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Food Protection Trends

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"VICKIE'S VIEW" FROM YOUR PRESIDENT

Fall season is in full swing as I write this column. The leaves are turning, apples have ripened and pumpkins are starting to show up everywhere! The football season has begun while the baseball season is winding down. My six-year-old son, Jack, is participating in flag football this year. His team is the "Skeletons." He is just beginning to learn about the intricacies of the game of football, without some of the roughness we observe each Sunday on national television! Each player wears a belt with two flags attached by Velcro strips on either side. The goal is to pull one of the flags from the belt of the player running with the ball, rather than tackle him to end the play. At the end of the play, the flag is either off and no points are scored, or it's still on and it's a touchdown. It's very black and white, with little to no room for dispute.

Max, my eight-year-old son, is playing baseball. He was "called up" to play on the 9- to 10-year-old team, the "Angels." Unlike Jack's flag football, there is plenty of opportunity for disputes in baseball—or so many fans, parents, players and coaches would like to believe. At a recent game, Max was up to bat; he had a fairly decent hit but was called out at first base on a very close call. The players, parents and fans immediately called out the familiar protest, "The tie goes to the runner!" The umpire stood his ground in solitude. Was Max the victim of another bad call, or did the umpire know something nobody else did? As it turns out, if you consult the Official Rules and Regulations of Baseball, you will not find the rule "the tie goes to the runner." What Section 7.00—The Runner does say is: Rule 7.01, "A runner acquires the right to an unoccupied base when that runner touches it **before** being put out." Rule 7.08 (e) states: "Any runner is out when…the runner fails to reach the next base **before** a fielder tags said runner on the base." And in Section 6.00—The Batter, Rule 6.05 (j)(1) says: "A batter is out when…after hitting a fair ball, the batter-runner or first base is tagged **before** said batter-runner touches first base." The key word in each of these rules is **before.** The burden of proof is on the runner that he is safe and failure to meet this burden results in the runner being called out. There is no tie in baseball; Max was called out fairly.

By VICKIE LEWANDOWSKI
PRESIDENT

"In the past six months there has been tremendous focus on food safety"

By now you're probably wondering what this has to do with food safety; after all, that's the focus of this column. Perhaps an analogy can be made between this baseball situation and food safety. In this scenario, the consumer is the batter-runner (offense) and the manufacturer/processor is the fielder (defense). The regulatory body is the umpire and the fans; studiers of the game—the ones who keep and analyze the stats—are academics (I didn't want to leave anybody out of the game!). Or, is it the other way around? Is the consumer on the defense (the fielder) and the manufacturer/processor the offense (batter-runner)?

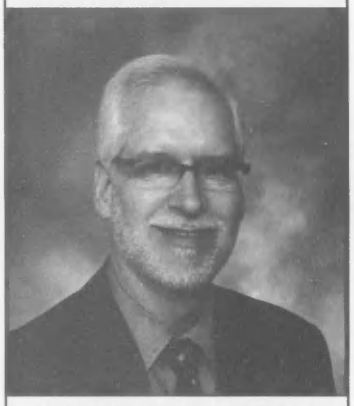
In any case, historically, in a foodborne illness outbreak, the burden of proof has been on the regulators, epidemiologists, and even consumers. For legal consideration, all the data had to line up to prove that product X from manufacturer/processor X was the reasonably likely source of food contamination. Without solid, conclusive evidence, a manufacturer/processor could not be held liable. While this is probably still true, I believe there has been a shift in the last 10 years or more with manufacturers/processors stepping up and taking a role, not only in accepting the burden of proof, but also in preventing occurrence of the burden in the first place.

In the past six months there has been tremendous focus on food safety by virtually everyone along the food supply chain, from farmer to consumer. Intense focus by US lawmakers recently has resulted in a significant legislation. On September 8, 2009, legislation came

into force that will do even more to guarantee the elimination or prevention of foodborne illness by removing contaminated products from commerce, preventing such products from ever reaching the consumer. The title of a September 2009 US Food and Drug Administration (FDA) news release stated it succinctly: "FDA Opens the Reportable Food Registry Electronic Portal for Industry: Food facilities now required to report potentially dangerous products." The new system replaces a voluntary approach to reporting with a legally binding **requirement** to notify the FDA about potential adulteration of food products. The Reportable Food Registry (RFR) helps to make the system less reactive and more preventive. Facilities that manufacture, process or hold food for consumption in the United States (responsible party) must now tell the FDA within 24 hours if they find a reasonable probability that an article of food will cause severe health problems or death to a person or an animal. This requirement applies to all foods and animal feed regulated by the FDA, except dietary supplements and infant formula. Examples of a reportable incident include bacterial contamination, allergen mislabeling, or elevated levels of certain chemicals. Once a report on a product is submitted through the RFR portal, the responsible party must: (1) investigate the cause of the adulteration if the adulteration may have originated with the responsible party; (2) submit initial information, followed by supplemental reports; and (3) cooperate with the FDA to help determine the cause. Companies must also notify relevant suppliers and distributors of the potential food safety issue. This requirement applies only to product that has already been shipped.

Getting back to the baseball analogy, this new legislation is equivalent to a well-fielded pop-fly; it takes the ball and the runner out of play. The new requirement will work to eliminate the burden of proof. Since there will not be a play at the base, so to speak, there is nothing for the batter-runner to prove. The consumer is no longer the defense or the offense, but should now have peace of mind when serving and consuming food. The manufacturer/processor is now both the offense and the defense, identifying and eliminating hazards before they can reach the consumer. As baseball great Leo Durocher once said, "You don't save a pitcher for tomorrow. Tomorrow it may rain." That's very relevant to those of us dedicated to food protection, because there are no rainouts in food safety. This new legislation should inspire everyone involved with the manufacture and distribution of foods to aim out of the ballpark in providing the highest level of food safety possible in every product, everyday. As always, feel free to contact me at anytime at VLewandowski@kraft.com.

"COMMENTARY" FROM THE EXECUTIVE DIRECTOR



By DAVID W. THARP, CAE
EXECUTIVE DIRECTOR

"Now with even more communication tools like Facebook, Twitter, text messaging, and others, our communication plans get more and more complicated"

E-mail and today's world – they naturally go together. The world today moves at a faster pace than ever before; communication is the driving force behind this fast movement. How did we ever get along without E-mail just 10 to 15 years ago?

When I started with the Association in 1993, we had a fax machine and telephones (of course). At that time, we seldom, if ever, made an intercontinental telephone call. We did receive a number of faxes from outside of North America, but the image quality was many times difficult to read. A funny story about our fax machine comes to mind. There was a promotional brochure with the fax machine that stated, "Imagine, being able to receive documents from around the globe in just a matter of minutes." Now in our present time, can you imagine waiting minutes to receive an E-mail from around the world with an attached document?

There are a number of times I have been on the phone with someone from outside of North America and they will say they have just sent an E-mail with a document attached. We both wait for what seems to be an eternity (maybe 15 to 30 seconds) for the E-mail to make its way anywhere from 4,000 to 7,000 miles (6.400 to 11,000 kilometers)! We become very impatient waiting for just those few seconds – how ironic is that?

The same thing happens when a person sends E-mail today. Most people expect a very fast answer to questions posed in E-mail communication. I know many times when I send E-mail with questions posed, I believe a rapid reply is forthcoming. Many times we even send E-mails to our coworkers with whom we might even have eye contact or are located as neighbors in cubes or offices. Sometimes it is just not possible to receive a fast reply for a number of reasons. First, if dealing with someone internationally, you must consider their work hours compared to your own. You might also be sending to someone who travels a lot and cannot always reply quickly. I'm sure many of our IAFP Members travel in their jobs and sometimes when this happens, E-mail does not come to the top of the priority list. Also, some people are well disciplined and only look at their E-mail periodically during the day (two, three or four times during the day).

Meetings, inspections, presentations, conferences all take people away from E-mail. So, someone invented the BlackBerry and iPhones to take care of this problem. Now, it is easy to at least see E-mail as it is coming in from around the world. I don't know about you, but one of the main functions of my BlackBerry is to let me know how much "important" work I have to do once I finally make it to my laptop to make replies. Or, I can monitor communication over the weekend again, to know what might need my attention on Monday morning. This just adds to the stress knowing all those E-mail messages are waiting (patiently, I might add) for a reply.

Oh sure, for those messages needing only a quick word or two of an answer, I might go ahead and reply through the BlackBerry. But if it requires a more lengthy reply, I'm waiting to do it on my laptop or I'll pick up the phone to make a reply! With E-mail, the telephone is another form of communication that seems to be dwindling away. Phone calls seem to be few and far between now and that is really too bad. When you talk with someone, you can understand their intent much clearer than when communicating with E-mail. Also, there are times we rely on E-mail for our communication only to find that there was a technical problem and the message was not delivered (or it was overlooked by the receiver).

Phone calls can help to move a project forward. When you talk together, an understanding of time commitments comes to the surface. You know more easily that an important report is due on Thursday at 9 a.m. and there is not a question remaining about a time or place for the completed report to be turned in.

Now with even more communication tools like Facebook, Twitter, text messaging, and others, our communication plans get more and more complicated. You may know that IAFP has a presence on Facebook. We are beginning to place additional information here and hope to open new lines of communication for our Members. If you have not already done so, look us up under the full Association name (International Association for Food Protection) and become a fan of IAFP. Then when we send messages through Facebook, you will be sure to receive the communication.

What am I trying to say by all of this? I'm not really sure. I think it is just interesting to see the massive changes in the way that people communicate. In just 100 years or so, we have gone from the telegraph to telegrams to telephones and fax machines and now electronic communication. For better or worse, this is where we are. Now, we just need to learn to manage the volumes of information and communications that come to us each day!

ARTICLES

Food Protection Trends, Vol. 29, No. 11, Pages 780–786

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International Association for Food Protection

Prevalence and Risk Factor Investigation of *Campylobacter* Species in Retail Ground Beef from Alberta, Canada

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ABSTRACT

Campylobacteriosis is the most commonly reported (notifiable) bacterial enteric disease in Alberta, Canada. The purpose of this study was to assess the prevalence of *Campylobacter* species in retail ground beef based on a survey of 60 stores (four supermarket chains, three cities) in southern Alberta. None of the 1,200 retail lean and regular ground beef packages were culture positive. Direct PCR results from a subset of samples (n = 142) indicated that 46% of packages tested were positive for *Campylobacter* DNA. By species, 14.8% (21/142), 26.8% (38/142) and 1.4% (2/142) of packages were PCR positive for *C. jejuni, C. coli* and *C. hyointestinalis* DNA, respectively. The presence of campylobacters varied depending on the dates of collection. However, type of package (regular or lean), whether the store cut/packaged poultry in the meat department, type of meat used as the beef source (market trim, coarse grind tubes or a combination of these), whether meat portions were previously frozen, and package weight were not associated with the odds of finding *Campylobacter* spp. DNA by use of PCR. The high levels of *Campylobacter* DNA in the beef suggest that breaks in food safety protocols within slaughter plants, processors or grocery stores could have potentially important public health repercussions.

A peer-reviewed article

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INTRODUCTION

In Alberta, Canada, campylobacteriosis is the most common bacterial enteric illness, with 36.1 cases per 100,000 people reported in 2005 *(25, 27)*. *Campylobacter jejuni* (*C. jejuni*), the most frequently isolated species in human disease, is responsible for approximately 85% of all human *Campylobacter* infections *(21)*. While consumption of contaminated poultry meat is generally considered the primary source of infection for people *(14)*, other routes of transmission may exist. Similarity between human and domestic livestock *Campylobacter* isolates has been reported based on molecular typing studies. *(6, 12, 18, 22)*.

In studies in Alberta feedlot cattle near the end of the feeding period, fecal prevalences for *Campylobacter* spp. and for *C. jejuni* have been estimated to be up to 87% and 61%, respectively *(2, 11, 16)*. Other species of *Campylobacter* of potential public health importance, including *C. coli, C. fetus, C. hyointestinalis*, and *C. lanianae*, have also been isolated from cattle feces in Alberta *(16, 17)*. However, research into the prevalence of *Campylobacter* spp. in retail ground beef in Alberta has been limited. In Edmonton, Alberta, a city in northern Alberta which was not part of the sampling area for our study, a recent retail ground beef survey reported no positive samples from the 100 packages tested *(4)*. The prevalence of *Campylobacter* spp. in retail ground beef has ranged from 0–20% worldwide on the basis of culture and biochemical or molecular identification of species; however, commonly less than 5% of samples tested have identified campylobacters *(4, 7, 28, 30)*.

The goals of this project were to assess the prevalence of *Campylobacter* spp. (in particular *C. jejuni)* and to investigate risk factors potentially associated with the presence of *Campylobacter* spp. in retail ground beef. This paper reports the results of a culture survey of retail ground beef (n = 1,200) and PCR of a subset of these (n = 142) from 60 retail grocers of four major chains in three cities in southern Alberta.

MATERIALS AND METHODS

Sample size calculation

For a survey using simple random sampling, 179 packages of ground beef would have been necessary to measure a 3% expected prevalence of *C. jejuni (29)* with 2.5% precision and 95% confidence (Epi-Info, version 3.01, CDC, USA, 2003). After application of an inflation factor formula *(9)* to account for clustering of the expected frequency of *Campylobacter* within retail stores, the survey required 1,200 packages from 60 stores (assuming an intraclass correlation coefficient (ICC) of 0.3, an unadjusted sample size of 179, and collection of 20 packages per store). An ICC describing clustering of *C. jejuni* within source was not available from previous publications; the choice of 0.3 was slightly more conservative than previously published ICCs for non-enteric cattle conditions *(19)*.

Sampling protocol

The goal of sampling was to identify grocery chains likely to supply the largest sales volume of ground beef to consumers. Four chains with the highest numbers of retail stores from three cities in southern Alberta were identified, and a sampling frame of individual stores was compiled from telephone book white and yellow pages (chain name and pharmacy headings) and internet searches (chain name). Stratified random sampling (by city and by chain within city) ensured that meat samples were taken from all chains in all cities. Fifteen stores were sampled from chain 1, 22 from chain 2, 16 from chain 3 and seven from chain 4. Forty-six stores were sampled in city 1, six stores in city 2 and eight stores in city 3. Five packages per store per collection were randomly sampled from the 60 stores, using a hand-held randomization program (Handy Randy, Stevens Creek Software, Cupertino, CA, USA), for a total of 1,200 retail packages of regular or lean ground beef. Three hundred packages were purchased during each of four collection periods: two winter (Nov. 21–23, 2004, and Jan. 9–11, 2005) and two summer (May 30–31, June 1, 2005 and July 18–20, 2005). After purchase, each package of ground beef was placed into a pre-labeled Ziploc bag (SC Johnson, Racine, WI, USA) and then packed into a cooler (The Coleman Company Inc., 5286B, Wichita, KS, USA) with six ice packs (Ice-Pak/Hot-Pak, Montreal, QC, Canada). A Hobo H08 Pro temperature monitor (Onset Computer Corporation, Pocasset, MA, USA) was included in one cooler from each of the 12 meat shipments. Each cooler was sealed and shipped to the Vaccine and Infectious Disease Organization (VIDO, Saskatoon, SK, Canada) by bus (Greyhound Transport Canada Corporation) overnight. Ground beef packages were processed within approximately 24 hours of collection. Transport temperature ranges were evaluated from two hours after closure to two hours before the cooler was opened.

Employees knowledgeable about in-store meat practices were identified by phone inquiry or observed directly working with meat, and were asked questions regarding their meat department practices. Information on the cutting and packaging of raw poultry, the type of meat used to produce the ground beef (coarse tubes, market trim or both) and whether the ground beef contained meat that had previously been frozen were collected.

Experimental inoculation of retail ground beef as sensitivity analysis

A pure culture of *C. jejuni* (NCTC 11168) that had been previously suspended in 25% glycerol/50% Brain Heart Infusion broth and frozen to -70°C was used as the source strain for this experiment. The culture was thawed on ice and plated on a Mueller-Hinton agar plate. The plate was then incubated microaerobically (85% N_2, 10% CO_2, 5% O_2) at 42°C for 48 hours and checked to ensure the culture was pure by use of the Gram stain. The culture was then suspended in 0.85% NaCl (normal saline) to an absorbance of 0.5 at 600 nm (Ultrospec® 3000, Pharmacia Biotech) to form a 10^9 colony forming units (CFU)/ml solution. To create the final 1×10^4, 1×10^3, 1×10^2, or 1×10^1 CFU/g dilutions, *C. jejuni* stock solution was further diluted with normal saline to a total volume of 1 ml, which was added

TABLE 1. *Campylobacter* spp. in retail ground beef (n = 142) based on PCR

Identification	Positive (%)
Genus:	
Campylobacter spp.	65 (45.8)
Species [a,b]	
C. jejuni only	20 (14.1)
C. coli only	35 (24.6)
C. jejuni and *C. coli*	1 (0.7)
C. coli and *C. hyointestinalis*	2 (1.4)

[a]seven isolates could not be identified to the species level.
[b]zero samples tested positive for DNA of *C. fetus*, *C. lanienae*, *C. concisus* or *C. upsaliensis*.

with each meat sample to the enrichment broth.

