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DAIRY, FOOD AND ENVIRONMENTAL

Sanitation

A PUBLICATION OF THE INTERNATIONAL ASSOCIATION FOR FOOD PROTECTION, INC.

SEPTEMBER 2002

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*fresh spinach
green beans
lemons
fresh fruit
zucchini
herbal salt
oatmeal
brown rice
parchment paper*

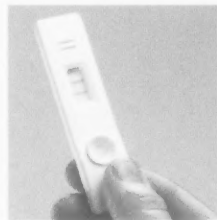
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THOUGHTS FROM THE PRESIDENT

“TIMING IS EVERYTHING”



By ANNA M. LAMMERDING
President

“It’s all about networking”

“A crisis is no time to be exchanging business cards ...”

Dr. Mitchell Cohen, Director of the Division of Bacterial and Mycotic Diseases, US Centers for Disease Control and Prevention, addressed the Opening Session audience at IAFP 2002 in San Diego, and talked about lessons learned in the aftermath of events in the United States one year ago this month. The harsh reality of terrorism starkly underlined the fact that we must be ever vigilant. Deliberate contamination of food and water supplies has become a too-real possibility. Dr. Cohen emphasized that a crisis is no time to be exchanging business cards; we need to establish our connections, before a crisis happens. What does this mean to our profession? An increased, urgent impetus to strengthen the linkages amongst all those involved in ensuring the safety of food and water supplies, and developing new types of partnerships. At the 1st International Conference on Microbiological Risk Assessment: Foodborne Hazards, held July 24–26 at the University of Maryland, a similar message was repeated by several speakers. In his opening remarks at that meeting, Dr. Lester Crawford, US Food and Drug Administration’s Deputy Director, noted that our profession is at a much higher profile now than just a few years ago, and much broader in scope. Our goals should be to guarantee every man, woman and child a safe, secure and sufficient food supply. Increasingly, global communications and interactions are necessary to help protect public health

and the safety of the food supply against either deliberate or unintentional threats.

IAFP strives to provide opportunities to bring together researchers, regulators, public health personnel, and the food industry. Our Annual Meeting and our Journals provide the vehicles for exchanging information on food safety – from pre-harvest through to retail, food service, and consumer handling. Although our Association has grown significantly during the past decade, the size of our meeting is still small enough that this year’s 1,400+ attendees could easily work on increasing their own personal networks. Students attending our meeting for the first time often remark that the opportunity to really get to know some of the scientists behind the publications is invaluable, and that the atmosphere of the meeting makes everyone feel welcomed. This is the time to exchange business cards – between symposia, during the poster sessions, over lunch, through social events.

E-mail is an amazing tool (perhaps too much so!) that helps us connect with people... but the connections are always more meaningful when you can put a face to the ISP address!

As IAFP strengthens its membership outside of the US and Canada, we can only benefit as our own personal networks become globalized. At a local level, our Affiliate Associations serve us well also. Their goals are

not only to educate through meetings, workshops and tours, but also to provide opportunities to forge new partnerships and develop connections with colleagues around us. Many affiliates work hard to organize 2 to 3 day meetings and provide lots of "down-time" to renew acquaintances and meet new colleagues. The spirit of camaraderie is certainly enhanced by a unique

venue and creativity in planning for meetings... the "snipe hunt" in the middle of the night, in the middle of nowhere, is a legendary annual event for the Florida Association for Food Protection! The Affiliate News, prepared by the Affiliate Council Chairperson and Secretary, this year Gene Frey and Steven Murphy together with Lucia Collison McPhedran at the IAFP office, lets our Members

see what is happening in other affiliates, and promotes exchange of ideas for conference themes and other events.

In closing, I encourage you to join in your local affiliate if one is in your region, and if not, consider starting one! Start planning for IAFP 2003, August 10 -13 in New Orleans. Let us provide you a fun and educational time and place to exchange business cards, before the crisis happens!



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COMMENTARY

From the Executive Director



By DAVID W. THARP, CAE
Executive Director

“This will be an exciting time for *DFES* as we embark upon its name change to *Food Protection Trends*”

Food Protection Trends, News and Science from the International Association for Food Protection. What do you think? Do you like the new name for *Dairy, Food and Environmental Sanitation*? We hope so! At IAFP 2002, The *DFES* Management Committee recommended the name, *Food Protection Trends*, to the Executive Board and the Executive Board accepted the recommendation. Now we are moving quickly to implement the new name.

