacteria on chicken carcasses

and are excellent biofilm formers, Hanning said.

Hanning looked at the ability of *C. jejuni* to survive from biofilm populations

isolated from four places: a drinking unit in a chicken growout house, a drain under a plucker in a processing plant, a retail chicken carcass and a crate used

to haul live chickens. No *C. jejuni* was found on the growth surfaces outside of biofilms that had already been established. The biofilms were cultured under three different temperatures that showed varying levels of ability to harbor *C. jejuni*.

"These experiments indicated that *C. jejuni* can be captured and harbored by a biofilm regardless of the bacterial constituents," Hanning said. "Therefore most biofilms should be considered as having the potential to promote and harbor *C. jejuni*." ■

Online Food Safety Messages... continued

liked the delivery method but the video content was originally targeted to older people when they're working in food service situations. The students found that a bit boring, so our long-term plans and some works in progress are to get more visuals, moving away from text-based food safety messages."

It's more than just a matter of style. Strohbahn noted that research indicates there are generational differences in learning.

"Look at this next generation in the quick service restaurants and even in institutional college and university dining situations. When you're walking around you see the students with the iPods. We want to try to reach that because many of those kids are working in food service situations."

A new SafeFood Blog has Food Safety Consortium researchers Jim Dickson, Joe Sebranek, Sam Beattie, Jim McKean and Strohbahn sharing their insights into everyday food safety issues along the farm-to-fork continuum. Elsewhere on the site, Strohbahn has updated materials targeted to consum-

ers who prepare food away from home, particularly those involved in temporary food stands. Church or civic groups often set up food stands for a day that may potentially be serving hazardous food.

"We developed an Extension publication that our field staff uses if they are asked to train these groups," she said.

"Often they don't get asked, so we're trying to reach new audiences. Ultimately our goal is to put segments of that on our food safety Web page."

Some pages in the site are useful for the implemen-

tation of Hazard Analysis and Critical Control Points (HACCP) programs for institutions such as schools and assisted living facilities, as well child care centers and restaurants. The programs are aimed at intervening where food contamination might occur. All the plans have been updated to reflect Iowa's food code enacted in 2005.

"Through those plans we've developed templates of standard operating procedures, which are really the foundation for a HACCP plan," Strohbahn said.

"The U.S. Department of Agriculture estimates that about half of every U.S. consumer dollar spent on food is spent on food prepared away from home. So, we want to provide information that will help those preparing food away from home to do so safely."

The Web site also ties into an ISU effort that examines consumers' motivations to practice food safety properly. The new study, led by Dr. Susan Arendt, is funded by a USDA grant. It examines such questions as why people don't follow proper food handling practices, even when they know it's the right thing to do.

"We're trying to get beyond the gap between knowledge and behavior," Strohbahn said. "We've developed Web pages for each of the major research projects. That's where some of the new delivery methods like podcasting or blogging will come into play. I think we'll find that when we conduct focus groups with student age groups, the thinking is 'I don't want to go somewhere to watch a video. Bring it to me.' What we're trying to do in the whole food safety area is focus on the Web site and keep it fresh and current." ■

Food Safety Education Goes Nationwide Via KSU Distance Learning

With food industry personnel seeking further education in their field, Kansas State University has expanded its distance education offerings to accommodate professionals throughout the nation who aren't able to study in person at the Manhattan campus.

"The distance courses are designed for distance students and for any on-campus students who want to take them," said Kelly Getty, an assistant professor in K-State's Food Science Institute who coordinates distance education initiatives. "Our distance students are getting master's degrees. They are from all over the U.S. There are about 70 in the master's distance program. They're coming from various food companies and many work in food safety."

The Food Safety Consortium is providing partial support for the program. Getty said FSC research results are integrated into the curriculum. The courses cover food safety and security educational materials that can be used by traditional students studying on campus and by distance education students gaining access online.

Nine courses in food science and food safety have been developed for distance education with more scheduled to come online later. One of the most recent to go online after starting as an on-campus course is Principles of Defense for the Food Industry, a one-hour credit course that provides an overview of food defense measures taught by representatives of AIB International.

"People listen to the various lectures and there are questions at the end for them to take as an online quiz," Getty said. "They can pace themselves through the course."