For each package of fresh retail ground beef, the plastic wrap over the middle was sliced with a sterile scalpel blade. A deep core sample of 25 g (24–26 g) of raw ground beef was removed with a sterile spoon. Each ground beef sample was placed into a 55-ounce Whirl Pak bag (82007-726, VWR International, Mississauga, ON, Canada) with 1 ml of *C. jejuni* solution and 100 ml of enrichment broth (Bolton broth (# CM0983 Oxoid Ltd., Basingstoke, UK) and 5% horse blood mixture) and mixed thoroughly for 30 seconds (Stomacher Lab Blender 400). The homogenate was then incubated (85% N_2, 10% CO_2, 5% O_2) for 44 hours at 42°C and then streaked onto Karmali selective agar (Oxoid, CM935 with supplement SR0167E, Nepean, ON, Canada) and microaerobically incubated for 48–72 hours. Each culture plate was then examined visually for colonies characteristic of *Campylobacter* spp. (based on growth, color and morphology of the colony, and color of the cell mass).

Ground beef packages were not tested for campylobacters prior to inoculation. Five packages of retail ground beef were tested at each concentration (1×10^4, 1×10^3, 1×10^2, or 1×10^1 CFU/g), and the experiment was repeated on two separate days. Each incubation of test plates included both a negative control plate and a laboratory strain *C. jejuni* plate as positive control. These experiments were conducted to document our ability to consistently recover *C. jejuni* from ground beef by use of our culture protocol.

Study protocol for detection of campylobacters by use of enrichment culture

The enrichment culture protocol for the study retail ground beef was the same as that already described for the experimental inoculation, except without the addition of the 1 ml of fresh *C. jejuni* solution. Briefly, 25 g of raw ground beef was added to 100 ml of a Bolton broth and 5% horse blood mixture in a 55-ounce Whirl Pak bag and mixed thoroughly for 30 s. The homogenate was then microaerobically incubated for 44 hours at 42°C and then streaked onto Karmali selective agar and re-incubated microaerobically at 42°C for 48–72 hours. Each culture plate was then examined visually for colonies characteristic of *Campylobacter* spp. Each incubation included a laboratory strain *C. jejuni* plate as positive control.

Detection of campylobacters by polymerase chain reaction (PCR)

At the same time as samples were taken for culture, ground beef from approximately 10% of the 1,200 packages collected (52 of 60 stores represented) were frozen for subsequent DNA extraction and application of taxon-specific PCR for campylobacters. Each subsample (1 g) was thawed and placed in a BagPage 100 filtered blending bag (EW-36840-58; Canadawide Scientific Ltd., Ottawa, ON, Canada) containing 9 ml of Columbia broth (Becton, Dickinson and Company, Sparks, NV, USA), and the sample was homogenized for 120 s at high setting in a Stomacher 80 blender (Seward Ltd., West Sussex, UK). The homogenate was then removed from the bag and centrifuged at 1,750 × g for 10 minutes, the supernatant containing *Campylobacter* cells was collected. To concentrate *Campylobacter* cells, the supernatant was centrifuged at 24,050 × g for 10 minutes, and the supernatant removed and discarded. The pellet was re-suspended in 1 ml of Columbia broth, 200 µl aliquots were placed in 2 ml tubes, an internal amplification control (IAC; 10 µl containing 700 copies/µl) was added to each tube *(15)*, and DNA was extracted using the DNAeasy Tissue Kit (Qiagen, Missassauga, Canada) according to the manufacturer's protocol. Direct PCR was applied for *Campylobacter* genus, IAC, *C. jejuni*, *C. coli*, *C. fetus*, *C. hyointestinalis*, and *C. lanienae (15)*. In addition, nested PCR to detect *C. concisus* and *C. upsaliensis* was applied (Inglis et al., unpublished). In all instances, negative and positive PCR controls were included, and arbitrarily-selected amplicons (including weak amplicons) were sequenced to ensure specificity. Samples were deemed to be negative for *Campylobacter* DNA only if amplification of the IAC occurred (i.e., in the absence of a *Campylobacter* genus amplicon).

Data analysis

Descriptive analyses were conducted using SPSS (version 15.0; SPSS, Chicago, US). A second commercial software package (MLwiN version 2.02; Centre for Multilevel Modeling, Institute of Education, London, UK) was utilized for the hierarchical model analysis. The hierarchical models *(9)* were specified with a logit link, binomial distribution, restricted iterative generalized least square and second order penalized quasi-likelihood nonlinear estimation. The outcome was whether or not a ground beef sample was positive for *Campylobacter* spp. DNA. Variables included "poultry cutting" (whether or not poultry was cut or

TABLE 2. Unconditional analyses of risk factors for whether a sample was positive for *Campylobacter* spp. by direct PCR (n = 140)

Variable	Level	# of packages	% packages C. spp. positive at each level	*P*-value
Chain	1[a]	28	42.9	0.936
	2	45	46.7	
	3	47	51.1	
	4	20	35.0	
City	1[a]	109	45.0	0.891
	2	9	55.6	
	3	22	45.5	
Collection period	1[a]	30	30.0	< 0.001
	2	30	66.7	
	3	31	80.7	
	4	49	20.4	
Frozen portions	No[a]	124	47.6	0.459
	Yes	16	31.3	
Package type	Lean[a]	86	40.7	0.158
	Regular	54	53.7	
Poultry cutting[b]	No[a]	94	48.9	0.937
	Yes	40	45.0	
Trim type	Coarse grind tube[a]	56	41.1	0.876
	Market trim	50	50.0	
	Both	34	47.1	
Weight_c	≤ 0.499 kg[a]	17	35.3	
	0.500–0.999 kg	113	48.7	
	≥ 1.000 kg	10	30.0	0.343

[a]Reference category; [b]Data unavailable for one store (six packages)

C. spp.: *Campylobacter* species

packaged in the meat department), "trim type" (what source of ground beef was used in the grinding; coarse grind tubes, market trim or a combination), "city" (1, 2 or 3), "collection" (collection period 1, 2, 3, 4), "package type" (lean or regular ground beef), and "weight" (kg, the only continuous variable). The scale of the "weight" variable was explored and categorized into "weight_c" (package less than 0.5 kg, package 0.5 to 0.999 kg, or package 1.0 kg or greater) to evaluate model linearity assumptions. Random effects (e.g. chain or store levels) were kept in the model if more than one variable at that level was entered as a fixed effect, if the amount of variability explained at that level was greater than 10%, or if the level was believed to be important to the data structure *a priori*.

RESULTS

Experimental inoculation

Of the 40 ground beef samples inoculated, only one sample (1×10^2 CFU/g) did not yield *C. jejuni*. Positive control plates and all other samples, including 100% of samples inoculated with 1×10^1 CFU/g, were positive for *C. jejuni* using the study protocol. None of the negative control plates grew *Campylobacter* spp.

Prevalence survey using culture

All 60 stores reported that they did a final grind of beef in-store, and that the source beef for grinding came from local (Alberta) slaughter plants or processors. Twenty-seven stores used coarse ground tubes, 17 stores used market trim, and 16 stores used a combination of both for their second in-store grind. Forty stores did not package or cut raw poultry in the department, 19 stores reported cutting or packaging some poultry products (e.g. wings), and for one store data were unavailable. Fifty-six stores used fresh meat only, while in four stores the retail ground beef may have included previously frozen portions. Of the 1,200 packages of retail ground beef, 726 were lean and 474 were regular ground beef. Twenty-eight packages were labeled as a "discount". By weight, 121 packages were less than 0.500 kg, 1,030 packages were 0.500 kg to 0.999 kg, and 49 packages were greater than or equal to 1.000 kg. Transport temperatures ranged

from 3.31°C to 9.03°C in the six summer shipments and -2.44°C to 9.42°C in the six winter shipments. *Campylobacter* species were not isolated from any of the 1,200 packages of retail ground beef.

PCR detection of campylobacters

Of the 142 samples tested using PCR, 65 (46%) were positive for DNA of *Campylobacter* spp. origin while 77 were negative (Table 1). Two of the 142 samples tested with use of PCR could not be linked to store or chain and were omitted from all subsequent analyses. The remaining 140 ground beef samples represented 52 different stores. Twelve stores had more than one meat sample tested from the same collection period. Of these 12 stores, only four stores had more than one meat sample positive for DNA of *Campylobacter* spp. origin. Ten of these 12 stores had either four or five samples from the same collection period tested with PCR, and the most any store had positive for DNA of *Campylobacter* spp. origin was two samples.

Factors associated with PCR detection of *Campylobacter* spp.

For one sample, data were missing for whether or not the source store cut poultry. This sample was included in risk factor analysis, and designated 'missing' in the "poultry" analysis. Supermarket chain did not explain an important part of the variance in the null model (chain level variance 0.000, standard error 0.000) and was not included as a random effect in the final analysis. After accounting for clustering within the store of origin, only the package type and the collection period variables were selected for consideration in the development of a final model ($P \leq 0.25$) (Table 2). None of the other risk factors considered (chain, city, inclusion of frozen portions, on-site poultry cutting practices, kinds of trim in the ground beef or package weight) were associated with the odds of detecting campylobacters by PCR (Table 2).

When package type (regular or lean) and collection period (1: Nov 21–23, 2004, 2: Jan 9–11, 2005, 3: May 30–31, June 1, 2005, and 4: July 18–20, 2005) were examined together, only the collection period was significantly associated ($P \leq 0.05$) with detection of *Campylobacter* spp. by PCR. The odds of a retail ground beef package testing positive for *Campylobacter* spp. DNA was 5.6 times greater if the package was from collection period 2 than if it was from collection period 1 (OR 5.6, 95% CI 1.8–17.5). Further, a package had 12 times greater odds of testing positive for *Campylobacter* spp. DNA if it was from collection period 3 than if it was from collection period 1 (OR 12.0, 95% CI 3.5–42.0). Ground beef from collection period 4 was not statistically different from beef from collection period 1 (OR 0.6, 95% CI 0.2–2.0).

DISCUSSION

The samples from this large retail ground beef survey represented four different supermarket chains and three cities in southern Alberta. Random selection of packages in stores, multiple collection periods, and limiting the number of packages purchased per store were used to avoid oversampling the same meat batches. In 2005, source beef for ground beef likely came from the six federally inspected slaughter plants in Alberta *(1)*, or from provincially inspected facilities. Because retail chains likely purchased meat from the same plants or processors, it was expected that variation within each chain would be small. As a result, only five packages of ground beef were purchased from each store at each collection time.

Hazard analysis critical control points (HACCP) have been identified and programs implemented in all federally registered beef slaughter plants in Canada *(5)*. In previous surveys in cattle, poultry and swine, significant reductions in *Campylobacter* isolation rates from slaughter to post-chill have been reported *(20, 24, 26)*. Protocols in cattle slaughter plants, including hide-on-carcass, lactic acid, hot water, and carcass washes, chilling, and the ability to remove potentially contaminating components (e.g., hides and intestinal tracts) quickly and intact may have all contributed to bacterial numbers below detectable levels in the retail ground beef surveyed here.

It can be difficult to compare laboratory protocols with other published research because many incubation and temperature protocols, culture media, and antimicrobial supplements are available, and because viable but non culturable *Campylobacter* strains may exist *(8, 23)*. Using the culture technique described, we were able to isolate *C. jejuni* at 1×10^1 CFU/g in experimentally inoculated ground beef samples; this level is below the estimated dose required for human infection *(3, 14)*. However, none of the 1,200 packages of retail ground beef collected as part of this study were culture positive for viable *Campylobacter* spp., an encouraging finding for public health in Alberta.

The very low prevalence of culturable *Campylobacter* levels in retail ground beef observed in this study is similar to those seen in other North American ground beef surveys *(4, 28)* and lower than the 60–90% prevalences reported in raw retail chicken *(4, 30, 31)*. In a survey in the United States from 2002–2005, campylobacters were identified in only 1 of 2,073 packages of ground beef using culture *(28)*, and a smaller Alberta survey found zero of 100 packages positive *(4)*. However, it is possible that the laboratory sensitivity of the culture method used here may not have been high enough to pick up very low numbers of organisms. Further, if campylobacters were sufficiently stressed, it is possible the method was not able to resuscitate these pathogens sufficiently for growth with culture. Three of the meat shipments dipped below the 0°C mark during shipping; however, campylobacters have been isolated from ground beef frozen at -18°C for 90 days *(10)*, and culture recovery in our study did not vary between summer and winter samplings.

Traditionally, PCR has been used to confirm isolates as campylobacters rather than as a survey tool in retail meat studies *(13, 30, 31)*. This is because from a food safety point of view, viable campylobacters are usually the targets of interest and the identification of *Campylobacter* DNA by use of PCR does not ensure viability. However, from our direct PCR results, *C. jejuni*, *C. coli*, and *C. hyointestinalis* were identified in the retail ground beef. None of the samples were positive for *C. fetus* or *C. lanienae*, species which may be carried by cattle, or for *C. concisus* or *C. upsaliensis*, which are pathogens responsible for infections in people but are putatively not carried by livestock *(14, 21)*. Finding 27% (38/142) of samples PCR positive for

C. coli and only 15% (21/142) of samples PCR positive for *C. jejuni* was interesting. *C. jejuni* is the most frequently isolated species from cattle *(11, 17)*, while *C. coli* is the most common *Campylobacter* species found in swine *(21, 24)*. Stores were asked about the cutting and packaging of raw poultry, but not raw pork, and this may be a consideration for future research.

We initially considered that cross-contamination of surfaces and equipment from raw poultry cutting and packaging in grocery stores might lead to ground beef contamination. However, 2/3 of stores did not cut poultry onsite and brought in pre-packaged poultry cuts for consumers. No association was found between poultry cutting and the presence of *Campylobacter* DNA in retail ground beef in the risk factor evaluation.

Approximately 10% of retail ground beef packages were tested by use of PCR. Initially, every 10th ground beef sample was selected and frozen for later testing, but this systematic approach did not continue for the entire study. However, 52 of the 60 stores were represented, 60 samples from winter and 82 from summer were selected, and samples were tested from all chains and most stores in all three cities. Hierarchical models were likely hampered by the small sample size tested with PCR (n = 142). However, individual collection periods were associated with the presence of *Campylobacter* spp. The results did not indicate a seasonal difference, as one winter and one summer collection period were significantly different from the others. However, these findings do indicate that differing levels of *Campylobacter* spp. contamination may occur between slaughter and retail sale. Descriptive analyses found that from the five packages collected at the same store on the same day, one package might be positive for *Campylobacter* DNA and the others negative. This may reflect differing package contamination levels, within package *Campylobacter* distribution (as only 1 g of ground beef was collected from the centre of each package), or possible dilution effects from the PCR process. Further, variables within the control of slaughter plants, processors or grocery meat departments (e.g., carcass cleanliness, hygiene practices, cross-contamination) may have contributed to variability between collections.

CONCLUSIONS

None of the 1,200 packages were culture positive for campylobacters in this retail ground beef survey, supporting the adequacy of food safety practices in the province. The prevalence of *Campylobacter* DNA with PCR detection, however, was moderate to high (46%); thus continued research into potential interventions in the slaughter-to-retail continuum could be of use. The high levels of *Campylobacter* DNA in the beef suggest that breaks in food safety protocols within slaughter plants, processors or grocery stores could have potentially important public health repercussions.

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Consumer Storage Period and Temperature for Peanut Butter and Their Effects on Survival of *Salmonella* and *Escherichia coli* O157:H7

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ABSTRACT

Recent recurrence of *Salmonella* contamination of peanut butter has become a serious food safety concern for consumers. A study was conducted to identify storage periods and temperature conditions of peanut butter in domestic kitchens and to determine the effects of those storage periods and conditions on survival of *Salmonella* and *Escherichia coli* O157:H7. Surveys assessed consumer storage periods of peanut butter in 150 households in Middle Tennessee. To simulate consumers' peanut butter storage conditions, *Salmonella* and *E. coli* O157:H7 were inoculated in peanut butter and held at 4 and 25°C for up to 15 weeks. Initial populations of *Salmonella* and *E. coli* O157:H7 in peanut butter were 4.78 CFU/g and 5.56 CFU/g, respectively. After 15 weeks of storage at 4°C, *Salmonella* and *E. coli* O157:H7 populations had decreased to 3.72 and 2.73 log CFU/g, respectively. A significantly higher reduction ($P < 0.05$) of *Salmonella* and *E. coli* O157:H7 was observed in peanut butter stored at 25°C than in that stored at 4°C for the same duration. Our results indicate that post-process contamination of peanut butter with *Salmonella* and *E. coli* O157:H7 may result in survival of these pathogens during their shelf life, posing health risks to consumers.