The new name will be put into use with the January 2003 issue, but a lot of details need to be tended to between now and then. With a new name will come a new look inside the Journal. We will keep the same features you have come to rely upon such as News, Updates, Industry Products, Coming Events and a Career Services Section. In addition, we will continue to run “Special Reports” and “Thoughts on Food Safety” when available.

With the cooperation of our authors and reviewers, we hope to be able to continue placing three articles in each issue as we have done over the past few months. The volume of submitted articles has been strong over the past year and we expect to see this trend continue.

So what will be different, you may ask? Mostly the name and inside look. It was time for a change and the Committee felt it was best to rename the Journal to be in line with the Association’s

name. Also, we hope to incorporate new information or columns such as Reader Comments and Point-Counterpoint columns. From our survey results one year ago, readers liked the content of *DFES* but were interested in receiving more information (articles) and more reader interaction (Reader Comments and Point-Counterpoint).

We encourage your participation in providing Reader Comments for publication. We feel that this type of interaction can be stimulating and helps to expose readers to a variety of individual opinions. If you have comments you want to share with readers, forward them to our office in care of Donna Bahun. If you have an idea for a Point-Counterpoint column, you may also contact Donna. We invite thought-provoking conversation and interaction among IAFP Members and readers.

This will be an exciting time for *DFES* as we embark upon its name change to *Food Protection Trends*. Watch the upcoming issues of *DFES* for the transition to its new name and be sure to help inform your colleagues of this change to help us sail smoothly through the transformation.

Now, before closing for this month, I would be remiss if I did not mention two things. First off, September is Food Safety Month and has been for a number of years. This program is sponsored

by the National Restaurant Association and many other fine associations and companies. The intent is to educate the consumer about safe handling of foods and to keep the consuming public healthy.

The second item is to remember September 11, 2001. The world is a different place than it was prior to September 11, 2001. The world of food safety has changed much over this last year. Think of what you are doing

differently than before the tragedies that occurred that day. Take a few minutes out of your life to pay your respects to the victims of those terrible attacks and let us gain strength from our unity to oppose these evil acts!

Congratulations

At IAFP 2002, we offered a drawing for a one-year membership with our Association and a registration for IAFP 2003 in New Orleans, LA. We are pleased to announce the following winners of the drawing:

IAFP Membership

Patricia Rule
BioMérieux
Hazelwood, MO

IAFP 2003 Registration

Samuel A. Palumbo
National Center for Food Safety
and Technology
Summit-Argo, IL

The Sink Environment as a Source of Microbial Contamination in the Domestic Kitchen

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SUMMARY

Samples from the sink base, draining board, joint around the tap, and tap nozzle surfaces were taken in 35 randomly chosen domestic premises and analyzed for total viable counts, total coliforms, and presence of *Escherichia coli* and *Salmonella*. Practices related to frequency of use of cleaning and disinfecting agents were also assessed. The results demonstrated that the kitchen sink environment is a reservoir for microorganisms.

INTRODUCTION

In a survey conducted by the Food Safety Authority Ireland (FSAI) (19, 20), of 1,000 Irish and British respondents, 5 and 6% respectively reported suffering from food poisoning in the previous 12 months. In 1998, over 93,900 cases of foodborne illness were reported in England and Wales (3). Each year in the United States, an estimated

76 million people experience foodborne illnesses (21). However, the World Health Organization (WHO) estimates that only 10% of incidents occurring in most European countries are reported (2).

People tend to associate greater risk with situations and circumstances that are controlled by others, such as eating in restaurants, rather than with situations in which they have perceived control, such

as preparing and eating food at home (51). A study in the Netherlands suggests that 80% of *Salmonella* infections arise in the home (27). Hilton and Austin (24) estimated that private homes account for more outbreaks of foodborne illness than the total of all other sources. A study by Roberts (41), of 1,000 outbreaks of food poisoning, showed that the source of the highest percentage of cases was the family home (19.7%), followed by restaurants (17.1%) and banquets (12.2%).

METHODS

Four surfaces in the kitchen were selected for investigation: the sink base, draining board, the sealer around the tap, and the tap nozzle. Stainless steel kitchen sinks, draining boards and tap surfaces were swabbed at 35 domestic premises. Swabs of approximately (5 × 4 cm²) were sampled and aseptically placed in a sterile universal bottle

A peer-reviewed article.