The course, which is popular with industry and government personnel, teaches how to develop a food defense

plan for a company. Students learn how to write a plan for handling food if a deliberate attempt is made to contaminate the premises where food is processed.

Also among the offerings is curriculum that leads to a graduate certificate in Food Safety and Defense through a distance education consortium known as the Great Plains Interactive Distance Education Alliance (GP-IDEA). The alliance for this graduate certificate consists of food science faculty at K-State, Iowa State University, University of Nebraska and University of Missouri.

The classes began in fall 2007. Students must complete 12 hours among core competency classes and electives. A core course is A Multidisciplinary Overview of Food Safety and Security, "where we discuss topics from bioterrorism to foodborne illnesses to crisis communication to risk assessment," Getty said. Other core requirements include Food Microbiology, Principles of Hazard Analysis Critical Control Points, and Food Toxicology.

K-State food science faculty members are participating in another consortium with five other U.S., Canadian and Mexican universities. Ten students in the consortium have participated in research projects on food safety lasting six to eight weeks and 30 students participated in two three-week food safety and processing courses at the University of Sonora in Mexico.

"We've had students go to the University of Guelph (Ontario) for six weeks and look at restaurant inspection issues," Getty said. "We've had another graduate student go through and look at BSE issues in regards to how they were handled in Canada."



Kelly Getty

K-State, Purdue University and Indiana University are part of a U.S. Department of Agriculture-funded project to develop a national educational and outreach program for food safety and defense. This team has used an established curriculum development process to identify desired skills, knowledge, behavior and attitudes upon which to develop, deliver and evalu-

ate a graduate level and a professional development curriculum for food safety and food defense. Students completing the program will be equipped to serve as leaders who can advance the knowledge, understanding and appreciation of food defense issues. K-State's role is to develop the curriculum into a distance education format.

A future initiative is to translate food safety research results into multimedia, bilingual training materials (English and Spanish) for workers in the beef cattle industry as part of K-State's Beef Cattle Institute project.

"Employees in all segments of beef cattle production need to have a fundamental understanding of the importance of intervention strategies and management practices that can be used to decrease the prevalence of foodborne pathogens in the product they are producing," said Deanna Retzlaff, assistant professor at K-State. "Uniform training opportunities for beef production workers, regardless of their primary language and literacy level, will be provided by the creation and distribution of multimedia, bilingual training materials that illustrate the critical role each worker plays in creating a safe and wholesome beef product." ■

Outbreak Prompted Company to Rethink Its Procedures

A 1993 outbreak of foodborne illness in the Pacific Northwest resulted in two deaths and hundreds of hospitalizations, with most of the cases being traced back to *E. coli* O157:H7 in hamburgers sold at Jack in the Box restaurants. The company was ready for some changes, so it began by getting down to the details of HACCP — the Hazard Analysis Critical Control Points program — in which each step of the food preparation process is analyzed for its potential risks to food safety.

“Along the food chain there are places that are critical control points; there are risk activities that occur where interventions need to occur,” explained Darren Blass, the Jack in the Box director of quality assurance. “What we like to see happen is those interventions occur in a fashion where we’re pushing the risk back as close to the manufacturer as we can and the furthest away from the restaurant.”

The reason for seeking to reduce the risk at the restaurant level is a simple one, according to Blass. That’s the place where “the last food safety decision made before a product is served to a guest may be made by an 18-year-old kid at 2 o’clock in the morning.”

Blass made his comments during an address at the 2007 Institute of Food Technologists annual convention in Chicago. He said Jack in the Box aimed to reduce risk by introducing a HACCP program covering the company’s activities from its handling of its raw materials to its service at the restaurant. That required some adjustment to a new culture for employees making many decisions every day.

“Those decisions are not always food safety decisions,” Blass said. “They’re service decisions, food cost decisions, scheduling decisions and food safety decisions. What we want to get to is where the default decision is always for food safety.”

After the 1993 episode, hamburger patties were the company’s big worry. Blass said Jack in the Box focused its HACCP program to address preparation of patties without cross-contamination. That meant making sure grills performed to deliver temperatures that would be lethal to pathogens on the meat. Over a few years, the input from the field resulted in the development of a checklist for employees to follow.