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INTRODUCTION

Foodborne pathogens have a significant impact on the food processing industry, consumers, and regulatory agencies. In the past, most outbreaks of *Salmonella* and *Escherichia coli* O157:H7 have been linked to consumption of animal products such as meat, poultry, and eggs *(17)*. However, the presence of *Salmonella* and *E. coli* O157:H7 in non-animal products has emerged as a serious food safety concern. Foods low in water activity, such as chocolate and cheese, have been implicated in *Salmonella* outbreaks *(5)*. Several reports have suggested that *Salmonella* in foods with low water activity and high lipid content tend to have increased resistance to heat *(8, 9, 11)*.

In 1996, an outbreak of *Salmonella* Mbandaka infection in Australia was associated with peanut butter, a food of low water activity *(16)*. *Salmonella* Agona infection has also been linked to consumption of peanut butter-coated savory in England and Israel *(10, 18)*. In 2007, a multistate outbreak of *Salmonella* Tennessee associated with peanut butter consumption was reported in 47 states *(3)*. This was the first reported outbreak of

TABLE 1. Percentage of consumers with different education levels who store peanut butter < 2 to > 24 weeks

Education level	Percentage of consumers who store peanut butter for:				
	< 2 weeks	2–4 weeks	5–12 weeks	13–24 weeks	> 24 weeks
< High school	1.7	3.4	5.0	1.7	0.8
High school	5.9	9.2	5.0	2.5	3.4
Some college	5.0	5.9	13.4	0.8	3.4
Bachelors or higher	1.7	10.1	11.8	5.0	4.2

foodborne illness caused by peanut butter consumption in the United States, with at least 625 cases. Another major *Salmonella* Typhimurium outbreak associated with peanut butter occurred in 2008–2009, with at least 486 people involved in 44 states *(4, 15)*. Therefore, *Salmonella* contamination of peanut butter continues to be a challenge in the United States, as suggested by these recent outbreaks.

Peanuts are the main ingredient in peanut butter, and contamination of peanuts with *Salmonella* or other foodborne pathogens is possible during growth, harvest, transportation, and even storage *(11)*. Thermal processing of peanut butter might not always eliminate *Salmonella (17)*, and post-process contamination during repackaging may lead to its presence at the point of consumption *(2)*. Because of the frequency of outbreaks of *Salmonella* associated with peanut butter and the associated substantial economic burden on society, additional studies on consumers' peanut butter storage conditions are needed. In addition, the survival of *E. coli* O157: H7 in peanut butter has not been evaluated. *E. coli* O157:H7 has a low infective dose *(19)* and is one of the most serious foodborne known pathogens *(1, 12)*. Therefore, this study recruited participants from the general public to gain a better understanding of preferred duration and storage temperatures of peanut butter in consumers' domestic kitchens, and of how these conditions affect the survival of *Salmonella* and *E. coli* O157:H7.

MATERIAL AND METHODS

Survey of consumer storage of peanut butter

A total of 150 households in Middle Tennessee participated in this study. Participants were recruited through posted flyers at senior housing communities, churches, and community organizations. Researchers contacted the subjects and used a script/screener to determine eligibility. In each household, the person mainly responsible for food purchase, storage, and preparation, and at least 18 years old, was interviewed. To mirror the general population, the participants were in the following categories: less than high school, (13.3%), high school diploma (26%), bachelor's degree or higher (32%), and some college (28.7). Most respondents had incomes between $15,000 and $75,000 a year. The survey questionnaire inquired about consumers' peanut butter purchasing, storage conditions, and storage period. Consumers were also questioned whether they ever threw away peanut butter after a certain period of storage and if so, why.

Laboratory simulation of consumer peanut butter storage conditions

Storage periods and temperatures of peanut butter in domestic kitchens and their effects on the survival of *Salmonella* and *E. coli* O157:H7 were evaluated in a laboratory setting. Peanut butter was contaminated with *Salmonella* and *E. coli* O157:H7 and thereafter stored either at room or refrigeration temperature to simulate consumers' storage conditions.

Preparation of bacterial cell suspension

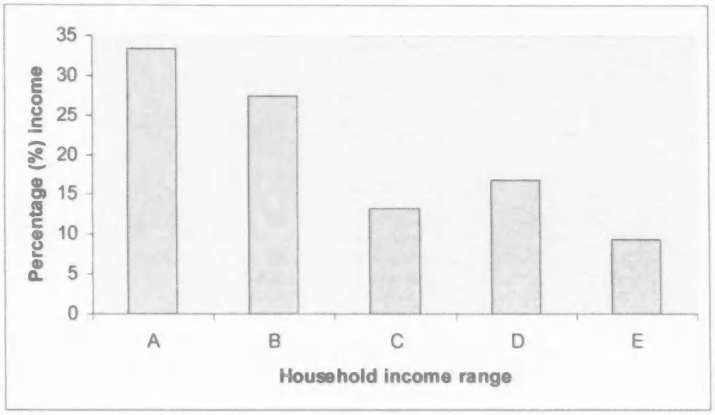
S. Mission (isolated from rectal swabs), *S.* Typhimurium (associated with peanut butter), *S.* Enteritidis (isolated from human feces), *E. coli* O157:H7 204P (pork isolate), *E. coli* O157:H7 301C (chicken isolate), and *E. coli* O157:H7 505B (beef isolate) were used in this study. These bacterial strains were obtained from Auburn University (Department of Nutrition and Food Science, Auburn, Alabama, USA) and have been linked to foodborne illnesses in the past. Information on the survival of these organisms in peanut butter is lacking. To test for ability to maintain genes associated with antibiotic resistance, antibiotic-resistant *Salmonella* and *E. coli* O157:H7 strains were grown in a series of broth-to-agar media inoculated with the respective antibiotics (*Salmonella*, 100 ppm nalidixic acid; *E. coli* O157:H7, 200 ppm nalidixic acid and 0.025 ppm novobiocin; Sigma, St. Louis, MO).

Bacterial cell cultures were maintained on Tryptic Soy Agar (TSA, Difco, Lawrence, Kansas) plates and subjected to two successive transfers into 10 ml Tryptic Soy Broth (TSB) and incubation at 37°C for 20 h. Cells were harvested by centrifugation (3,500 × g, 15 min) at 4°C and washed three times in Butterfield's phosphate buffer (BPB). Bacterial cell pellets were resuspended in 5 ml of sterile BPB and combined to form a three serotype cocktail for each bacterium. Concentration levels of each cocktail were quantified by spread plating 100 µl onto TSA plates inoculated with the appropriate antibiotics for *Salmonella* and *E. coli* selection. To facilitate recovery and eliminate background flora, antibiotic-resistant strains of *Salmonella* (100 ppm nalidixic acid) and *E. coli* O157:H7 (200 ppm nalidixic acid; 0.025 ppm novobiocin) were used.

Inoculation of peanut butter with *Salmonella* and *E. coli* O157:H7

Commercially processed jars of peanut butter were purchased at a local grocery store. Creamy peanut butter (Kroger Co., Cincinnati, OH) listed ingredients were: roasted peanuts, sugar, 2% molasses, fully hydrogenated vegetable oils (rapeseed, cottonseed, and soybean) and salt. Peanut butter sam-

FIGURE 1. Percentage by income of participants who purchased peanut butter. A, less than $15,000; B, 15,000 – 34,000; C, 35,000 – 49,000; D, 50,000 – 79,000; E, $75,000 and above



ples (100 g) were placed in sterile 500-ml glass beakers and kept in a heated water bath at 44°C. Warm water resulted in less viscous peanut butter and therefore minimized large pockets of inoculum in the peanut butter. Each bacterial cocktail (1 ml) was added separately to different batches of peanut butter and mixed with sterile spatula. Four 100-g portions of contaminated peanut butter were pooled into sterile blenders to form six 400-g peanut butter samples, each contaminated with *Salmonella* and *E. coli* O157:H7. To ensure uniform distribution of the inoculums, the pooled peanut butter samples were stirred for 4 minutes. The achieved concentrations of *Salmonella* and *E. coli* O157:H7 in the peanut butter samples were 4.78 and 5.56 log CFU/g, respectively. Another set of 400-g peanut butter samples were contaminated with antibiotic-sensitive *Salmonella* (4.74 log CFU/g) and *E. coli* O157:H7 (5.05 log CFU/g) to compare their survival capacity with that of antibiotic-resistant mutants. All samples were aseptically transferred to sterile jars and stored at either 25 (room temperature) or 4°C (refrigeration temperature) for up to 15 weeks.

Microbial analysis

Jars of contaminated peanut butter were opened every week and analyzed for detectable *Salmonella* and *E. coli* O157:H7. Approximately 25-g samples of peanut butter were placed in sterile stomacher bags and 225 ml of BPB was added. To achieve homogeneous suspensions, samples were pummeled at 230 rpm for 2 minutes. Aliquots (1 ml) of the homogeneous samples were plated (pour plate) onto TSA plates that contained the appropriate antibiotic. The plates were incubated at 37°C for 20 h. *Salmonella* was confirmed by plating typical colonies on xylose-lysine-tergitol 4 agar plates and by using the Reveal for *Salmonella* complete System- SC (Neogen, Lansing, MI). The MacConkey agar plates and Reveal for *E. coli* O157:H7 20 h complete systems were used to confirm *E. coli* O157:H7.

Statistical analysis

All experiments were performed in triplicate. Means were analyzed by one-way ANOVA, followed by the Tukey test. Significance implies $P < 0.05$ unless stated otherwise.

RESULTS AND DISCUSSION

Consumer survey of peanut butter storage

Peanut butter, which is found in about 75% of American homes, is considered by many to be a staple like bread and milk. Peanut butter is spread on a slice of bread, is melted into a soup, and finds its way into everything from breakfast to dessert. In our study, 80% of the participants consumed peanut butter in their households; most surveyed were female (76%) rather than male (24%). The survey targeted the person mainly responsible for food purchase, storage, and preparation in each household, and for the most part, this person tended to be female. Most respondents had incomes between $15,000 and $75,000 a year (Fig. 1). Findings from this study indicate that a *Salmonella* or *E. coli* O157:H7 outbreak associated with peanut butter consumption could affect consumers regardless of income levels.

In this study, 1.3% of the participants had children under 2 years of age, and 20% were adults over 60 years of age. Persons affected by the recent *Salmonella* Typhimurium outbreak associated with peanut butter ranged in age from < 1 to 98 years *(4)*. Participants in this study were within this age range; it must be borne in mind that immunocompromised individuals, as well as the old and young, are at increased risk for foodborne illness. Previous reports have shown that *Salmonella* infections can lead to severe and potentially fatal conditions such as bacteremia, septic arthritis, meningitis, and pneumonia, especially in infants and immunocompromised hosts *(6)*.

Our results suggest that 87% and 13% of the householders stored peanut butter at room temperature and at refrigeration temperatures, respectively. Consumers' commonly used areas for storage of peanut butter included: cabinets (80%), inside refrigerators (13%), top of refrigerators (4%), counter tops (1%), ledge of a window (1%) and on dinner or breakfast table (1%). The duration of consumers' peanut butter storage ranged from less than 2 weeks to about 6 months. The storage period of peanut butter was independent of education level and age group; there was no association between education level and storage period or between age and storage period (Tables 1, 2). During those storage times, some consumers ate all the peanut butter purchased while others threw away part of it for specific reasons. Some prominent reasons why consumers discarded peanut butter were: (1) the peanut butter "smelled funny" (5%); (2) there was a peanut butter recall (7.5%) especially due to a *Salmonella* Typhimurium outbreak, and (3) the peanut butter was too old to eat (16%). Commercial peanut butter requires no refrigeration and can be kept up to six months after opening. Unopened jars can be stored up to one year in a cool, dark location.

TABLE 2. Percentage of consumers at different age groups who store peanut butter for < 2 to > 24 weeks

	Percentage of consumers who store peanut butter for:				
Age (yrs)	< 2 weeks	2–4 weeks	5–12 weeks	13–24 weeks	> 24 weeks
18–29	1.7	5.9	10.1	0.8	2.5
30–44	5.9	8.4	5.9	5.0	3.4
45–59	6.7	10.1	11.8	4.2	4.2
60–69	0.0	1.7	3.4	0.0	0.8
70+	0.0	2.5	4.2	0.0	0.8

TABLE 3. Populations of *Salmonella* and *E. coli* O157:H7 in peanut butter stored at 4 and 25°C for up to 15 weeks

	Population (log CFU/g)[a] over storage time (weeks) of:						
Storage Temperature	1	2	3	6	9	12	15
Salmonella							
4°C	4.72^{ax}	4.61^{ax}	4.53^{ax}	4.17^{ay}	3.90^{ayw}	3.83^{aw}	3.72^{aw}
25°C	3.83^{ax}	3.55^{bx}	3.23^{bx}	2.67^{by}	1.81^{bz}	ND^{bw}	ND^{bw}
E. coli O157:H7							
4°C	3.47^{axy}	3.53^{ax}	3.15^{axy}	3.12^{ayz}	2.93^{az}	2.83^{az}	2.73^{az}
25°C	2.82^{ax}	2.61^{bx}	2.23^{bx}	1.30^{by}	1.10^{by}	ND^{bz}	ND^{bz}

[a]Initial population of *Salmonella* was 4.78 log CFU/g; initial population of *E. coli* O157:H7 was 5.56 log CFU/g.

[a,b]Mean values (log CFU/g) in the same column within pathogen that are not followed by the same letter(s) are significantly different ($P < 0.05$).

[x,y]Mean values in the same row within pathogen that are not followed by the same letter are significantly different ($P < 0.05$).

The results of this study raise concerns in that peanut butter recalled because of a *Salmonella* Typhimurium outbreak was mentioned by about 7.5% of consumers surveyed in our study. Our results obviously indicate that extended periods of storage time of contaminated peanut butter pose risks of foodborne disease to consumers.

Viability of *Salmonella* and *E. coli* O157:H7 under simulated domestic kitchen conditions

Viable *Salmonella* and *E. coli* O157:H7 cells recovered were entirely attributed to the inoculated peanut butter; no traces of *Salmonella* or *E. coli* O157:H7 were detected in uncontaminated peanut butter (control). Populations of *Salmonella* and *E. coli* O157:H7 in inoculated peanut butter stored at either 4 or 25°C is shown in Tables 3. The initial populations of *Salmonella* and *E. coli* O157:H7 in peanut butter were 4.78 CFU/g and 5.56 CFU/g, respectively. All reductions were tabulated in reference to the initial concentrations of tested pathogens.

There was no significant ($P < 0.05$) difference in *Salmonella* reduction within weeks 1, 2 and 3 of peanut butter storage at 4°C (Table 3). However, *Salmonella* reductions of approximately 0.95 to 4.00 log CFU/g of tested peanut butter samples were observed during storage at room temperature (25°C). At 9, 12, and 15 weeks of peanut butter storage at 4°C, *Salmonella* populations were significantly ($P < 0.05$) lower than populations noted during the first 6 weeks of storage of the peanut butter. When the Reveal for *Salmonella* complete System kit was used, the presence of *Salmonella* was confirmed in peanut butter at weeks 12 and 15 (Table 3). Storage of peanut butter at 4°C resulted in the least reduction of *Salmonella*, which ranged from 0.06 to 1.06 log CFU/g, compared with the peanut butter stored at 25°C. Generally, reductions of *Salmonella* were significantly ($P < 0.05$) higher at 25°C than at 4°C for up to 15 weeks (Table 3). These results are in agreement with the report of Burnett et al. *(2)* that *Salmonella* deaths were more prevalent in butters

and spreads stored at 21°C than in those stored at 5°C.

The pattern of *E. coli* O157:H7 reduction was generally similar to that of *Salmonella* (Table 3). The *E. coli* O157:H7 reductions in samples stored for 1, 2, 3, weeks at 25°C were 2.74, 2.95, and 3.33 log CFU/g, respectively (Table 3). When stored much longer, to 9 weeks at 25°C, *E. coli* O157:H7 reductions in the peanut butter were significantly higher ($P < 0.05$) than those of peanut butter stored at 25°C for 1, 2 and 3 weeks (4.46 log CFU/g vs 2.74, 2.95 and 3.33 log CFU/g, respectively).