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TABLE 1. Total microbial levels on the sink environment

Count /cm ²	TVC (%)				Total Coliforms (%)			
	Sink	Draining board	Tap	Surface around tap	Sink	Draining board	Tap	Surface around tap
<10 ²	15	26	51	20	34	68	83	34
10 ² -10 ³	25	40	17	17	40	9	11	26
10 ³ -10 ⁴	23	11	23	17	14	6	6	14
10 ⁴ -10 ⁵	14	1	6	17	3	11	0	17
10 ⁵ -10 ⁶	9	6	3	12	9	3	0	9
10 ⁶ -10 ⁷	14	6	0	17	0	3	0	0

containing 9 ml of 1% bacteriological peptone (Oxoid™) as a diluent and 1 ml inactivator consisting of 3 g lecithin, 30 ml tween-80, 5 g sodium thiosulphate, 1 g L-histidine, and 10 ml phosphate buffer per l distilled water at pH 7.2 (17). The samples were then returned to the laboratory for bacteriological analysis.

Each surface swab was analyzed by the standard pour plate method for total viable counts (TVC) on Tryptone Soya Agar (TSA) (Oxoid™) incubated at 30°C for 48 hours. Total coliform analysis was carried out with the standard pour plate method, using Violet Red Bile Agar (VRBA) and incubating at 37°C for 24 hours. Typical colonies were inoculated into Brilliant Green Bile Broth (BGBB) (Oxoid™) containing an inverted Durham fermentation tube, incubated at 37°C for 24 hours, and examined for gas production.

The presence of *E. coli* was detected by enrichment using Enterobacteriaceae Enrichment Broth (EEB) (Oxoid™) and incubation at 37°C for 24 hours. Eosine Methylene Blue agar (EMB) (Oxoid™) was

inoculated from the enrichment media and incubated at 37°C for 24 hours. *Salmonella* presence was also tested for by enrichment in Rappaport-Vassiliadis Broth (RV) (Oxoid™) and Selenite Cystine Broth (SC) (Oxoid™) and incubation at 42°C and 37°C respectively for 24 hours. Modified Brilliant Green Agar (MBG) (Oxoid™) and Xylose Lysine Desoxycholate Agar (XLD) (Oxoid™) were incubated at 37°C for 24 hours. Identification of *E. coli* and *Salmonella* was confirmed using the Biolog™ identification system.

At the time of sampling, questionnaires were issued to assess general awareness and practices with regard to hygiene.

Using the SPSS™ computer package, sample results were cross-tabulated with questionnaire responses to ascertain if there was any relationship between hygiene practices and surface contamination levels.

RESULTS

In analysis of surfaces, it has been suggested that total counts in excess of 10² CFU/cm² represent high contamination levels, either

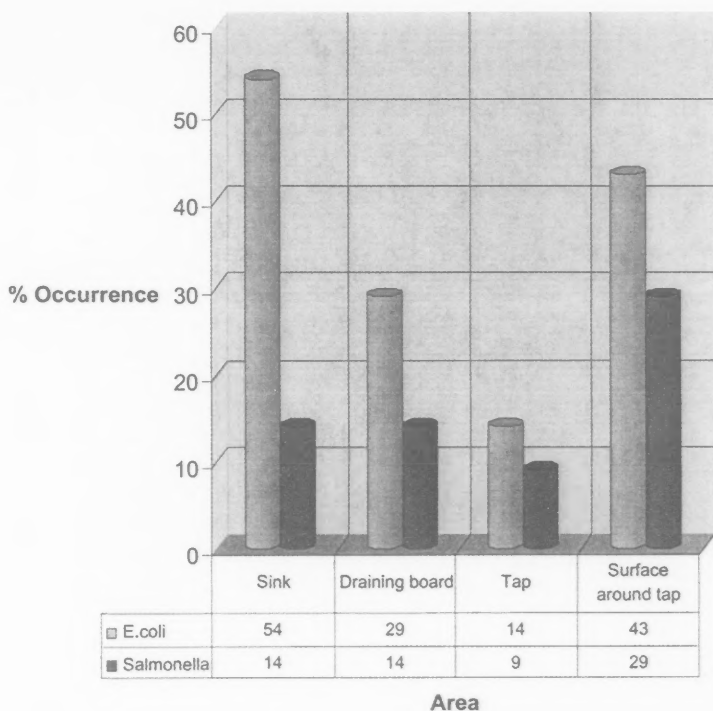
alone or along with species of enteric origin or other potentially pathogenic species (5), while in another study (13), > 3.9 × 10² CFU/cm² TVC was considered high.