“That goes to . . . how employees are going to act in the restaurant, when they’re going to wash their hands, what tools are they going to use, why are they going to use them, temperature tracking on food and critical equipment. Are refrigerators running right? Are seals on refrigerators working? Do we have hot water?”

At the corporate level, management became more involved in selecting, rating and grading raw materials. Jack in the Box required its hamburger patty manufacturer to hold samples of its ground patties off the production line every 15 minutes and send them out for microbiological testing and to send other samples to labs for cooking tests. Patties would have to pass both tests before being released into the distribution chain.

Some suppliers of raw materials didn’t pass the Jack in the Box standards, and new ones had to be found to fit into the company’s new overall plan.

“Entire food chains are going to participate in this: raw materials suppliers, production, manufacturers, distribution, all the way into the restaurant chain,” Blass said. It was essentially building a new culture and the employees bought into it.

“There are 18- and 19-year-old kids out there who are running the show. We were able to evolve the program. Once they understood what a critical control point was, we could really hone in on those and focus on food safety criteria.”

Corrective actions are vital when critical control points are violated. It’s important to act on failures within the system, Blass said, or else attorneys for parties pursuing a lawsuit will notice a failure to act within a restaurant’s documentation of activities.

“When we started this program and talked about corrective actions, people understood corrective actions, but corrective action in the field was [viewed as] a bad thing,” Blass said. “They’d evaluate a temperature, the temperature was bad, and they thought they were going to get in trouble for that, so they wouldn’t fill in the form. So we had to go back and re-teach that. A corrective action or a failed control point shows the system is working. You’re picking that up in the program, you correct it, and you can address it.” ■

Biosafety Research Institute Works Toward Comprehensive Approach

Kansas State University's BRI — Biosecurity Research Institute — is the National Biosafety and Biocontainment Training Program's first designated training facility in the nation.

"When the BRI was designed, we knew it wouldn't be enough to build a facility focused exclusively on research needs," said Ron Trewyn, K-State's vice president for research. "Those charged with performing the research and working in the facility must also be adequately prepared to conduct their tasks in a safe manner."

The BRI at K-State's Pat Roberts Hall is the only biosafety level-3 biocontainment research and training facility in the U.S. that can accommodate high-consequence pathogen research on food animals, food crops and food processing under one roof. Pat Roberts Hall is also equipped with an integrated training suite that includes a classroom and mock lab, as well as a large auditorium and advanced video capabilities.

The National Biosafety and Biocontainment Training Program was established in 2004 through a partnership with the Office of Research Services, Division of Occupational Health and Safety, National Institutes of Health. Administered by the Frontline Healthcare Workers Safety Foundation, the program aims to provide the latest in professional education to those who operate, maintain and work in biocontainment laboratories.

Deborah E. Wilson, director of the Division of Occupational Health and Safety at the National Institutes of Health, said recent advances in animal and public health research have led to a growing number of labs and a pressing need for high-quality occupational safety and health training.

"With the expansion of biocontainment laboratories in the U.S., so expanded the need for highly trained,



Scott Rusk, director of Pat Roberts Hall, discusses work going on in the training suite at the BRI, Biosecurity Research Institute.

biosafety professionals to help protect the investments made, support the nation's pressing research initiatives and to ensure the safety of the communities in which these laboratories are sited," Wilson said. "In the last five years, the National Biosafety and Biocontainment Training Program has expanded to provide training for laboratory professionals across the globe. We are leading the way in biocontainment laboratory sustainability."

Wilson also commended the BRI's focus on safe research and training.

"This designation is an acknowledgment of the BRI's commitment, that of Kansas State and that of the state of Kansas — a commitment to the public health and safety of our country," she said. "The research to be conducted here and the personnel you have retained will ensure that the BRI will be as safe as its research is scientifically productive."

Murray L. Cohen, Frontline president, which serves as the government

contractor for the National Biosafety and Biocontainment Training Program, noted the vision it took to pull together a facility like the BRI.

"Kansas State University, through the Biosecurity Research Institute, has shown bold foresight in planning for biosecurity and food security matters," he said. "This facility is unparalleled and unsurpassed. It took a lot of vision and gumption to move forward and put this together while a lot of folks were simply talking about what is needed."