Overall, *E. coli* O157:H7 cell count reductions of peanut butter stored at 4°C ranged from 2.73 to 3.53 log CFU/g (Table 3). The *E. coli* O157:H7 was confirmed by the Reveal for *E. coli* O157:H7 20 h complete system method at 12 and 15 weeks of peanut butter storage. *E. coli* O157:H7 reductions were significantly ($P < 0.05$) higher with storage at 25°C than at 4°C for up to 15 weeks of peanut butter storage. These observations are in agreement with previous reports *(20)* that *E. coli* O157:H7 reductions in mayonnaise were higher when storage was at room temperature (25°C) than when storage was at refrigeration temperature (4°C). Antibiotic-sensitive *Salmonella* cell counts in samples stored for 6 and 15 weeks at 25°C were 3.37 and 1.72 log CFU/g, respectively. After 6 and 15 weeks at 25°C, antibiotic-sensitive *E. coli* O157:H7 showed cell counts of 2.73 and 1.01 log CFU/g, respectively. Survival capacity of antibiotic-resistant mutant strains exhibited slower growth rates, compared with antibiotic-sensitive strains. These results suggest that the use of antibiotic resistance as a selective marker could present different growth rates in laboratory media and show different resistance to stresses. This possibly will result in overestimates of any treatment, such as heat, against antibiotic-sensitive *Salmonella* and *E. coli* O157:H7.

Findings in this report indicate that post-process contamination of peanut butter with *Salmonella* and *E. coli* O157:H7 may result in survival of these pathogens during their shelf life. This premise is in agreement with previous studies showing that *Salmonella* populations decreased more rapidly in peanut butter at 22°C than at 4°C storage *(13)*. Similar results were observed when *Salmonella* populations decreased more rapidly in a butter and margarine blend stored at 21°C, compared to 4°C *(7)*. It is most probable that at 25°C, the conditions are highly conducive to bacterial growth in the peanut butter, resulting in accelerated growth and hence attainment of a stationary phase sooner than when storage is at 4°C.

It is well documented that storage temperature of colloidal food products influence the availability of *Salmonella (13)*. In our study, *Salmonella* and *E. coli* O157:H7 were detected in the peanut butter throughout the storage period. These findings give cause for concern, because previous reports have shown that consumption of even very low numbers of *Salmonella* or *E. coli* O157:H7 can cause disease *(16)*. It has also been pointed out that during thermal processing of products such as peanut butter, foodborne pathogens are expected to be eliminated, but post-process contamination may take place during repackaging or with use of ingredients in other food products not subjected to conditions sufficient to kill the pathogens *(2)*. Personal hygiene as well as cross-contamination of finished products with raw materials and unsanitary equipment are significant fundamentals in controlling the contamination of food products with pathogens and spoilage microorganisms *(14)*.

CONCLUSIONS

Salmonella grows over a wide range of temperatures and will survive long periods of dehydration. As demonstrated in our results, *Salmonella* and *E. coli* O157:H7 can survive in contaminated peanut butter stored at room and refrigerated temperatures for long periods of time and therefore, can pose a health risk to consumers. To minimize or eliminate such risks in peanut butter, Food Safety Programs (FSP) should be imposed in peanut butter processing facilities. Such actions would eliminate *Salmonella*, *E. coli* O157:H7 or other foodborne pathogens. In addition, plant sanitation and verification of any heat processes are crucial and must be key components of an inclusive FSP to ensure food safety to the public. More research on the survival of foodborne pathogens in peanut butter will be of great importance to the food industry and will translate to fewer recalls of products, recapturing of lost prestige and improvement of the income potential of the food industry. Peanut butter processing facilities must have in place Food Safety Programs to eliminate and control foodborne pathogens in the product.

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In Memory

Ms. Carol Adair

Sharnbrook, Bedfordshire, United Kingdom

We extend our deepest sympathy to the family of Carol Adair who recently passed away. IAFP will always have sincere gratitude for her contribution to the Association and the profession. Ms. Adair has been a member of IAFP since 2008.

History of Consumer Food Safety Education Focus on Beef: Impact on Risk of Foodborne Illness

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SUMMARY

In the past, food safety topics of public concern appeared to be limited to chemical contamination, pesticide residues, and the occasional case of stomach flu that made the victim miserable for a few hours. In recent years, the public has come to recognize that microbiological safety can have serious, long-term consequences. This paper traces the history of consumer food safety educational programs over the past three decades by examining food safety references and the content of educational material

Over this period, advice to the consumer has evolved from general guidelines to specific targeted messages. Changes in consumer knowledge and behavior, as indicated by surveys and actual observation, indicate that programs have had a positive but limited effect. These findings suggest that additional measures are required by the food production/processing and retail/food service industries to reduce the incidence of life-threatening foodborne illness. While this article focuses on ground beef, the findings apply to many food categories, including fresh produce.

EDUCATIONAL PROGRAMS

Food safety education is delivered by the federal government through the US Food and Drug Administration (FDA) and the US Department of Agriculture (USDA). States are involved in development and delivery of educational programs through Cooperative Extension at land grant institutions. Food industry organizations engage in general or product-specific information on safe handling, often combined with guidelines on selection and preparation for flavorful dishes. Since the late 1990s, a partnership of educators and government, food industry, and non-government organizations has played a major role in defining and delivering food safety information.

FOOD SAFETY OVER THE DECADES

Awareness of pathogens and food safety messages has evolved over the past three decades. Textbooks used in college and university food science classes designed for home economists and dietitians provide only a cursorily overview of food safety. Classic textbooks published in the 1950s and 1960s address the chemical, physical and nutritional changes that take place in food during food preparation but do not address food safety*(13, 20, 25)*. Botulism, staphylococcal food poisoning, salmonellosis and *Clostridium perfringens* are briefly mentioned by Bennion in 1980 *(12)*. A more extensive discussion of food safety is included in *Foundations of Food Preparation*, which was published in 1987 *(19)*. Major pathogens such as *Clostridium botulinum* and *Salmonella* are mentioned, but pathogenic *E. coli* is not identified. The authors state that the most important factors to prevent foodborne illness are the application of heat, adequate refrigeration, safe thawing, length of storage, storage conditions, and proper sanitation. Details are provided on appropriate refrigerator temperature and storage time; however, end cooking temperatures are indicated only for stuffed turkey.

Information from the FDA food safety material in the early 1980s is more extensive than that in college-level textbooks, but food safety guidelines lack specific details that would result in safe handling. For example, "Who, Why, When and Where of Food Poisons (And What to Do about Them)" published in the *FDA Consumer* reports that *Salmonella* could be found in raw meat *(10)*. To prevent foodborne illness, readers are advised to handle food in a sanitary manner, cook foods thoroughly, and promptly and properly refrigerate foods. Similarly, the discussion of staphylococcal food poisoning indicates that a toxin is formed when food, including meat, is held at room temperature for too long. Advice for preventing this condition, the same general precautions associated with *Salmonella* control, is repeated here. People are advised to handle food in a sanitary manner with prompt and proper refrigeration. Because details of handling are not specified, consumer adoption of effective food handling practices is unlikely.

Food safety material developed by USDA ten years later is more specific. The publication, *Is*

Someone You Know at Risk for Foodborne Illness? identifies people at increased risk as seniors, pregnant women, children, and people with a weakened immune system *(43)*. Written in a proactive way, readers are encouraged to "take control" to reduce the risk for foodborne disease. The reasons why people with specific health conditions are more vulnerable to foodborne illness is explained in a clear and understandable manner. Specific handling guidelines are provided for shopping, cold storage, safe thawing, proper food preparation, serving, and handling leftovers. The recommended temperature for the home refrigerator is specified at 40°F or colder, and readers are advised to cook ground meat to 160°F.

Other publications by USDA provide specific recommendations consistent with current knowledge of foodborne illness. *Food News for Consumers*, for example, recommends that foods should be marinated in the refrigerator, foods should be cooked completely rather than partially cooked, held and reheated, and meat should be cooked to 160°F *(31)*. Similarly, *A Quick Consumer Guide to Safe Food Handling* includes specific information as to temperature control and safe storage time *(45)*.

USDA's Meat and Poultry Hotline, established in 1985, provides answers to consumer questions through a toll free telephone call, fact sheets, articles in educational publications such as *Food News*, and fact sheets available through the internet *(47)*. Hotline representatives also respond to media calls, reaching an even larger audience. Reports of the hotline activities are posted periodically *(46)*.

Another USDA consumer publication, *Preventing Foodborne Illness*, provides detailed food handling information *(44)*. Sections are devoted to safe shopping, storage, preparation, serving, and handling of leftovers. *Escherichia coli* O157:H7 is mentioned, and consumers are advised to cook ground beef to 160°F. *Listeria* is discussed and pregnant women are identified as being at increased risk for this pathogen. Those at high risk are advised to reheat processed meats.

In 1991, the FDA also provided more comprehensive and specific consumer food safety guidelines. *Preventing Foodborne Illness* provides foodborne illness prevention tips, including sections on cleaning and cooking, safe storage with recommended storage times, symptoms and sources of bacteria and sources for additional information *(3)*. The minimum recommended cooking temperatures for beef is 140°F. A higher temperature for ground beef is not advised. Although this document was reprinted and revised in 1997, a recommended end point cooking temperature for ground beef was not added.

College textbooks published in the 1990s reflect a more comprehensive coverage of foodborne illness. *Food Safety,* by Julie Jones, includes a discussion of significantly more microbial pathogens than books from the previous decade, including *Salmonella*, *Campylobacter jejuni*, *Toxoplasma gondii*, *Staphylococcus aureus*, *C. perfringens*, *Shigella*, *Escherichia coli*, *Trichinella spiralis*, *Bacillus cereus*, *Vibrio*, *Listeria monocytogenes*, *Yersinia enterocolitica*, and others. Raw meat and meat products are identified as a source of *Salmonella*, *C. perfringens*, and *L. monocytogenes*. Jones notes that *E. coli* is a common resident of the intestinal tract of warm-blooded animals. She notes that for many years it had been considered harmless; however, particular strains of *E. coli* were the cause of enteric disease in the 1980s, with soft cheeses and ground beef identified as the food sources. Sanitary handling to avoid cross-contamination, thorough cooking, and keeping foods out of the danger zone are specified as ways to reduce the probability of illness.

Consumers indicate that they obtain safe handling information from cookbooks and magazines *(35)*. A review of classic cookbooks, such as *Better Homes and Gardens* or *Joy of Cooking*, indicates that virtually all limit food handling information to culinary issues such as the temperature for roasts cooked to rare, medium, or well done. Even books published in the1990s and later, specializing in ground beef or grilling, address preference for degree of doneness rather than food safety considerations. There are exceptions. The 1997 edition of *Joy of Cooking* lists the recommended end point temperature of 160°F for meat loaf (page 722) but incorrectly advises consumers to cook ground beef to 155°F (page 646) *(38)*. Further, readers are advised that risk is lessened by buying top-grade beef and grinding it themselves. This is a potentially risky practice, since the opportunity for cross contamination in the kitchen is high. Some cookbooks provide current, accurate information. The *Complete Meat Cookbook*, for example, recommends 160°F or 155°F for 15 seconds as the end point cooking temperature for ground beef *(1)*.

LANDMARK FOOD SAFETY EVENT

A landmark event in food safety occurred in 1993. Consumption of undercooked hamburger contaminated with *E. coli* O157:H7 resulted in 501 illnesses, 151 hospitalizations, and 3 deaths *(11)*. This outbreak received extensive publicity because the source of illness was a popular food and many victims were children. In 1994, USDA declared *E. coli* O157:H7 an adulterant in raw beef, and a program began to test for the pathogen in raw ground beef from federally inspected establishments and retail stores *(15)*. In 1994, the public was advised to cook ground beef until it is brown and juices run clear; however, in 1997, FSIS revised this recommendation. Cooked ground beef color was demonstrated to be an inaccurate predictor of end point temperature. Consumers were advised to use a meat thermometer and cook to 160°F rather than rely on color.

Since 1994, USDA has required safe food-handling labels on retail packages or raw and partially cooked meat and poultry products. The label advises consumers to refrigerate the product, avoid cross contamination, cook thoroughly, keep hot food hot, and handle leftovers properly. Interview and survey data indicate that 51% or more of consumers contacted recalled seeing the label. Of these, 79% or more remember reading the label, and 37% of these said they changed the way

they handle raw meat as a result of reading the label *(34, 39, 48)*. These studies found that people were more likely to remember the message to avoid cross contamination than any other.

In 1997, President Clinton announced the National Food Safety Initiative *(15, 33)*. This measure established the Partnership for Food Safety Education, a not-for-profit organization of government agencies, food industry, nutrition/food safety professional societies, and consumer groups. The Partnership's mission is to educate consumers to protect themselves from bacteria (FightBAC®) and reduce risk of foodborne illness by following 4 simple practices:

CLEAN: *Wash hands and surfaces often*

SEPARATE: *Don't cross-contaminate!*

COOK: *Cook to proper temperature*

CHILL: *Refrigerate promptly*

The partnership provides a coordinated and consistent set of food safety messages based upon consumer-tested information and graphics. Messages are developed through public opinion research and expert scientific and technical review. Information is distributed through mass media, public service announcements, the Internet, point-of-purchase, and school and community initiatives. Material is available to use nationwide by public health, nutrition, food science, education, and special constituency groups.

USDA, FDA, and others in the Partnership sponsor a "Partner's Toolkit" that contains flyers, posters, and a CD with additional educational material. "Consumer Education Planning Guides" mailed to food safety educators include media material such as a press release and public service announcements as well as fact sheets, FightBAC brochures, and food-safety related games and activities.

Although these tools are available, they are not used as widely as they could be. Food safety educators indicate that their available time is a limitation *(16)*. Over 30% of educators responding to a USDA survey report that they spend less than 25% of their time on food safety education, with the rest of the time devoted to various other food, nutrition, and health topics. Only 15% of educators spend 50 to 75% of their time on food safety education. Restricted funding is also a limitation. Twenty percent of educators have annual budgets for food safety education of less than $5,000. The availability of additional resources in terms of both finances and staff could result in more extensive delivery of the FightBAC message.

Use of a thermometer to verify adequate cooking is a key component of the Partnership message to cook to proper temperature. The Research Triangle Institute evaluated the effectiveness of the Thermy™ educational material used nationally to promote use of a food thermometer *(37)*. McCurdy and colleagues also explored consumer attitudes toward food thermometers *(26)*. Both groups found that participants already believed they prepared meat safely. People relied on color and were not aware of the importance of using a food thermometer. Some were not familiar with food thermometers and did not know how to read or interpret the results. Consumers suggested developing messages that emphasized that using a thermometer is the only way to be sure the food has reached a sufficiently high temperature to destroy foodborne bacteria, using a thermometer will help protect children or elderly persons, and using a thermometer improves food quality because the food will not be over-cooked. Consumers report that they are reluctant to use thermometers to cook small or thin meat items because they lack the time, forget, are too lazy, or lack confidence in accurately positioning the thermometer in thin cuts of meat *(26)*.

As a result of these findings, comprehensive guide to using a thermometer when cooking thin portions of meat was developed by Washington State University Extension and the University of Idaho *(41)*. *Now You're Cooking … Using a Food Thermometer!* uses color illustrations to demonstrate that brown meat may not have reached 160°F. Further, the brochure describes different types of thermometers, demonstrates how to use a thermometer to determine end point temperature in burgers, and describes with text and illustrations how to most effectively cook a burger to the recommended end point temperature.

USDA, in partnership with others, developed educational material targeted to specific audiences. *Listeriosis and Pregnancy — What is Your Risk?* produced by the Association of Women's Health, Obstetric and Neonatal Nurses, the International Food Information Council Foundation, USDA, and US Department of Health and Human Services in 2001 utilizes the four FightBAC messages in conjunction with text and photos to explain *Listeria* risk and protection practices. *Protecting Your Baby and Yourself from Listeriosis*, written by USDA in 2004, includes additional pictures and repeats the same basic messages. *To Your Health! Food Safety for Seniors*, published in 2000, targets older Americans with larger print, simple pictures, and updated end-point cook temperatures.

A team of food safety educators from Washington State University, Ohio State University, and Colorado State University developed food safety materials for highest risk consumers. Available for free download are materials for persons living with HIV/AIDS, cancer, bone marrow transplants, and others *(21, 28–30)*. These materials, developed in consultation with the target audience, included specific information on shopping, storing, cooking, and handling leftovers. Tips for using a thermometer are included, as well as updated information on safe end point temperatures of various foods.

EFFECT OF EDUCATIONAL PROGRAMS ON BEHAVIOR

While food safety messages are tested with the consumers, changing consumer practices is challenging. Survey results on consumer attitudes and practices indicate increased awareness in several areas:

Hand washing

People appear to be more aware that hand washing is an important component of food safety.