Table 1 shows that 85% of the sink basins had a TVC (total viable count) in excess of 10² CFU/cm², with 14% exhibiting TVC in the range of 10⁶ to 10⁷ CFU/cm². The draining board was also highly contaminated, 74% of those sampled had TVC > 10² CFU/cm². The tap nozzle surface had the lowest microbial load of the four sites sampled with 49% of the surfaces having > 10² CFU/cm² and with no tap nozzle surface samples having TVCs in excess of 10⁶ CFU/cm². The joint around the tap had the greatest frequency of contamination, in the range 10⁶ to 10⁷ CFU/cm² (17%). With regard to total coliforms, almost two-thirds of the sites sampled in the sink basin and around the tap joint had over 10² coliforms/cm², however, the majority of the tap nozzle and draining boards tested had < 10² coliforms/cm². Figure 1 shows that *E. coli* is more frequently isolated than *Sal-*

TABLE 2. The effects of frequency of cleaning agent usage on the prevalence of microbial contamination in the sink environment

Count /cm ²	Frequency of cleaning agent usage	TVC (%)				Total Coliforms (%)			
		Sink	Draining board	Tap	Around tap	Sink	Draining board	Tap	Around tap
<10 ²	At least daily	57	38	77	33	69	87	86	29
	>Weekly	5	29	50	28	21	76	100	59
	Less frequently	0	0	0	0	0	40	29	0
10 ² -10 ³	At least daily	29	62	23	50	31	13	14	71
	>Weekly	37	42	13	18	50	6	0	23
	Less frequently	0	0	17	0	38	10	42	0
10 ³ -10 ⁴	At least daily	14	0	0	17	0	0	0	0
	>Weekly	32	21	25	12	8	6	0	6
	Less frequently	11	13	66	25	49	10	29	36
10 ⁴ -10 ⁵	At least daily	0	0	0	0	0	0	0	0
	>Weekly	16	0	6	18	0	12	0	6
	Less frequently	23	50	17	25	13	20	0	46
10 ⁵ -10 ⁶	At least daily	0	0	0	0	0	0	0	0
	>Weekly	0	7	6	12	21	0	0	6
	Less frequently	33	13	0	16	0	10	0	18
10 ⁶ -10 ⁷	At least daily	0	0	0	0	0	0	0	0
	>Weekly	10	0	0	12	0	0	0	0
	Less frequently	33	24	0	32	0	10	0	0

Figure 1. Pathogen presence in the domestic sink area



monella from the sites sampled and there was a high occurrence of both pathogens, particularly in the sink basin, draining board, and joint around the tap.

To ascertain if there was any correlation between microbial levels on the kitchen surfaces and cleaning agent usage, participants were questioned about the frequency of use of chemicals. With respect to cleaning agent use, responses to the questionnaire showed that 20% of respondents used a cleaning agent at least daily, and 54% used them more than once a week, while 26% used them less frequently. Table 2 shows the relationship between microbial levels on the sink environment and frequency of cleaning agent usage. When a cleaning agent was used at least daily, the TVC of the sites sampled never exceeded 10^4 CFU/cm². In kitchens where cleaning

agent was used less frequently than weekly, microbial levels of up to 10^6 CFU/cm² were detected for the tap surface and up to 10^7 CFU/cm² for the sink base and the joint around the tap. Counts were also $>10^2$ CFU/cm² only when cleaning agent was used less frequently than weekly. When cleaning agent was used in the home at least daily, the total coliform levels recorded were never in excess of 10^5 CFU/cm² on the sites sampled. However, less frequent usage of cleaning agent generally reflected a higher coliform count on the sample sites, with the exception of the tap nozzle, where counts of up to 10^4 CFU/cm² were recorded. In an examination of the four sample sites, a higher *E.coli* percentage presence occurred when cleaning agent was used infrequently (Fig. 2a). From Fig. 2b it can be seen that *Salmonella* occurred to a higher extent in all sites

when cleaning agent was used infrequently.