The BRI will also be the first in the nation to host the National Biosafety and Biocontainment Training Program's premier biosafety and biocontainment curriculum. That session will provide the latest in professional education to those who handle biohazardous materials in biocontainment laboratories. ■

FSRC Calls for More Collaboration for Food Safety

Food Safety Research Consortium researchers in May released a new report that calls for sweeping changes in the way food safety information is collected and shared. The report, “Harnessing Knowledge to Ensure Food Safety: Opportunities to Improve the Nation’s Food Safety Information Infrastructure,” was written by Michael Taylor (George Washington University) and Michael Batz (University of Florida) with funding from the Robert Wood Johnson Foundation.

The Food Safety Research Consortium is a multidisciplinary collaboration among eight research institutions to improve the U.S. food safety system. Its full report and executive summary are available electronically on the FSRC Web site at <http://www.thefsrc.org/FSII>.

Based on dialogue with the food safety community, the report calls for broader collaboration in the collection and sharing of information that can be used to prevent foodborne illness. Taylor and Batz identify a number of constraints on information sharing under the status quo and make the case for a new national policy and program to drive change in current practices. They detail a number of other specific recommendations aimed at improving the food safety information infrastructure.

Key findings include these points:

- Information of many types and from many sources is essential to understanding food safety risks and devising preventive measures.
 - System-wide improvement in how food safety information is collected and shared is essential to achieving the vision of a risk-based, preventive system in the Food and Drug Administration’s Food Protection Plan and in most of the food safety bills being developed in Congress.
 - More information is being generated by government agencies, food companies and researchers, and new information-collection tools and information-management technologies hold great promise for food safety.
 - There is little coordination among those collecting food safety information and too few efforts to ensure that existing information, even information collected by the government, is made readily available to those who can use it to ensure food safety.
 - This lack of coordination is a consequence of the highly decentralized nature of the food safety system, built-in obstacles to data sharing in many government and private organizations and the lack of incentives and means for organizations and individuals to help meet the information needs of the system as a whole.
- To address these problems, the authors recommend the following:
- Establish a national policy making it the duty of all federal agencies to better coordinate information collection, consider the information needs of the system as a whole, and maximize information sharing among all levels of government and with the private sector.
 - Establish within the Department of Health and Human Services a focal point for leadership that pulls together federal, state and local officials for collaborative efforts to implement the national policy.
 - Establish a forum to foster communication and collaboration among government, industry, consumers and academia to solve food safety information problems.
 - Give high priority to enhancing the nation’s investment in food safety epidemiology and making the collection and sharing of epidemiological data more responsive to the needs of regulators, the food industry and consumers.
 - Use the Web to connect dispersed databases and electronic networks in order to make it easier for those seeking food safety information to find it.
 - Do a better job of prioritizing information collection and making valuable data generated by academic researchers and private firms more readily available to others in the food safety system.
 - Provide adequate public resources to implement the new food safety information policy and program. ■

Abbey Nutsch, Kelly Getty, Deanna Retzlaff, Justin Kastner and Curtis Kastner, all of Kansas State, were awarded a grant for “Development and Implementation of a Graduate Certificate of Completion Program in Food Production and Defense.”

Justin Kastner and Abbey Nutsch, both of Kansas State, and **Jason Ackleson**, New Mexico State, received a grant for “Frontier Disciplinary Experiences (FIXs) in Border Security, Food Protection and Food Security.” Both grants were awarded by the National Center of Food Protection and Defense at the University of Minnesota.

Daniel Fung, Kansas State, was the keynote speaker and poster competition coordinator at the Food Safety and Security Summit in March in Washington. In June, he participated in several activities at the Institute of Food Technologists national meeting in New Orleans. He delivered five presentations in August at the International Association for Food Protection national meeting in Columbus.

In June, Fung was the director of the 28th International Workshop on Rapid Methods and Automation in Microbiology at Kansas State. In 1981, Fung founded the event, which has attracted more than 4,000 participants from 60 nations. ■

USDA Awards \$5 Million for Avian Flu Research

The U.S. Department of Agriculture announced in June that it would renew the Avian Influenza Coordinated Agricultural Project (AICAP) with another \$5 million for three years to the University of Maryland-College Park to study the prevention and control of the disease.