In an annual survey repeated over several years, consumers were asked to volunteer practices they follow to keep food safe. In 1990, no consumers volunteered that they wash their hands *(32)*. In 2005–2007, between 74 and 76% identified washing hands as something they do "every time" *(18)*. Further, a review of select safe-handling practices indicates that more consumers report washing their hands with soap after handling raw meat or poultry, with 66% reporting washing in 1993, 76% in 1998 and 82% in 2001 *(4)*. In 2009, 87% reported washing their hands with soap and water, but this percentage had decreased from 92% in 2008 *(23)*.

Do consumers really wash every time? The American Society for Microbiology has repeatedly shown that actual behavior is frequently different from reported behavior. For example, 92% of Americans say they wash their hands after using a restroom, but when observed, only 88% of women and 66% of men actually wash their hands *(5)*. Video taping consumers in their homes while preparing a meal revealed that 45% of subjects attempted to wash their hands before starting meal preparation, of which 38% used soap *(2)*. This indicates that consumers know that hand washing is important, but people may not always wash as frequently as food safety authorities recommend.

Cross-contamination

Consumer response to a question on cleaning cutting boards indicates an increasing percentage respond with recommended behavior. In 1996 and 1997, 7% of consumers acknowledged that they do not always wash their hands after handling raw meat or poultry, and 7% also admitted that they do not always wash the cutting board after cutting these raw foods *(39)*. Proper cleaning of cutting boards or other surfaces after cutting raw meat or poultry was reported by 68% of consumers in 1993, 79% in 1998, and 85% in 2001 *(4)*. In contrast, in 2009, only 50% of consumers reported using different or freshly cleaned cutting boards between raw meat and poultry and produce *(23)*. Others found that in 1999 and 2002, 18% of consumers did not wash the plate between using it to hold raw and cooked meat *(14)*.

People may overstate what they perceive as the recommended behavior. Actual observation again reveals that consumers do not always follow recommended practices. When consumers were observed during meal preparation, over 477 cross-contamination events occurred. Most of these, 84%, involved contamination of ready to eat foods with raw meat or poultry *(2)*.

Thorough cooking of ground beef

A national telephone survey conducted between December 1992 and February 1993 found that 23% of consumers served home prepared hamburgers rare or medium *(24)*. In 1996 and 1997, 10% of consumers interviewed said they had eaten undercooked hamburger in the five days prior to the interview, while 30% said they preferred undercooked hamburger *(39)*. In 1998 and 2001, those who said they had eaten rare or medium burgers decreased to 17 and 18%, respectively *(4)*.

Use of meat thermometer to determine doneness

More consumers reported owning a meat thermometer in 2001, at 60%, compared to only 46 in 1998 *(4)*. In 1998, 22% of consumers reported using a meat thermometer to determine when roasts or large pieces of meat are done. This percentage increased to 32% in 2001. Use of a thermometer is not an ingrained behavior. In 2009, 71% responded that they cook food to the required temperature. However, only 25% said they used a thermometer to check doneness of meat and poultry items *(23)*. The percentage using a meat thermometer when cooking hamburgers is much lower. Only 3% indicated that they used a thermometer in 1998, and 6% in 2001 *(4)*. Consumers can accidentally undercook ground beef that is used as part of a large meal item. Even though consumers believed their meatloaf was fully cooked, 46% of the meatloaves had not reached the recommended temperature of 160°F *(2)*.

Popular sources of recipes do not encourage use of a thermometer but rather rely on time of cooking and color. Celebrity chef Bobby Flay describes several tasty ways to cook burgers in the Sunday newspaper insert, *Parade* magazine *(17)*. Readers are told to "Grill for 3-4 minutes on each side, until golden brown and cooked medium inside." The September 2009 issue of *Saveur* magazine featuring *The Burger Bible* focuses on flavorful ingredients. Readers are advised to "cook burgers, flipping once, until cooked to desired doneness, about 12 minutes total for medium rare"*(6)*. In the article "Ultimate Burgers," *Sunset Magazine* advises readers to grill burgers 4 to 6 minutes, turning once for rare, and ten minutes for medium to well-done burgers *(42)*. Cooks are advised to "check doneness," but use of a thermometer is not mentioned. Perhaps the most shocking advice comes from the *New York Times (40)*. The writer interviewed several chefs from around the country, gleaning tips from each to share with the reader. None mention use of a thermometer. The paper reports that Seamus Mullen, the chef and an owner of the Boqueria restaurants in the Flatiron district and SoHo, uses a wire cake tester to determine doneness. *"We stick it in the middle through the side," he said. "If it's barely warm to the lips, it's rare. If it's like bath water, it's medium rare. The temperature will never lie. It takes the guesswork out of everything."*

Knowledge and behavior

Surveys indicate that consumer knowledge of several key messages on safe handling has increased, but knowledge gaps still exist *(4, 36)*. In some cases, people are not familiar with details of the recommendation. They do not know the appropriate end-point temperature for cooked hamburger or the appropriate temperature for the refrigerator. People do not realize the importance of hand washing, and they think that rinsing hands or a cutting board with water constitutes adequate cleaning.

Even if they know the recommendations, people do not always follow them. People say that the recommendations do not apply to them, or that they are too busy

and the recommended practices are inconvenient *(9, 36)*. Taste preference also plays an important role in food choice. Some prefer their burgers cooked to rare *(35)*. McIntosh and coworkers found that awareness of the danger of improperly cooked hamburger, knowledge of foodborne pathogens, and knowledge of food safety practices had no effect on willingness to change burger cooking practices *(27)*.

Knowledge and behavior of those at highest risk

Athearn et al. *(8)* found that pregnant women interviewed through focus groups expressed moderate concern about food safety and had made some changes since becoming pregnant; however, many were not following seven of 12 recommended practices. Women believed their food was safe and resisted change because of convenience or taste preference. Pregnant women and those at increased risk for *Listeria* infection said that they did not want to reheat luncheon meat.

Focus group discussions revealed that persons with HIV/AIDS had "weakly positive" attitudes toward food safety and that many consumed foods that would be considered risky *(22)*. Initially, people were resistant to and confused about many safety recommendations. Initially, project participants did not want to use a food thermometer and did not want to avoid favorite foods, such as unheated deli meats. Barriers to accepting the food safety recommendations include lack of understanding why the practices are necessary, willingness to take risks, resistance to change, feeling that someone else, such as food processors, should control food-related risks, and belief that risks could be controlled by their own food preparation actions. Even after hearing why extra food safety precautions are appropriate for their health conditions, participants were not willing to adopt all recommendations. The most widely accepted recommendation was that regarding hand washing. Resistance was strongest for the recommendations to avoid unheated lunchmeats and to use a thermometer to determine safe cooking temperature.

SUMMARY AND IMPLICATIONS

Food safety education is available in more venues today than in previous decades. Messages are directed to the general audience as well as populations at increased risk, such as children, pregnant women, older people, and those whose immunity is compromised. Guidelines are specific, with details on how to wash hands and cooking surfaces, how cool to keep the refrigerator, and the appropriate end temperature for cooked ground beef. Messages are presented nationwide, but consumers do not remember the details of how cold or how hot food should be held. Many do not follow all the recommendations. People think they already handle food safely and are reluctant to change habitual behavior. Many will not sacrifice flavor preference for safe handling. In summary, a substantial number of consumers continue to follow unsafe food handling practices. Education alone is not sufficient to protect against foodborne disease.

According to the International Food Information Council Foundation's fourth annual Food & Health Survey, more than half of Americans think foodborne illness from bacteria, such as *E. coli* and *Salmonella*, is the most important food safety issue today *(23)*. Failure to offer food that is free of pathogens has a profound impact on consumer confidence in the food supply and likelihood to select specific food items in the future. A 2009 nationwide survey found that less than 20% of consumers trust food companies to develop and sell food products that are safe and healthy *(7)*. Consumers indicated that when they heard of recalls, they changed their buying practices, with 63% saying they will not buy the food in question again until the source of contamination has been found and eliminated. Although most consumers in this survey recalled contamination incidents with peanut butter, spinach, tomatoes, and ground beef, recalls and foodborne illnesses traced to these products continues to be in the news.

This author believes that to reduce the likelihood of a foodborne illness outbreak, the meat industry should expand use of advanced food safety technology such as high pressure processing and irradiation. These treatments greatly reduce levels of pathogens that cause illness from accidental cross-contamination or undercooking. Use of these technologies will benefit the meat industry through reduction of meat-related foodborne illnesses and fewer ground beef recalls. Additionally, the public will be protected from pathogens that cause devastating foodborne illness. The food service industry must join the efforts to enhance safety by using products processed for added safety. Similarly, consumers can make safer choices only if supermarkets offer foods processed for added safety. Health educators should continue to advocate safe food handling, coupled with promoting the advantages of safety-enhanced food.

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In Memory

Helene Uhlman

Hobart, Indiana

We extend our deepest sympathy to the family of Helene Uhlman who recently passed away. IAFP will always have sincere gratitude for her contribution to the Association and the profession. An IAFP Member since 1969, it was during that decade that Ms. Uhlman became the first female certified milk inspector in the US Grade "A" Milk Program. She later became the first female Grade "A" Milk Plant Inspector.

Ms. Uhlman's 40-year career in the industry encompassed appointments as Project Director for the tri-city Northwest Indiana Grade "A" Milk Cooperation, which evolved into a seven-county Indiana State Department of Health (ISDH) contractual agreement; Director of Sanitation and first female Administrator for the City of Gary Health Department; Project Director for a stop-smoking program initiated by ISDH with the American Cancer Society; and as Administrator for the City of Hammond Health Department.

Ms. Uhlman served the IAFP Affiliate Council as Delegate of the Indiana Environmental Health Association since 1969, chairing the council for three different terms. She was active on the Dairy Quality and Safety PDG since 1997, chairing its predecessor groups; served as Food Protection Committee Chairperson; and was active in the former Bridge Committee between IAFP and the National Environmental Health Association, of which she was also a longtime active member.

A devoted advocate and mentor for female industry professionals, Ms. Uhlman was instrumental in encouraging women to become more active in IAFP. By reviewing the Association's Membership rosters, Annual Meeting attendance and presenter lists, and various leadership roles over the years, the success of her efforts is apparent.

In 1998, she received the IAFP Honorary Life Membership Award.

AWARD NOMINATIONS

The International Association for Food Protection welcomes your nominations for our Association Awards. Nominate your colleagues for one of the Awards listed below. You do not have to be an IAFP Member to nominate a deserving professional. Nomination criteria is available at:

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- Persons nominated for individual awards must be current IAFP Members. Black Pearl Award nominees must be companies employing current IAFP Members. GMA Food Safety Award and Frozen Food Foundation Research nominees do not have to be IAFP Members.
- Previous award winners are not eligible for the same award.
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- Presentation of awards will be during the Awards Banquet on August 4, at IAFP 2010 in Anaheim, California.

Contact IAFP for questions regarding nominations.

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Plaque and $1,500 Honorarium
Sponsored by ConAgra Foods, Inc.

Presented to an individual for many years of dedication and devotion to the Association ideals and its objectives.

Food Safety Innovation Award

Plaque and $2,500 Honorarium
Sponsored by Walmart

Presented to a Member or organization for creating a new idea, practice or product that has had a positive impact on food safety, thus, improving public health and the quality of life.

International Leadership Award

Plaque, $1,500 Honorarium
and Reimbursement to attend IAFP 2009
Sponsored by Cargill, Inc.

Presented to an individual for dedication to the high ideals and objectives of IAFP and for promotion of the mission of the Association in countries outside of the United States and Canada.

GMA Food Safety Award

Plaque and $3,000 Honorarium
Sponsored by Grocery Manufacturers Association

This Award alternates between individuals and groups or organizations. In 2010, the award will be presented to a group or organization in recognition of a long history of outstanding contributions to food safety research and education.

Frozen Food Foundation Freezing Research Award

Plaque and $2,000 Honorarium
Sponsored by the Frozen Food Foundation

Presented to an individual, group or organization for preeminence and outstanding contributions in research that impacts food-safety attributes of freezing.

Maurice Weber Laboratorian Award

Plaque and $1,500 Honorarium
Sponsored by Weber Scientific

Presented to an individual for outstanding contributions in the laboratory, recognizing a commitment to the development of innovative and practical analytical approaches in support of food safety.

Larry Beuchat Young Researcher Award

Plaque and $2,000 Honorarium
Sponsored by bioMérieux, Inc.

Presented to a young researcher who has shown outstanding ability and professional promise in the early years of their career.

Sanitarian Award

Plaque and $1,500 Honorarium
Sponsored by Ecolab Inc.

Presented to an individual for dedicated and exceptional service to the profession of Sanitarian, serving the public and the food industry.

Elmer Marth Educator Award

Plaque and $1,500 Honorarium
Sponsored by Nelson-Jameson, Inc.

Presented to an individual for dedicated and exceptional contributions to the profession of the Educator.

Harold Barnum Industry Award

Plaque and $1,500 Honorarium
Sponsored by Nasco International, Inc.

Presented to an individual for dedication and exceptional service to IAFP, the public, and the food industry.

CALL FOR ABSTRACTS
IAFP 2010

August 1–4, 2010

Anaheim Convention Center
Anaheim, California

General Information

1. Complete the Abstract Submission Form Online.
2. All presenters must register for the Annual Meeting and assume responsibility for their own transportation, lodging, and registration fees.
3. There is no limit on the number of abstracts individuals may submit. However, one of the authors must deliver the presentation.
4. Accepted abstracts will be published in the Program and Abstract Book. Editorial changes may be made to accepted abstracts at the discretion of the Program Committee.
5. Membership in the Association is not required for presenting a paper at IAFP 2010.

Presentation Format

1. Technical – Oral presentations will be scheduled with a maximum of 15 minutes, including a two to four-minute discussion. LCD projectors will be available and computers will be supplied by the convenors.
2. Poster – Freestanding boards will be provided for presenting posters. Poster presentation surface area is 48" high by 96" wide (121.9 cm × 243.8 cm). Handouts may be used, but audiovisual equipment will not be available. The presenter is responsible for bringing pins and velcro. All posters should include the title and author information.

   Note: The Program Committee reserves the right to make the final determination on which format will be used for each presentation.

Instructions for Preparing Abstracts

1. All abstracts must be written in clear and correct English.
2. All abstracts must be approved and signed off by all authors before submission. The results should not have been presented/published previously by any one of the authors.
3. Title – The title should be short but descriptive. The title should be in title case.
4. Authors – List all authors using the following style: first name or initials followed by the surname.
5. Presenter Name and Title – List the full name and title of the person who will present the paper.
6. Presenter Address – List the name of the department, institution and full postal address (including zip/postal code and country).
7. Phone Number – List the phone number, including area, country, and city codes of the presenter.
8. Fax Number – List the fax number, including area, country, and city codes of the presenter.
9. E-mail – List the E-mail address for the presenter.
10. Format preferred – Check the box to indicate oral or poster format. The Program Committee reserves the right to make the final determination of presentation format.
11. Category – The categories are used by the Program Committee to organize the posters and technical sessions. Please check 2–3 boxes which best describe the categories for which the abstract is suitable.

Categories used for this years Annual Meeting are:

Pathogens
Microbial Food Spoilage
General Microbiology
Sanitation
Produce
Meat and Poultry
Seafood
Dairy and Other Food Commodities
Beverages and Water

Antimicrobials
Risk Assessment
Epidemiology
Non-Microbial Food Safety
Food Toxicology
Applied Laboratory Methods
Novel Laboratory Methods
Education/Other

12. Developing Scientist Awards Competition – Check the box to indicate if the presenter is a student wishing to be considered in this competition. The student will make the initial submission, and IAFP will E-mail the abstract to the major professor, who will complete the submission process. For more information, see "Call for Entrants in the Developing Scientist Awards Competitions."
13. Abstract – Key the abstract into the web-based system. In addition, a double-spaced copy of the abstract, typed in 12-point font in MS Word, should be E-mailed to abstracts@foodprotection.org at the time of submission. Limit the Abstract length to approximately 300 words.

In addition to following these instructions, authors should carefully review the sections on selection criteria and rejection reasons as well as the sample abstract before submitting the abstract. Original research abstracts MUST be in the following format:

Introduction: Provide background, statement of problem, or basis of the study. (2–3 sentences)

Purpose: State the purpose or objectives of the study (1–2 sentences)

Methods: State the methodology used in the study (2-3 sentences). The methods should be specific enough that researchers in the same or similar field would understand the basic experimental design or approach.

Results: Describe the results obtained in the study (2–3 sentences). NOTE: Specific results, with statistical analysis (if appropriate), MUST be provided. A statement of "results pending" or "to be discussed" is not acceptable and will be grounds for abstract rejection. Results should be summarized; do NOT use tables or figures.

Significance: State the significance of the findings to food protection and/or public health (1–2 sentences) NOTE: Do not include reference citations in the Abstract. Please see sample abstracts for further guidance on abstract structure.