When the participants in the survey were asked about frequency of disinfectant usage, 14% said they used it at least once a day, 69% said several times a week while 17% used it less frequently. Table 3 demonstrates the relationship between frequency of disinfectant use and microbial contamination levels of the sites in the sink environment. Where disinfectant was used at least daily, the TVC of the sites did not exceed 10^4 CFU/cm². Where disinfectant was used weekly or less frequently, TVC levels of up to 10^7 CFU/cm² were detected. A similar pattern could be seen in relation to total coliform levels. Where disinfectant was used at least daily, the total coliform count of the sink, draining board, and tap nozzle never exceeded 10^5 CFU/cm² and 10^4 CFU/cm² for the joint around the tap. Correspondingly, using a disinfectant less than weekly was associated with a higher level of contamination.

The lowest levels of *E. coli* occurred when a disinfectant was used frequently, and presence was recorded only on the sink base and the joint around the tap. The frequency of *E. coli* presence was also generally higher when the frequency of disinfectant use was less than weekly, except on the draining board, where the numbers of incidences of *E. coli* were the same as when disinfectant was used more regularly (Fig. 3a).

Salmonella were isolated less frequently than *E. coli* except on the draining board. When disinfectant was used frequently, *Salmonella* was not detected on any of the sites sampled. The pattern of increased usage of disinfectant reflects lower levels of *Salmonella* except on the draining board (Fig. 3b).

DISCUSSION

Stainless steel is frequently used as a sink material because of its mechanical strength, corrosion

Figure 2a. The effects of frequency of cleaning agent use in the kitchen on the prevalence of *E. coli* in the sink environment

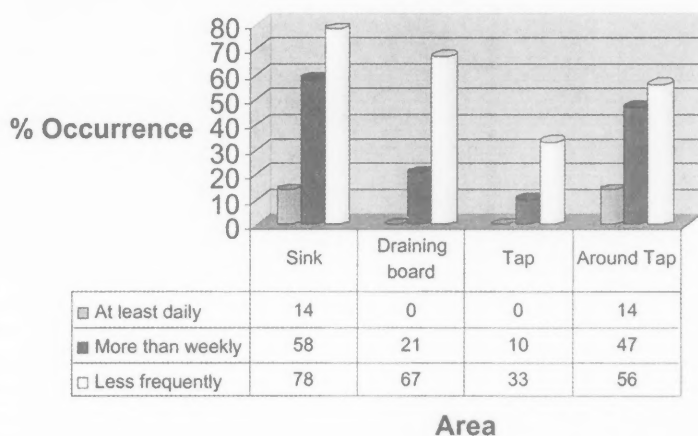
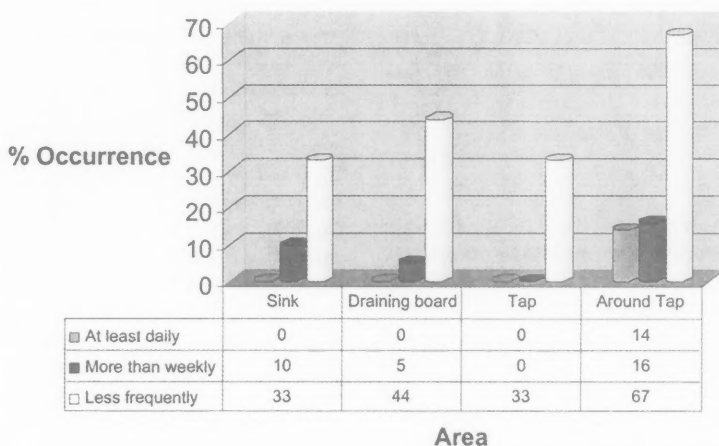


Figure 2b. The effects of frequency of cleaning agent use in the kitchen on the prevalence of *Salmonella* in the sink environment



resistance, longevity and ease of fabrication. It is also stable, inert, and easily cleaned (10, 11, 16, 36). Holah and Thorpe (26), reported that modern sink materials such as polycarbonate, mineral resin and some enamelled steels are as cleanable as stainless steel when new, but its resistant properties make stainless steel more likely to retain its hygienic status over a longer period

of time. On a microscopic scale, stainless steel can be seen to have cracks and crevices, quite unlike its macroscopic appearance (12, 23, 24, 26, 28, 33, 34, 40, 46, 48). These surfaces are likely to retain bacteria because of increased numbers of attachment sites, a larger bacterial/material surface contact area, and topographical areas in which applied cleaning shear forces are reduced (4, 16, 26, 35, 42).