The USDA’s Cooperative State Research, Education, and Extension Service originally awarded the AICAP in 2005 to the University of Maryland to establish a research and education project to help prevent and control avian influenza. The project was composed of a multidisciplinary team of researchers and extension specialists representing 17 states.

AICAP goals include epidemiology, basic research, diagnostics, vaccines and education. Since 2005, AICAP researchers and educators have:

- assembled the first continent-wide network to study the ecological and biological characteristics of avian influenza viruses isolated from wild birds;
- integrated research and education into a unique program available to a range of poultry producers;
- shown that quail can change and expand the host

range of avian influenza viruses and found that quail respiratory and intestinal tracts have human-like sialic acid receptors that could partially explain the emergence of avian influenza strains with the capacity to infect humans;

- developed a comprehensive program that has been delivered in 33 states and in Canada and Brazil to train producers and veterinarians on the depopulation and composting of flocks with avian influenza;
- developed a testing component for rapid diagnosis of avian influenza in birds; and
- developed promising vaccines for mass immunization of birds.

The institutions and researchers participating in AICAP are Virginia Tech, Auburn University, University of California-Davis, University of Delaware, University of Georgia, USDA-Agricultural Research Service-Southeast Poultry Research Laboratory, The Ohio State University, Oregon State University, Texas A&M University, Western University Health Sciences and University of Maryland-College Park. ■

Food Safety Digest

by Dave Edmark

The Canadian government and private industry have launched a “Be Food Safe” public awareness and education program that is modeled after a similar one that was implemented in the U.S.

“We all have a role to play in keeping food safe and the Be Food Safe program provides Canadians with helpful information about safe food handling practices,” said Christian Paradis, Canada’s secretary of state for agriculture. “Ensuring safe foods for Canadians is a collaborative effort between government, industry and consumers, and this initiative is an excellent example of how industry, consumer groups and government can work together to keep Canadians safe.”

The program emphasizes four core messages: clean, separate, cook and chill. The campaign will appear in messages in advertising fliers, product packaging and in-store displays.

The Canadian Partnership for Consumer Food Safety Education is the driving force behind the campaign and consists of federal and provincial government agencies, industry, consumer groups and health and environmental organizations.

One way to avoid foodborne pathogens on mushrooms is the obvious way: wash them.

“We have found that the washing process limits growth of pathogens such as *Listeria* and *Salmonella* in whole mushrooms,” said Robert Beelman, a food science professor at Penn State University. “The protective effect of washing was more pronounced in sliced mushrooms, which are more prone to bacterial growth than unsliced ones.”

In a research project, the Penn State team inoculated mushrooms with foodborne pathogens. They found mushrooms that were washed before being inoculated showed significant reduction in the pathogens. Pathogens grew more rapidly in sliced mushrooms, possibly because the release of nutrients in fluids provides a nourishing environment for microbes’ growth.

New Zealand in recent years has endured higher rates of foodborne illnesses from *Campylobacter* than Australia and the U.S. *The New Zealand Herald* reported that two years ago some scientists thought things had gotten so bad that fresh chicken cuts should be withdrawn from the market. The poultry industry didn’t want that to happen, so the government Food Safety Authority worked with the industry to develop a risk management strategy.

A year after the new effort began, reports of *Campylobacter* infection have

dropped to their lowest level in a decade. *The Herald* said processing plants have had to record bacterial levels and report them to a national microbial database. The government said any plant with an unacceptably high reading would be subject to closure. Performance targets were imposed.

“From data we know we weren’t bad by world standards but there was always room for improvement,” said Michael Brooks, executive director of the New Zealand Poultry Industry Association. “We clearly were a contributor to (high illness levels) but we’ve looked at it as an industry and the results have had a truly dramatic impact.”

Scott Russell, a poultry science professor at the University of Georgia, wrote in the April edition of *WATT PoultryUSA* that a proposed rule change by the federal Food Safety and Inspection Service to the *Salmonella* Verification Sampling Program would be tough on the industry. He said it would tighten limits on *Salmonella* levels and threaten to slow or stop processing lines if the standards aren’t met.

“Clearly, FSIS is getting tough on industry in its new policies, but are they the right proposals to help reduce *Salmonella* in poultry?” Russell asks.

Russell’s article is online at <http://wattpoultry.com/0804USAsalmonella.aspx?terms=russell>.

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