Failure to follow the above formatting instructions is reason for rejection.

Abstracts submitted in the Education category MUST present an improvement or innovation on a proven method in order to educate others about a food protection related topic. There should be a way to measure the outcomes and substantiate the improvements and/or outcomes. If measured, the sample size should be sufficiently large to represent the intended population.

Visit the IAFP Web site at htpp:www.foodprotection.org for a sample abstract.

Abstract Submission

Abstracts submitted for IAFP 2010 will be evaluated for acceptance by the Program Committee. Please be sure to follow the instructions above carefully; failure to do so may result in rejection. Information in the abstract data must not have been previously published in a copyrighted journal.

Abstracts must be received no later than January 20, 2010. Completed abstract and information must be submitted online. Use the online submission form at www.foodprotection.org. In addition, a double-spaced copy of the abstract, typed in 12-point font in MS Word, should be E-mailed to abstracts@foodprotection.org at the time of submission. You will receive an E-mail confirming receipt of your submission.

Selection Criteria

1. Abstracts should be structured as described above.
2. Abstracts must report the results of original research pertinent to the subject matter. Work should report the results of new, applied studies dealing with: (i) causes (e.g., microorganisms, chemicals, natural toxicants) and control of all forms of foodborne illness; (ii) causes (e.g., microorganisms, chemicals, insects, rodents) and control of food contamination and/or spoilage; (iii) food protection from farm-to-fork (including all sectors of the chain including production, processing, distribution, retail, and consumer phases); (iv) novel approaches for the tracking of foodborne pathogens or the study of pathogenesis and/or microbial ecology; (v) public health significance of foodborne disease, including outbreak investigation; (vi) non-microbiology food protection issues (food toxicology, allergens, chemical contaminants); (vii) advances in sanitation, quality control/assurance, and food protection systems; (viii) advances in laboratory methods; and (ix) food protection risk assessment. Work may also report subject matter of an educational nature.
3. Research must be based on accepted scientific practices.

4. Research should not have been previously presented nor intended for presentation at another scientific meeting. Work should not appear in print prior to the Annual Meeting.

Rejection Reasons

1. Abstract was not prepared according to the "Instructions for Preparing Abstracts." This includes abstracts that are too lengthy.
2. Abstract reports inappropriate or unacceptable subject matter about advancing food safety worldwide.
3. Abstract is not based on accepted scientific or educational practices and/or the quality of the research or scientific/educational approach is inadequate.
4. Potential for the approach to be practically used to enhance food safety is not apparent.
5. Work reported appears to be incomplete and/or data and statistical validity are not presented. Percentages alone are not acceptable unless sample sizes (both numbers of samples and sample weight or volume) are reported. Detection limits should be specified when stating that populations are below these limits. Indicating that data will only appear in the presentation without including them in the abstract is NOT acceptable.
6. Abstract was poorly written or prepared. This includes spelling and grammatical errors or improper English language usage.
7. Results have been presented/published previously by one of the authors.
8. Abstract was received after the deadline for submission.
9. Abstract contains information that is in violation of the International Association for Food Protection Policy on Commercialism.
10. Abstract subject is similar to other(s) submitted by same author. (The committee reserves the right to combine such abstracts.)
11. Abstracts that report research that is confirmatory of previous studies and/or lacks originality will be given low priority for acceptance.

Projected Deadlines/Notification

Abstract Submission Deadline: January 20, 2010.
Acceptance/Rejection Notification: March 9, 2010.

Contact Information

Questions regarding abstract submission can be directed to Tamara P. Ford, 515.276.3344 or 800.369.6337; E-mail: tford@foodprotection.org

Program Chairperson

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Call for Entrants in the Developing Scientist Awards Competitions

Supported by the International Association for Food Protection Foundation

The International Association for Food Protection is pleased to announce the continuation of its program to encourage and recognize the work of students and recent graduates in the field of food safety research. Qualified individuals may enter either the oral or poster competition.

Purpose

1. To encourage students and recent graduates to present their original research at the Annual Meeting.
2. To foster professionalism in students and recent graduates through contact with peers and professional Members of the Association.
3. To encourage participation by students and recent graduates in the Association and the Annual Meeting.

Presentation Format

Oral Competition — The Developing Scientist Oral Awards Competition is open to graduate students (enrolled or recent graduates) from M.S. or Ph.D. programs or undergraduate students at accredited universities or colleges. Presentations are limited to 15 minutes, which includes two to four minutes for discussion.

Poster Competition — The Developing Scientist Poster Awards Competition is open to students (enrolled or recent graduates) from undergraduate or graduate programs at accredited universities or colleges. The presenter must be present to answer questions for a specified time (approximately two hours) during the assigned session. Specific requirements for presentations will be provided at a later date.

General Information

1. Competition entrants cannot have graduated more than a year prior to the deadline for submitting abstracts.
2. Accredited universities or colleges must deal with environmental, food or dairy sanitation, protection or safety research.
3. The work must represent original research completed and presented by the entrant.
4. Entrants may enter only one paper in either the oral or poster competition.
5. All entrants must register for the Annual Meeting and assume responsibility for their own transportation, lodging, and registration fees.
6. Acceptance of your abstract for presentation is independent of acceptance as a competition finalist. Competition entrants who are chosen as finalists will be notified of their status by the chairperson by May 3, 2010.
7. Entrants who are full-time students, with accepted abstracts will receive a complimentary, one-year Student Membership with *JFP* Online.
8. In addition to adhering to the instruction in the "Call for Abstracts," competition entrants must check the box to indicate if the paper is to be presented by a student in this competition. A copy of the abstract will be E-mailed to the major professor for final approval.
9. You must also specify full-time student or part-time student.

Judging Criteria

A panel of judges will evaluate abstracts and presentations. Selection of up to ten finalists for each competition will be based on evaluations of the abstracts and the scientific quality of the work. All entrants will be advised of the results by May 3, 2010. Only competition finalists will be judged at the Annual Meeting and will be eligible for the awards.

Judging criteria will be based on the following:

1. Abstract — Clarity, comprehensiveness and conciseness.
2. Scientific Quality — Adequacy of experimental design (methodology, replication, controls), extent to which objectives were met, difficulty and thoroughness of research, validity of conclusions based upon data, technical merit and contribution to science.
3. Presentation — Organization (clarity of introduction, objectives, methods, results and conclusions), quality of visuals, quality and poise of presentation, answering questions, and knowledge of subject.

Finalists

Awards will be presented at the International Association for Food Protection Annual Meeting Awards Banquet to the top three presenters (first, second and third places) in both the oral and poster competitions. All finalists are expected to be present at the banquet where the award winners will be announced and recognized.

Awards

First Place — $600 and an engraved plaque
Second Place — $400 and a framed certificate
Third Place — $200 and a framed certificate

Award winners will receive a complimentary, one-year Membership including *Food Protection Trends*, *Journal of Food Protection*, and *JFP* Online.

Policy on Commercialism
for Annual Meeting Presentations

1. INTRODUCTION

No printed media, technical sessions, symposia, posters, seminars, short courses, and/or other related types of forums and discussions offered under the auspices of the International Association for Food Protection (hereafter referred to as to Association forums) are to be used as platforms for commercial sales or presentations by authors and/or presenters (hereafter referred to as authors) without the express permission of the staff or Executive Board. The Association enforces this policy in order to restrict commercialism in technical manuscripts, graphics, oral presentations, poster presentations, panel discussions, symposia papers, and all other type submissions and presentations (hereafter referred to as submissions and presentations), so that scientific merit is not diluted by proprietary secrecy.

Excessive use of brand names, product names or logos, failure to substantiate performance claims, and failure to objectively discuss alternative methods, processes, and equipment are indicators of sales pitches. Restricting commercialism benefits both the authors and recipients of submissions and presentations.

This policy has been written to serve as the basis for identifying commercialism in submissions and presentations prepared for the Association forums.

2. TECHNICAL CONTENT OF SUBMISSIONS AND PRESENTATIONS

2.1 Original Work

The presentation of new technical information is to be encouraged. In addition to the commercialism evaluation, all submissions and presentations will be individually evaluated by the Program Committee chairperson, technical reviewers selected by the Program Committee chairperson, session convenor, and/or staff on the basis of originality before inclusion in the program.

2.2 Substantiating Data

Submissions and presentations should present technical conclusions derived from technical data. If products or services are described, all reported capabilities, features or benefits, and performance parameters must be substantiated by data or by an acceptable explanation as to why the data are unavailable (e.g., incomplete, not collected, etc.) and, if it will become available, when. The explanation for unavailable data will be considered by the Program Committee chairperson and/or technical reviewers selected by the Program Committee chairperson to ascertain if the presentation is acceptable without the data. Serious consideration should be given to withholding submissions and presentations until the data are available, as only those conclusions that might be reasonably drawn from the data may be presented. Claims of benefit and/or technical conclusions not supported by the presented data are prohibited.

2.3 Trade Names

Excessive use of brand names, product names, trade names, and/or trademarks is forbidden. A general guideline is to use proprietary names once and thereafter to use generic descriptors or neutral designations. Where this would make the submission or presentation significantly more difficult to understand, the Program Committee chairperson, technical reviewers selected by the Program Committee chairperson, session convenor, and/or staff, will judge whether the use of trade names, etc., is necessary and acceptable.

2.4 "Industry Practice" Statements

It may be useful to report the extent of application of technologies, products, or services; however, such statements should review the extent of application of all generically similar technologies, products, or services in the field. Specific commercial installations may be cited to the extent that their data are discussed in the submission or presentation.

2.5 Ranking

Although general comparisons of products and services are prohibited, specific generic comparisons that are substantiated by the reported data are allowed.

2.6 Proprietary Information (See also 2.2.)

Some information about products or services may not be publishable because it is proprietary to the author's agency or company or to the user. However, the scientific principles and validation of performance parameters must be described for such products or services. Conclusions and/or comparisons may be made only on the basis of reported data.

2.7 Capabilities

Discussion of corporate capabilities or experiences are prohibited unless they pertain to the specific presented data.

3. GRAPHICS

3.1 Purpose

Slides, photographs, videos, illustrations, art work, and any other type visual aids appearing with the printed text in submissions or used in presentations (hereafter referred to as graphics) should be included only to clarify technical points. Graphics which primarily promote a product or service will not be allowed. (See also 4.6.)

3.2 Source

Graphics should relate specifically to the technical presentation. General graphics regularly shown in, or intended for, sales presentations cannot be used.

3.3 Company Identification

Names or logos of agencies or companies supplying goods or services must not be the focal point of the slide. Names or logos may be shown on each slide so long as they are not distracting from the overall presentation.

3.4 Copies

Graphics that are not included in the preprint may be shown during the presentation only if they have been reviewed in advance by the Program Committee chairperson, session convenor, and/or staff, and have been determined to comply with this policy. Copies of these additional graphics must be available from the author on request by individual attendees. It is the responsibility of the session convenor to verify that all graphics to be shown have been cleared by Program Committee chairperson, session convenor, staff, or other reviewers designated by the Program Committee chairperson.

4. INTERPRETATION AND ENFORCEMENT

4.1 Distribution

This policy will be sent to all authors of submissions and presentations in the Association forums.

4.2 Assessment Process

Reviewers of submissions and presentations will accept only those that comply with this policy. Drafts of submissions and presentations will be reviewed for commercialism concurrently by both staff and technical reviewers selected by the Program Committee chairperson. All reviewer comments shall be sent to and coordinated by either the Program Committee chairperson or the designated staff. If any submissions are found to violate this policy, authors will be informed and invited to resubmit their materials in revised form before the designated deadline.

4.3 Author Awareness

In addition to receiving a printed copy of this policy, all authors presenting in a forum will be reminded of this policy by the Program Committee chairperson, their session convenor, or the staff, whichever is appropriate.

4.4 Monitoring

Session convenors are responsible for ensuring that presentations comply with this policy. If it is determined by the session convenor that a violation or violations have occurred or are occurring, he or she will publicly request that the author immediately discontinue any and all presentations (oral, visual, audio, etc.) and will notify the Program Committee chairperson and staff of the action taken.

4.5 Enforcement

While technical reviewers, session convenors, and/or staff may all check submissions and presentations for commercialism, ultimately it is the responsibility of the Program Committee chairperson to enforce this policy through the session convenors and staff.

4.6 Penalties

If the author of a submission or presentation violates this policy, the Program Committee chairperson will notify the author and the author's agency or company of the violation in writing. If an additional violation or violations occur after a written warning has been issued to an author and his agency or company, the Association reserves the right to ban the author and the author's agency or company from making presentations in the Association forums for a period of up to two (2) years following the violation or violations.

NEW MEMBERS

BELGIUM

Liesbeth Jacxsens
Ghent University
Ghent

BRUNEI DARUSSALAM

Tuti Safwati Omar
National Standard Centre, Ministry of Industry & Primary Resources
Tutong

CANADA

Nicolas Bachand
University of Montreal
Sherbrooke, Quebec

Timothy C. Ells
Agriculture and Agri-Food Canada
Kentville, Nova Scotia

Marlee Loiseue
V.I.H.A.
Victoria, British Columbia

Grant L. Penn
Glanbia Nutritionals (Canada) Inc.
Angusville, Manitoba

John Pickles
Vancouver Coastal Health
North Vancouver, British Columbia

Ting Zhou
Agriculture and Agri-Food Canada
Guelph, Ontario

CHILE

Sebastian Gutierrez
QTech Ltda.
Santiago

Rolf G. Kümmerlin
Kummerlin S.A.
Concepción

FRANCE

Nelly Dumont
bioMérieux
Marcy L'Etoile

Geraldine Ramage
Chemin De L'Orme
Marcy L'Etoile

GERMANY

Ulrich Busch
Bavarian Health and Food Safety Authority
Oberschleissheim

Jochen Weiss
University of Hohenheim
Garbenstrasse, Stuttgart

INDIA

S. Hemawati
New Delhi

Sudarsan Muralidharan
Alltech Biotechnology Pvt. Ltd.
Kodihalli

IRAN

Ramin Khaksar
Shaheed Beheshti University
Tehran

ISRAEL

Gideon Zipori
Institut of Foodsafety & Quality
Rosh-HaAyin

THE NETHERLANDS

Eelco Heintz
Purac Biochem
Gorinchem

Peter D. Tips, Sr.
Mead Johnson Nutrition
Berlicum

SERBIA

Draga Crnobrnja
City Center for Public Health
Belgrade

Sladjana Randjelovic
City Center for Public Health
Belgrade

SOUTH KOREA

Hye-Kyung Moon
Changwon National University
Changwon, Kyungnam

SPAIN

M. Carmen Vidal-carou
University of Barcelona
Barcelona

UNITED ARAB EMIRATES

Muhammad Khalid Saeed
Dubai Municipality
Dubai

Manju Stephen
National Corporation for Tourism & Hotels
Abu Dhabi

UNITED KINGDOM

Jonathan Cloke
Oxoid – Thermo Fisher Scientific
Basingstoke, Hampshire

UNITED STATES

ARIZONA

Anna Pfender
Arizona Dept. of Agriculture
Phoenix

CALIFORNIA

Bethina Hernandez
Heinz San Diego
San Diego

GEORGIA

Walid Alali
University of Georgia
Griffin

NEW MEMBERS

ILLINOIS

Dorothy C.S. David
Peoria City County Health Dept.
Peoria

INDIANA

Richa Vaid
Purdue University
West Lafayette

MARYLAND

Cheryl Burgess
Food & Drug Administration
College Park

MaryAnn Principato
Food & Drug Administration
Laurel

Linda Verrill
US Food and Drug Administration
College Park

MICHIGAN

Joan Bowman
International Food Protection Training Institute
Battle Creek

Alissa M. Wesche
Old Orchard Brands
Rockford

MINNESOTA

Lance Heaton
Provesta
Hutchinson

Mark Wagenius
ConAgra Foods
Minneapolis

MISSOURI

Linda J. Steffens
St. Anthony's Medical Center
St. Louis

NEW JERSEY

John J. Reynolds, II
Food Sciences Corp.
Mount Laurel

NORTH CAROLINA

Margaret A. Duckson
Virginia Tech
Staley

Jackie R. Glover
US Dept. of Agriculture
Gastonia

Paul L. Knechtges
East Carolina University
Harrellsville

NORTH DAKOTA

Michael W. Mahero
North Dakota State University
Fargo

OHIO

Keith Eames
New Philadelphia City Health Dept.
New Philadelphia

TENNESSEE

Steve Calhoun
American Peanut Council
Cleveland

Fur-Chi Chen
Tennessee State University
Nashville

TEXAS

Davonna Koebrick
Texas DSHS
Victoria

Adam W. Tittor
Tittor Consulting
Stephenville

Chitra N. Wendakoon
New Mexico State University
Austin

UTAH

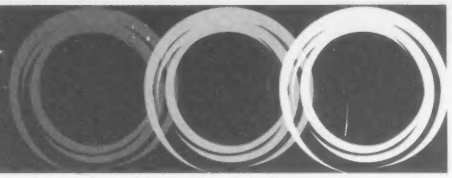
Michelle Cooke
Weber – Morgan Health Dept.
Ogden

WASHINGTON

Raghupathy Ramaswamy
Avure Technologies Inc.
Kent

James M. Wilson
Veratect Corporation
Kirkland

WHAT'S HAPPENING IN FOOD SAFETY



FMI Statement on FDA Launch of Reportable Food Portal and Registry

The Food Marketing Institute (FMI) issued the following statement from Leslie Sarasin, president and chief executive officer, regarding this week's launch by the Food and Drug Administration (FDA) of a Reportable Food Electronic Portal and Registry.