Results showed that from the four sample sites analyzed, the sink basin, draining board, tap nozzle, and joint around the tap had very high counts. Similarly in a report by the IFH (29), the sink environment was classified as a reservoir site for microbial contamination. Total coliform levels were also high, with counts up to 10^6 to 10^7 CFU/cm². A bacteriological kitchen survey by Amsden (1) also showed that 75% of draining boards and 51% of hot water taps were contaminated with coliforms, an estimated 82% of which were contaminated during food preparation.

Dissemination from the sink to a food contact surface is implied in previous studies (8, 13, 18, 19). Concern has been expressed regarding cross-contamination from the sink onto dishware, which is another possible mode of cross-contamination directly to the individual (37).

Pathogenic microorganisms such as *Salmonella* and *E. coli* can readily multiply in a warm nutrient-rich environment (32, 44). Survival and proliferation of such microorganisms is increased if the contaminated surface is soiled and moist (15, 22, 38, 43). Epidemiological investigations have also revealed that draining boards and the sink area are frequently contaminated with *E. coli* and other coliforms and can pose a health hazard to consumers (9, 46). Similarly, a study by Jones (31) indicates that 60% of 60 domestic sinks sampled had total coliform $> 10^2$ CFU/cm². In the analysis, it was discovered that *E. coli* frequently occurred in the sink basin (54%) and the joint around the tap (43%), while the tap nozzle (14%) and the draining board (29%) had the lowest levels of contamination. The presence of *Salmonella* was more prominent in the joint around the tap (29%), followed by the sink basin and draining board (14%), while the tap nozzle (9%) recorded the lowest *Salmonella* occurrence.

Few domestic kitchens have separate washing facilities for hand

Figure 3a. The effects of frequency of disinfectant use in the kitchen on the prevalence of *E. coli* in the sink environment

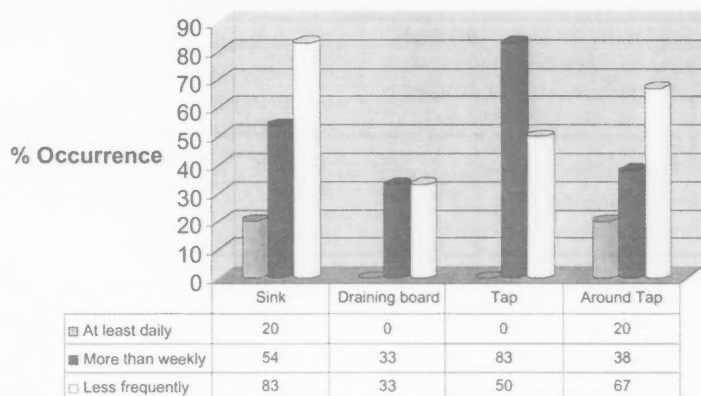
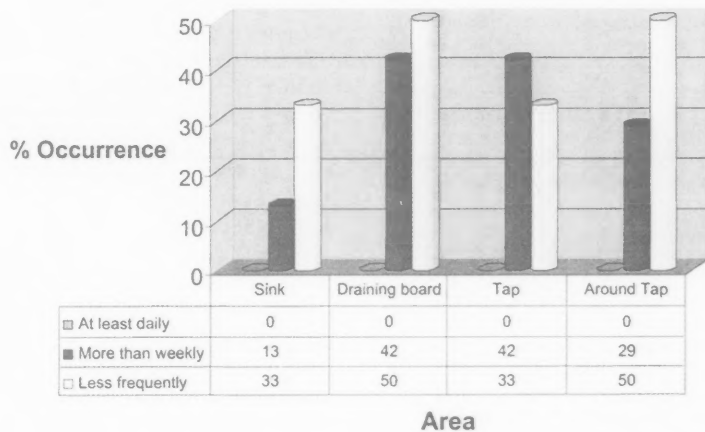


Figure 3b. The effects of frequency of disinfectant use in the kitchen on the prevalence of *Salmonella* in the sink environment



washing and cleaning food and equipment, the majority of households rely on a single sink and draining board for all of these functions, thereby increasing the risk of cross-contamination if the sink and draining board are not cleaned and disinfected between each separate activity (37). The kitchen sink is a high risk surface that becomes rapidly recontaminated after cleaning (31). As a rule, people work close to the sink environment when preparing meals, thereby making the

task of cleaning and disinfection more important (26, 37, 43, 49, 50). Contamination of up to 10^7 CFU/cm² TVC was recorded when disinfectant was used less than weekly, a level of contamination that indicates the existence of a typical biofilm (25). However, counts of no greater than 10^1 CFU/cm² were recorded when a disinfectant was used at least daily. Research by Frank and Chemiclewski (22) has shown that disinfection is an effective means of reducing microbial

contamination on stainless steel surfaces. When participants in the kitchen survey used a disinfectant at least daily, the level of total coliforms was reduced for all sites except the joint around the tap. Those kitchens where disinfectant was used less frequently had total coliform counts of up to 10^7 CFU/cm². A 4 log₁₀ reduction in *Staphylococcus aureus* was recorded when stainless steel type 304 was exposed to a quaternary ammonium compound (22). The data presented shows that the frequency of cleaning agent use in the kitchen can influence microbial levels. When a cleaning agent was used at least daily, the contamination levels of all surfaces was no greater than 10^1 CFU/cm². However, with less frequent use, levels of up to 10^7 CFU/cm² occurred. Use of a cleaning agent alone reduced *Pseudomonas* or *S. aureus* levels on a stainless steel surface by 2 log₁₀ (46). Holah and Thorpe (25) also showed that by using a microbial tracer, cleaning reduced contamination levels by 1 to 3 log₁₀ on a domestic sink surface.

Adsorbed organic material can affect bacterial retention in three ways either by changing the surface charge (7, 41, 45), by acting as a nutrient source (34), or even by inactivating or providing protection from disinfecting agents (45). Adsorbed organic material in the sink environment requires an effective cleaning regime such as heat, mechanical action and/or chemical disinfection (11, 29). The hygiene levels of contact surfaces can deteriorate with wear and can lead to surface damage and to surface defects that can act as sites for the retention of microorganisms and organic material (7, 11, 39, 45, 48). A greater force is required to move cells retained on a worn surface than on an unused surface, but the application of a cleaning agent has been reported to decrease the amount of required force (47).

Data also show that all total coliform levels were less than 10^1 CFU/cm² when a cleaning agent

TABLE 3. The effects of frequency of disinfectant usage on the prevalence of microbial contamination in the sink environment

Count /cm ²	Frequency of cleaning agent usage	TVC (%)				Total Coliforms (%)			
		Sink	Draining board	Tap	Around tap	Sink	Draining board	Tap	Around tap
<10 ²	At least daily	30	38	71	40	62	86	100	29
	>Weekly	10	31	65	28	37	90	96	50
	Less frequently	0	0	0	0	0	0	17	0
10 ² -10 ³	At least daily	60	62	29	60	38	14	0	42
	>Weekly	16	45	20	16	53	5	4	30
	Less frequently	0	0	0	0	13	13	50	0
10 ³ -10 ⁴	At least daily	10	0	0	0	0	0	0	29
	>Weekly	43	8	15	28	5	0	0	10
	Less frequently	0	33	64	9	50	24	33	13
10 ⁴ -10 ⁵	At least daily	0	0	0	0	0	0	0	0
	>Weekly	21	8	0	11	0	15	0	5
	Less frequently	33	33	25	33	13	37	0	62
10 ⁵ -10 ⁶	At least daily	0	0	0	0	0	0	0	0
	>Weekly	5	0	0	6	5	0	0	5
	Less frequently	22	23	11	25	24	13	0	25
10 ⁶ -10 ⁷	At least daily	0	0	0	0	0	0	0	0
	>Weekly	5	8	0	11	0	0	0	0
	Less frequently	45	11	0	33	0	13	0	0

was used at least daily but that counts were up to 10^7 CFU/cm² with less frequent use. A questionnaire survey by Worsfold & Griffith (49, 50) showed that taps receive less regular cleaning attention than work surfaces because the taps are considered difficult to clean effectively. Similarly, in this study, 33% of tap surfaces were positive for *Salmonella* and *E. coli* when cleaning agent was used less than weekly. The area in and around the sink is also easily contaminated during food preparation and can often be recontaminated by cleaning attempts (14). Results indicate that the contamination levels recorded in this area were particularly high e.g., the sink basin and area around the tap had TVC in the range 10^6 to 10^7 CFU/cm² and up to 10^6 CFU/cm² for total coliforms.

A high number of sample sites were positive for *Salmonella* and *E. coli*, e.g., 67% of the joint around the tap samples were positive for *Salmonella* and 78% of sink basins were positive for *E. coli*, when a cleaning agent was used less frequently than weekly. When the participants in the survey were questioned, >80% claimed to use cleaning agent and disinfectant less than daily. Low level usage of these chemicals generally correlated with higher microbial levels, as also found by Jay et al. (30) who observed that the most common cleaning activity was wiping down kitchen surfaces without either a cleaning agent or disinfectant. Up to 83% of *E. coli* and up to 50% *Salmonella* presence was recorded when disinfectant was used less than daily. Josephson et al. (32) also correlated infrequent use of these agents with the presence of *E. coli* and *Salmonella* on kitchen surfaces.