"We commend FDA for launching version 1.0 of the Reportable Food Electronic Portal and Registry to fulfill the congressional directive to track patterns of adulteration in food. We look forward to working with FDA through the implementation process and on additional food safety measures."

"The agency's electronic database should work well with the industry's Rapid Recall Exchange. This online initiative, set to be launched later this month, is designed to expedite supplier notification of food recalls to food retailers and wholesalers with more complete and accurate information."

3-A SSI Issues Revamped Standard for Metal Tubing

3-A Sanitary Standards, Inc. announces the release of a comprehensive revision of 3-A® Sanitary Standard #33-02, Metal Tubing. This newly published revision is the major (5-year) update of this Standard.

The Metal Tubing standard is widely referenced in the dairy processing industry and covers the sanitary aspects of metal tubing used to conduct milk and milk products. This standard does not apply to the assembly of metal tubing into further fabricated forms or systems. This standard includes the requirements for the materials of construction and fabrication techniques, including surface finish. The polishing requirement, which appeared in previous versions of the standard, was removed due to improvements in stainless steel manufacturing techniques.

Copies of the new standard are now available for purchase in electronic format or printed version through the 3-A SSI Web site at www.3-a.org, see 'Purchase Standards and Practices'.

US EPA Registers PURE Bioscience's SDC-based Food Contact Surface Sanitizer

PURE Bioscience, creator of the patented silver dihydrogen citrate (SDC) antimicrobial, has announced that it has obtained US Environmental Protection Agency (EPA) registration for its SDC-based sanitizer for food contact surfaces. The new sanitizer was registered by PURE's wholly owned subsidiary, ETI-H2O, under the trade name Axen®50 for sanitization of food contact surfaces and equipment in dozens of environments including farms, food processing plants, schools, hospitals and other institutions, restaurants and homes.

Michael L. Krall, President and CEO of PURE Bioscience commented, "This long-awaited registration opens new, major markets for PURE Bioscience. Foodborne illnesses create significant health and economic problems in the US and internationally, and PURE welcomes the opportunity to offer a technology to help stem the spread of these dangerous pathogens that cause millions of illnesses."

Mr. Krall continued, "The EPA's registration of Axen50 as a food contact sanitizer cleared a big hurdle for PURE. Now that we've established a food contact tolerance of 50 parts per million of silver, this registration provides two roads to market for SDC-based food contact surface sanitizers via the EPA. We plan to add the extensive broad-spectrum antimicrobial claims from our existing disinfectant registration to the registration of the new food contact sanitizer, and, also through the EPA, we expect to amend our disinfectant product registration claims to add the new food contact sanitization claims. The EPA regulatory work will include state registrations by distributors and is expected to take at least six months."

"In addition, this registration accelerates our ongoing pursuit, through USDA, of additional direct food contact applications of SDC-based formulations as antimicrobial processing aids."

The CDC estimates that foodborne pathogens cause 76 million illnesses per year in the US resulting in 325,000 hospitalizations and 5,200 deaths. And although Americans have come to expect such risks associated with meat products like raw hamburger, the proportion of outbreaks caused by seemingly innocuous fruits and vegetables is increasing. *E. coli* alone causes approximately 70,000 infections each year, and 5–10% of those infected develop a potentially fatal kidney complication called hemolytic uremic syndrome.

Foodborne illness creates not only health but also confidence

issues for consumers. Food recalls can cause a significantly negative economic impact on businesses. For example, salmonellosis is estimated by the CDC to cost more than $1 billion in medical costs and lost wages annually.

Mr. Krall concluded, "This summer's recall of more than 5 million pounds of beef because of suspected *E. coli* contamination is just one example of a string of recalls in the US this year including the well-publicized cookie dough recall and the wide-reaching recalls of peanut and dried milk products. SDC-based food contact surface sanitizers will offer the same benefits of efficacy as our disinfectants along with the same remarkable Category IV toxicity for which no warning statements are required. In addition, SDC-based food contact sanitizers are odorless, colorless, non-corrosive, do not require hazardous materials procedures or gear and do not require rinsing after use. We believe that this combination of unique benefits creates a competitive edge for SDC-based food contact sanitizers."

Food contact surface antimicrobials are processed as "sanitizers" by the EPA and, if registered, can only carry a 60-second sanitization claim, even if laboratory testing demonstrates faster kill times.

SDC is an electrolytically generated source of stabilized ionic silver. As a platform technology, SDC is distinguished from competitors in the marketplace because of its superior efficacy, low toxicity and the inability of bacteria to form a resistance to it. The first new disinfectant active to be registered by the EPA in more than 30 years, SDC-based disinfectants are antiviral, antifungal and antibacterial, including a 30-second kill and 24-hour residual protection against standard indicator bacteria and a two-minute kill claim on MRSA (Methicillin-resistant *Staphylococcus aureus*), CA-MRSA, PVL-MRSA and VRE (Vancomycin-resistant *Enterococcus faecium*). Moreover, SDC-based disinfectants are odorless, colorless, non-corrosive, non-flammable and are compatible with other disinfecting and cleaning chemicals.

Covance Receives ISO Accreditation for North America Nutritional Chemistry and Food Safety Laboratory

Covance Inc. has announced that it has received International Organization for Standardization (ISO) 17025 accreditation for its Nutritional Chemistry and Food Safety laboratory in Madison, Wisconsin. Granted by the American Association for Laboratory Accreditation (A2LA), ISO accreditation confirms compliance with the AOAC Guidelines for Laboratories Performing Microbiological and Chemical Analyses of Food and Pharmaceuticals.

"ISO accreditation confirms Covance's commitment to providing our global clients and the food industry with the highest level of quality data," said Marlo Vasquez, vice president and general manager, Nutritional Chemistry and Food Safety, Covance.

ISO standards provide practical tools for generating confidence, reducing uncertainty, and managing risk. ISO 17025 specifies the general competence requirements for testing laboratories to carry out tests and sampling. Competence requirements include testing performed using standard and/or non-standard methods and laboratory-developed methods.

Food manufacturers around the world request ISO 17025 accreditation of laboratory service providers to ensure quality practices. Laboratory customers, regulatory authorities, and accreditation bodies use ISO 17025 to confirm laboratory competence.

ISO 17025 accreditation follows a variety of other awards recognizing the accuracy and proficiency of Covance's Nutritional Chemistry and Food Safety laboratory, including two 2008 American Association of Cereal Chemists (AACC) Accuracy Awards and several proficiency certificates from both the AACC and the US Department of Agriculture (USDA). Covance's Singapore laboratory received ISO 17025 accreditation in 2008.

With more than 70 years of experience in nutritional testing, Covance plays a leading role in the design of testing programs required to meet regulatory nutrition facts labeling requirements, regulatory mandates and scientific standards. Covance offers expertise in the complete spectrum of recognized nutrients and an unparalleled range of sample matrices.

Dr. Jimmy Keeton Named Head of the Nutrition and Food Sciences Department at Texas A&M University

Dr. Jimmy Keeton has been named head of the nutrition and food sciences dept. at Texas A&M University College of Agriculture and Life Sciences, according to Dr. Mark Hussey, vice chancellor and dean of agriculture.

Dr. Keeton came to Texas A&M in 1984 as an associate professor in the department of animal science. Since then, he has been promoted to full professor and was interim head of the nutrition and food science department since 2007.

He has studied the safety, nutritional value and quality attributes of meat products. He has also

authored or co-authored more than 70 refereed journal articles and 10 textbook chapters, secured six patents and received more than $4 million in grant/contract funding as principle investigator.

Dr. Keeton earned a bachelor's degree in animal husbandry and agricultural education, and a master's and a doctoral degree in food science, all from the University of Tennessee-Knoxville.

The NPD Group Names Mark East to Head North America Food and Beverage Unit

The NPD Group, Inc., a market research company, announces the appointment of Mark East as president of its North America food and beverage business unit, which provides market information and insights used by food, beverage, pharmaceutical, ingredient manufacturers, and retailers, as well as agencies in the public sector. He replaces Arnie Schwartz, who was recently appointed president of NPD's US foodservice unit.

Mr. East was formerly vice president of client development for the North America food and beverage unit. In this role, he and his client development team worked closely with a portfolio of clients in the United States and Canada to provide insights on a wide range of critical trends in consumer eating behavior, attitudes, and usage motivators – from diet and nutrition to food safety and brand awareness.

Prior to joining NPD, Mr. East spent four years as US marketing director for Storck, one of the world's premier confectionery companies. Previous to that, he worked for more than 15 years with Information Resources, Inc., a market research firm, where he started his career in data processing operations before moving into a succession of client service, product management, and marketing roles.

"Mark's experience on both the client and supplier sides and deep understanding of the consumer goods arena will serve his food and beverage clients well," says Randall Smith, group president, US Food and Automotive, Canada and Latin America at NPD. "NPD is the only marketing information company that measures everything that consumers actually eat and drink, and armed with this information and insight, Mark and his team are uniquely positioned to help clients understand the entire food and beverage market."

"The food and beverage industry in the US and Canada is a dynamic, ever-changing market and I look forward to continuing to help NPD clients stay in touch and understand consumers' behaviors and attitudes," says Mr. East. "Our job, as I see it, is to help them make informed decisions to drive greater long-term and short-term marketplace success."

INDUSTRY PRODUCTS

Synbiosis

Danisco Uses AutoZone Automated Zone Sizing System to Ensure Foods are Consistently Protected against Pathogenic Bacteria

Synbiosis, a manufacturer of automated microbiological systems, has announced that international food ingredients company, Danisco is using an AutoZone, automated zone measurement system to reproducibly predict the efficacy of Nisaplin®, a natural bacteriocide which inhibits growth of pathogenic and food spoilage Gram-positive bacteria in food.

Microbiologists at Danisco's Food Protection Division in Denmark liquidize different food samples containing Nisaplin®. They plate them out on 35 cm glass plates of Iso-Sensitest Agar seeded with *Micrococcus luteus*. The Nisaplin® in the food produces 64 zones of inhibition on each plate, which scientists at Danisco can rapidly measure and analyze using the AutoZone system. From the zone size data, they can assess if the correct Nisaplin® levels are present in each food batch.

Malene Svejstrup, application scientist at Danisco explained: "It is important to have the correct dosage of Nisaplin® in the foods we test. If it is too low, it could result in a reduced shelf life of the food. We have been manually measuring inhibition zones with callipers to test Nisaplin® levels for 25 years at Danisco. This method can introduce many variations and results can differ from person to person, which is why we are validating an automated zone sizer to determine if it is a good alternative."

Mrs. Svejstrup continued, "To date, the system has generated promising results and we can measure the zones in half the time it used to take when we were performing manual measurements."

Martin Smith of Synbiosis stated, "Ensuring the quality of food is very important and we are excited that one of the food ingredients companies has chosen to use an AutoZone to standardize a critical food test. Danisco's validation studies with the AutoZone show that microbiologists can save time, while achieving accurate and reproducible results, making the AutoZone an essential tool for testing the activity of bacteriocides in any food manufacturing facility."

Synbiosis
301.662.2863
Frederick, MD
www.synbiosis.com

BAX® System MP Enrichment Media Approved by AOAC for Both *E. coli* O157:H7 and *Salmonella* Testing

The AOAC Research Institute has approved the use of BAX® System *E. coli* O157:H7 MP enrichment media for *Salmonella* testing. Validated on ground beef, beef trim, spinach and lettuce, the BAX® System performed as well as or better than traditional culture methods for detecting *Salmonella*, but with quicker time to result.

The MP enrichment media was originally designed for use with the BAX® System assay for detecting *E. coli* O157:H7 in ground beef and beef trim. Recently, AOAC RI extended certification of that assay to also include lettuce and spinach. This means that the identical MP enrichment protocol has been approved by AOAC RI for both *Salmonella* and *E. coli* O157:H7 testing of those foods.

"Customers can now use the same 8-hour enrichment to test certain types of meat and fresh produce for two different pathogens," said Linda Peng, research microbiologist – DuPont Qualicon. "This will not only save hands-on time, but the single medium will also reduce inventory and storage costs for food companies."

Food processing companies around the world rely on the BAX® system to detect pathogens or other organisms in raw ingredients, finished products and environmental samples. The automated system uses leading-edge technology,

including polymerase chain reaction (PCR) assays, tableted reagents and optimized media to detect *Salmonella*, *Listeria* species, *Listeria monocytogenes*, *E. coli* O157:H7, *Enterobacter sakazakii*, *Campylobacter*, *Staphylococcus aureus*, *Vibrio*, and yeast and mold. With certifications and regulatory approvals in the Americas, Asia and Europe, the BAX® system is recognized globally as one of the most advanced pathogen testing systems available to food companies.

DuPont Qualicon
800.863.6842
Wilmington, DE
www2.dupont.com

Harvard Apparatus

New Smooth, Accurate and Precise Syringe Pump from Harvard Apparatus

Harvard Apparatus has introduced the new PHD ULTRA™ Syringe Pump. The PHD ULTRA sets a new performance standard in syringe pumps for smooth, accurate and precise flow.

Harvard Apparatus introduced the first commercial syringe pump in 1956 and is the global leader in high-performance syringe pumps. The PHD ULTRA™ is designed to meet today's most demanding standards in fluidics applications.

The new Advanced patent-pending flow control mechanics and electronics provide the smoothest, most accurate, and precise flow across the largest flow range.

The new EZ Pro™ Software functions like a PC and contains an advanced methods architecture for preprogrammed quick-start or advanced methods templates.

A new easy-to-use GUI on an advanced color display allows alpha/numeric reporting capability and advanced connectivity at the touch of the screen.

This unit also provides maximum versatility of configuration and application. It can handle flow rates from picoliter to 220 ml/min with the highest accuracy, precision and smoothness of flow.

The PHD ULTRA™ can control remote units 30 ft away, accomodates 2 to 10 syringes for multi-channel or larger reservoir capacities, and contains advanced, preprogrammed operational modes. With the push of a button, alternate between auto-fill continuous-flow, pulsatile, bolus, concentration mode, daisy chain, gradients and flow programming modes.

The functional balance of these features makes the PHD ULTRA™ the ultimate problem solver for your lab or work place in MS, drug infusion, nanofluidics, electro-spinning, aerosol generation, reaction chamber dosing and more.

Solve your most demanding fluidics applications with PHD ULTRA™ fluidics from Harvard Apparatus.

Harvard Apparatus
800.272.2775
Holliston, MA
www.harvardapparatus.com

Strategic Diagnostics Awarded Patent for Use of Bacteriophages in Mircrobiological Assays and Processes

Strategic Diagnostics Inc., (SDI), a provider of biotechnology-based products and services for a broad range of food safety, life science and industrial applications, has announced it has been awarded US Patent No. 7,521,201 B2 for using bacteriophages in microbiological assay tests and processes. The invention is a rapid bacterial detection method that reduces or eliminates the growth of undesirable bacteria, resulting in improved test performance.

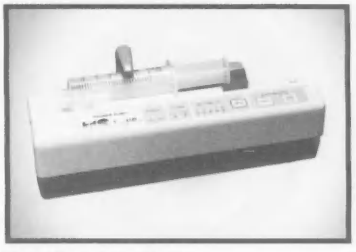
The invention addresses the problem of how to detect a harmful pathogen among billions of other bacteria present in a test sample. Reducing the growth of competing bacteria in the sample reduces false negative results, while preventing the growth of cross-reactive bacteria in the sample reduces false positive results. Together, these benefits reduce the time required to obtain test results while improving the accuracy of test methods.

In one application, SDI uses this technology in the enrichment media of its RapidChek® SELECT™ *Salmonella* and *E. coli* food pathogen assay test kit to inhibit the growth of cross-reactive and competitive bacteria, providing an optimal environment for *Salmonella* and *E. coli* to grow and, therefore, be more easily detected. Enrichment media is a significant component of the $1B global food pathogen testing market. Depending on the detection method used, media can represent more than fifty percent of the cost per test. There are more than 138 million tests conducted globally each

year to test for the presence of pathogens like *Salmonella* or *E. coli* in food products. Improving productivity and accuracy of tests is a major goal of the food testing industry.

"The award of this patent and the current application of the technology in our products and services reinforce and confirm the value of the R&D investments we are making," said Fran DiNuzzo, president and CEO of SDI. "Our customers are already seeing this technology reduce the time required to obtain test results while improving accuracy."

Strategic Diagnostics Inc.
800.544.8881
Newark, DE
www.sdix.com



Torrey Pines Scientific, Inc.

Torrey Pines New 5 Position Stirring Hot Plate

Torrey Pines Scientific, Inc. announces its new 5-position Model HS15 stirring hot plate with individual stirring control for each vessel.

The large 12" (30.48 cm) square ceramic heater top has a temperature range to 450°C. The unit can heat and stir 5–800 ml beakers. Stirring range is from 100 to 1500 rpm.

The unit measures 19" (43.2 cm) deep by 12.5" (31.75 cm) wide by 5.25" (13.4 cm) tall. It can support more than 50 pounds (22.6 kg) on the plate surface, and the chassis is designed to keep spills out of the interior of the unit.

All controls are mounted well in front of the heater surface to protect against accidental burns.

The HS15 is available in 100VAC/50Hz, 115VAC/60Hz, 220VAC/60Hz and 230VAC/50Hz. It is fused for safety and is supplied with user's manual and detachable line cord for the country of use. It is UL, CSA and CE or equivalent rated.

Torrey Pines Scientific, Inc.
866.573.9104
San Marcos, CA
www.torreypinesscientific.com

KD Scientific New Syringe Pumps Ideal for Lab or IV Applications

KD'S EZFlow 2020 is a durable syringe pump useful in high-rate infusions. It is designed to enhance quick efficient operation while maintaining simplicity.

The EZFlow 2020 system has an automated calculation of delivery based on 4, 8, 12, 16 and 20 minutes, with an infusion accuracy of ± 20 seconds.

A wide range of plastic syringes can be used with the unit including 20/30 ml, 50/60 ml and 100 ml. The ergonomic, easy-to-use, horizontal design protects the syringe barrel and allows single-handed loading.

Durable ergonomic waterproof touch control panel provides for efficient and reliable operations.

Flow rates range from 60 ml/h to 1,500 ml/h depending on the syringe size and pump settings.

There are 4 visual and audible alarms, occlusion detection, low battery, near end of dispense and complete.

There are two models available for different power requirements, 115 VAC (EZFlow 2020) or 220 VAC (EZFlow 2021). Both units have a rechargeable battery, which provides continuous operation of 15 syringes (50 ml) set at 12 minutes.

KD Scientific designs, manufactures and sells a range of quality fluidics equipment used by research laboratory markets worldwide.

KD Scientific syringe pumps are an economical solution to delivering precise and smooth flow in research, pilot plants and production applications. They are recognized worldwide for quality, accuracy and reliability. A broad line of syringe pumps are offered: from a simple one-syringe infuse only, to a programmable multi-syringe infuse/withdrawal pump.

KD Scientific
508.429.6809
Holliston, MA
www.kdscientific.com

Warner Electric Corrosion-Resistant Stainless Steel Permanent Magnet Clutches and Brakes Provide Smooth Torque

Ideal for harsh, washdown environments, these Warner Electric permanent magnet clutches and brakes feature all stainless-steel construction and require no electricity to operate.

Since torque is independent of slip speed, smooth torque is achieved as low as 1 RPM up to 1800 RPM. Perfectly smooth slip torque provides constant torque for tension or torque-limiting applications. Units provide dependable performance, with no friction surfaces to break down or wear out. They also feature 400 Series stainless steel bearings designed for extremely long life.

Warner Electric
800.825.9050
South Beloit, IL
www.warnerelectric.com

COMING EVENTS

DECEMBER

- **4, Turkish Food Safety Association, First Food Safety Congress,** Harbiye Military Museum and Cultural Center, Istanbul, Turkey. For more information, go to www.gidaguvenligikongresi.org.
- **7–10, Pasteurization Workshop,** Murfreesboro, TN. For more information, call 205.595.6455; E-mail: kristy.clark@raiconsult.com.
- **8–9, BRC Global Food Safety Standard Training Course,** San Antonio, TX. For more information, contact Wendy Harmon at 888.525.9788 ext. 262 or go to www.food-safetynet.com.
- **10-11, Food Service Managers HACCP Training Course,** Rutgers University, Rutgers, NJ. For more information, go to www.cpe.rutgers.edu.
- **14–15, Advanced HACCP Training Course,** Ecolab Inc., Eagan, MN. For more information, contact Tatiana Lorca at tatiana.lorca@ecolab.com.
- **16–17, Implementing SQF 2000 Systems Training Course,** Eagan, MN. For more information, contact Tatiana Lorca at tatiana.lorca@ecolab.com.

JANUARY 2010

- **27–29, International Poultry Expo,** Atlanta, GA. For more information, call 770.493.9401 or go to www.ipe10.org.
- **31–Feb. 3, NMC 49th Annual Meeting,** Albuquerque, NM. For more information, go to www.nmconline.org.

FEBRUARY

- **3–5, CIES International Food Safety Conference,** Hotel JW Marriott, Washington, D.C. For more information, go to www.ciesfoodsafety.com.
- **22–24, Dubai International Food Safety Conference, Dubai Convention and Exhibition Centre, Dubai.** For more information, go to www.foodsafetydubai.com.
- **27–March 3, AFFI Frozen Food Convention,** Manchester Grand Hyatt, San Diego, CA. For more information, go to www.affi.com.

MARCH

- **4–5, Implementing SQF 2000 Systems,** Eagan, MN. For more information, E-mail: foodsafety@ecolab.com.
- **8–9, ASQ Lean Six Sigma Conference,** Phoenix, AZ. For more information, go to www.asq.org.
- **14–17, FMI Asset Protection Conference,** Ritz-Carlton Hotel, Dallas, TX. For more information, call Aileen Dullaghan Munster at 202.220.0704 or go to www.fmi.org.
- **23–26, 2010 Food Safety Education Conference, *Advancements in Food Safety Education: Trends, Tools and Technologies,*** Hyatt Regency Atlanta, Atlanta, GA. For more information, go to www.fsis.usda.gov/Atlanta2010.

APRIL

- **9–14, Conference for Food Protection 2010 Biennial Meeting,** Providence, RI. For more information, call 916.645.2439 or go to www.foodprotect.org.
- **18–21, TAPPI 2010 PLACE Conference,** Albuquerque, New Mexico. For more information, call 800.332.8686 or go to www.tappi.org.
- **25–27, ADPI/ABI Annual Conference,** Hyatt Regency, Chicago, IL. For more information, go to www.adpi.org.

MAY

- **5, Carolinas Association for Food Protection Annual Meeting,** North Carolina Research Campus, Kannapolis, NC. For more information, contact Steve Tracet at smtracey@foodlion.com.
- **5, Florida Association for Food Protection Annual Educational Conference,** International Plaza Resort and Spa, Orlando, FL. For more information, contact Zeb Blanton at 407.618.4893 or go to www.fafp.net.
- **5–8, ISOPOL XVII International Symposium on Problems of Listeriosis,** Alfândega Congress Centre, Porto, Portugal. For more information, go to www.esb.ucp.pt/isopol2010.
- **6–7, Associated Illinois Milk, Food and Environmental Sanitarians Spring Conference,** Eastland Suites, Bloomington, IL. For more information, contact Steve DiVincenzo at Steve.DiVincenzo@illinois.gov.
- **6–7, Metropolitan Association for Food Protection Spring Seminar,** Rutgers University, Cook College Campus Center, New Brunswick, NJ. For more information, contact Carol Schwar at 908.475.7960; E-mail: cschwar@co.warren.nj.us.
- **7–8, High-Throughput Methods for Detecting Foodborne Pathogens Workshop,** York College, Jamaica, NY. For more information, go to http://york.cuny.edu/conted/fdaworkshops/2008-fda-workshop/preliminary-program.
- **17–21, 3-A SSI 2010 Education Program and Annual Meeting,** Wyndham Milwaukee Airport Hotel & Convention Center, Milwaukee, WI. For more information, contact Tim Rugh at trugh@3-a.org or go to www.3-a.org.

IAFP UPCOMING MEETINGS

AUGUST 1-4, 2010
Anaheim, California

JULY 31-AUGUST 1, 2011
Milwaukee, Wisconsin

JULY 22-25, 2012
Providence, Rhode Island

ADVERTISING INDEX

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David W Throop — Executive Director — Date: 9/30/09

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International Food Safety Icons

Available from International Association for Food Protection®

Handwashing

Potentially Hazardous Food

Cooking

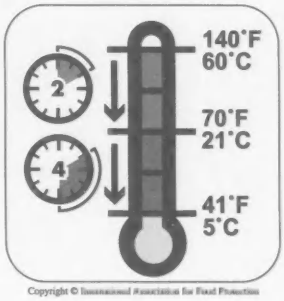
Do Not Handle if Ill

Cross Contamination

Wash, Rinse, and Sanitize

No Bare Hand Contact

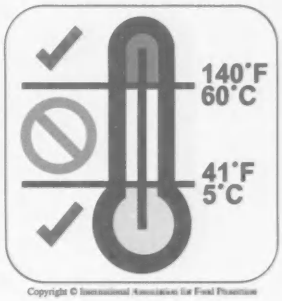
Cooling



Refrigeration/Cold Holding

Hot Holding

Temperature Danger Zone



For additional information, go to our Web site: www.foodprotection.org or contact the IAFP office at +1 800.369.6337; +1 515.276.3344; E-mail: info@foodprotection.org

IAFP OFFERS

All Guidelines now available on CD

"Guidelines for the Dairy Industry" from the Dairy Practices Council®

IAFP has agreed with the Dairy Practices Council® to distribute their guidelines. DPC is a non-profit organization of education, industry, and regulatory personnel concerned with milk quality and sanitation. Its membership roster lists individuals and organizations throughout the world. Professionals working through six permanent DPC task forces write DPC guidelines. Prior to distribution, every guideline is peer reviewed and submitted for approval to state regulatory agencies, where exceptions to each state's regulations are noted in the final document. These guidelines represent the state of the knowledge at the time they are written.

The guidelines are renowned for their common sense and useful approach to proper and improved sanitation practices. We think they will be a valuable addition to your professional reference library.

Guidelines are available on CD and in printed form.
Complete sets in printed form are bound in 3-ring binders.
Please check which guidelines you are ordering.

Complete set (over 80 guidelines):	CD ($270) ☐	Printed ($330) ☐
Farm Set (58 guidelines):	CD ($180) ☐	Printed ($250) ☐
Plant Set (44 guidelines):	CD ($135) ☐	Printed ($160) ☐
Small Ruminants (19 guidelines):	CD ($61.20) ☐	Printed ($68) ☐

Please add $20.00 for each printed set and $4.00 for each CD for shipping and handling. Outside US shipping depends on existing rates. Make checks payable in US dollars on a US bank or pay by credit card.

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Province, Code
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- ❒ D1100 Mastitis Prevention and Control
- ❒ D1105 Milk Hauling Training
- ❒ D1120 Milk Processing Plant Inspection Procedures
- ❒ D1130 Pasteurizer: Design and Regulation
- ❒ D1140 Pasteurizer: Operation
- ❒ D1180 10 Points to Dairy Quality

ENVIRONMENTAL

- ❒ E3031 Allergy Beware
- ❒ E3040 Asbestos Awareness
- ❒ E3055 Effective Handwashing – Preventing Cross Contamination in the Food Service Industry
- ❒ E3125 Good Pest Exclusion Practices
- ❒ E3128 Integrated Pest Management (IPM)
- ❒ E3131 Key Pests of the Food Industry
- ❒ E3133 Physical Pest Management Practices
- ❒ E3235 Regulatory and Good Manufacturing Practices
- ❒ E3236 Rodent Control Strategies
- ❒ E3240 Sink a Germ
- ❒ E3245 Wash Your Hands
- ❒ E3251 Would Your Restaurant Kitchen Pass Inspection?
- ❒ E3260 Swabbing Techniques for Sampling the Environment and Equipment

FOOD

- ❒ F2005 A Lot on the Line
- ❒ F2007 The Amazing World of Microorganisms
- ❒ F2008 A Recipe for Food Safety Success
- ❒ F2009 Basic Personnel Practices
- ❒ F2011 Available Post Harvest Processing Technologies for Oysters
- ❒ F2012 Control of *Listeria monocytogenes* in Retail Establishments
- ❒ F2013 Control of *Listeria monocytogenes* in Small Meat and Poultry Establishments
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- ❒ F2015 Controlling *Listeria*: A Team Approach
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- ❒ F2155 Tape 5 – Production and Process Controls
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- ❒ F2162 Tape 2 – Personnel and Personnel Practices
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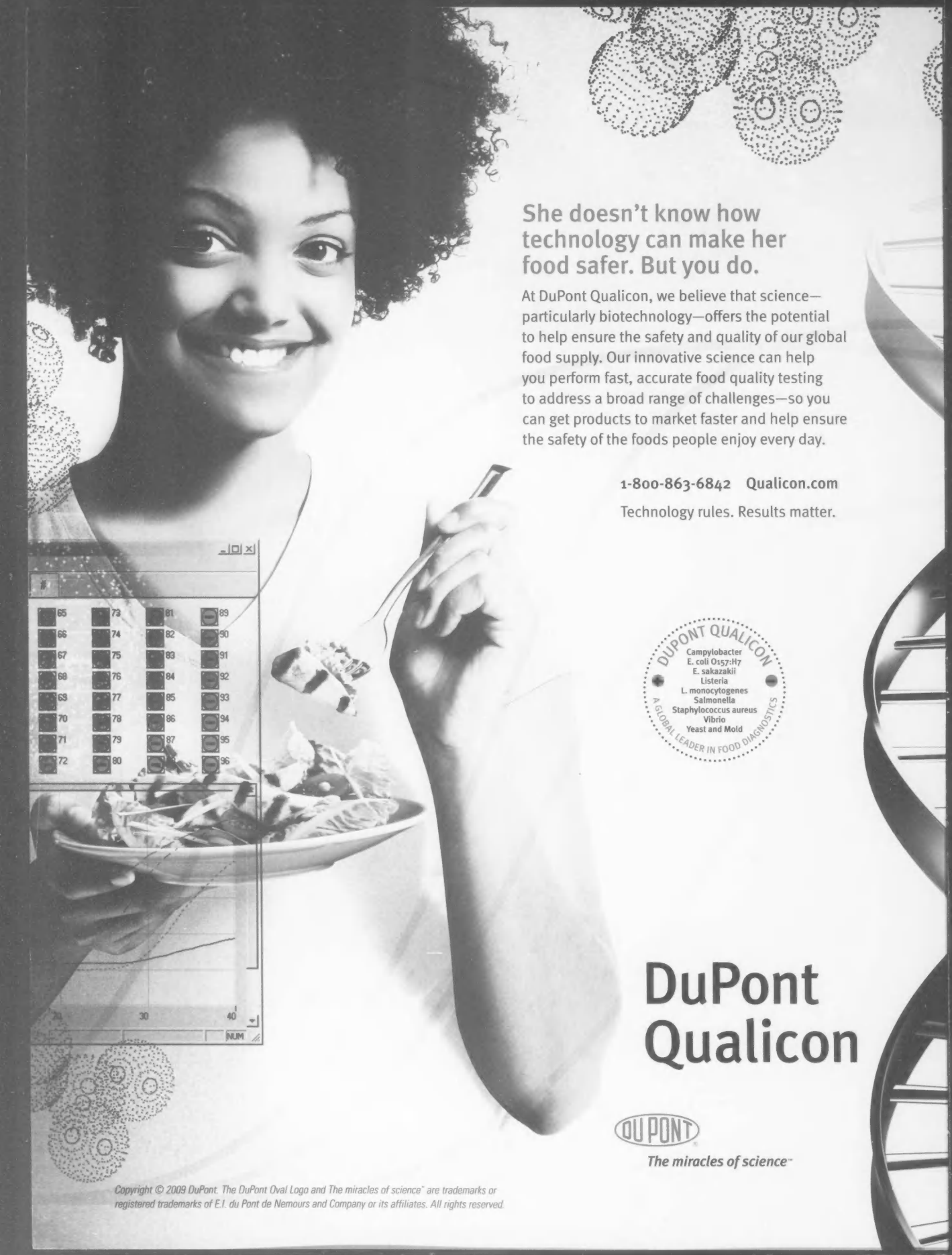
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