The data recorded in this survey is in agreement with results of previous studies, indicating in particular the potential of wet sites in the kitchen to act as reservoirs of microorganisms with the risk of dissemination of contamination (6, 31).

CONCLUSION

The sink environment is a main reservoir for microorganisms in the domestic kitchen environment. Cross-contamination should be minimized by the appropriate use of disinfectant and cleaning agent at least daily. The general public should also be made more aware of the risk that exists, and of preventive measures to control the risk.

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In Loving Memory
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Internalization of *Escherichia coli* in Apples under Natural Conditions

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SUMMARY

Foodborne illnesses caused by drinking unpasteurized apple cider have been attributed to the pathogenic bacterium *Escherichia coli* O157:H7. Contamination is likely to occur during the fruit growing and harvesting phases. In apple cider production in which the entire apple is pressed, pathogens found within the apple core and surrounding tissue are a potential problem. Internalization of *E. coli* in apples under natural environmental conditions was addressed in this study by use of a controlled outdoor setting. A surrogate *E. coli* species (ATCC 25922) was used as an alternative to the pathogenic species. The bacterial culture was applied to topsoil and spread evenly on a 6 × 6-foot area. Red Delicious, Golden Delicious, and Rome Beauty apples were placed randomly on the soil, much like drop or windfall apples. The position of each apple was noted as to whether it had fallen calyx up, calyx down or on its side. Apples were examined for the presence of *E. coli* and sampled on days 1, 3, 8, and 10. Skin, flesh, inner core, and outer core samples were plated on MacConkey agar supplemented with cycloheximide and MUG for ease of identification. *Escherichia coli* was found in the inner core and flesh samples of all apple varieties, indicating the potential for infiltration by the organism outside of laboratory conditions.

INTRODUCTION

Over the past 10 years, the consumption of unpasteurized apple juice has been linked to increasing numbers of outbreaks associated with *Escherichia coli* O157:H7 (3, 7, 8, 18), *Salmonella* (9, 10) and *Cryptosporidium parvum* (8, 9, 14). These outbreaks have raised questions as to the safety of unpasteurized juice and the use of surface treatments to decontaminate fruits. These issues are addressed in the US Food and Drug Administration final rule and Hazard Analysis and Critical Control Point (HACCP) guide for juice processing (12). The direct causes of these outbreaks are difficult to determine; however, possible routes of transmission include irrigation water, manure, sewage, poor worker hygiene, harvesting equipment and containers, insects, birds, and processing equipment. Microbial contamination of apple cider can result from the use of damaged, scald, or windfall fruit that may harbor disease-causing microorganisms (19, 20). Common practices of apple cider producers could support bacterial infiltration; historically, apple cider has been

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TABLE 1. Location of *E. coli* ATCC 25922 infiltration in the inner and outer cores of different apple varieties

Mean \pm standard deviation (sd) of *E. coli* in cores of two apples sampled during duplicate trials. Statistical analysis using ANOVA showed significant differences in the outer core data only by position and by day ($P < 0.05$). *E. coli* not detected (nd) in apples sampled on day zero.

Apple Variety	Day	Outer Core log CFU/ml \pm sd n = 4	Inner Core log CFU/ml \pm sd n = 4
Rome Beauty	0	nd	nd
	1	2.45 \pm 1.16	1.98 \pm 0.37
	3	4.40 \pm 1.52	2.72 \pm 0.88
	8	2.83 \pm 0.09	2.06 \pm 0.37
	10	3.92 \pm 0.84	2.39 \pm 0.42
Red Delicious	0	nd	nd
	1	1.31 \pm 0.43	1.00 \pm 0.10
	3	4.84 \pm 0.45	1.46 \pm 0.65
	8	2.73 \pm 1.44	1.73 \pm 1.03
	10	4.05 \pm 0.57	2.79 \pm 0.60
Golden Delicious	0	nd	nd
	1	3.82 \pm 0.53	2.15 \pm 1.17
	3	4.92 \pm 0.75	1.46 \pm 0.65
	8	2.52 \pm 1.14	3.02 \pm 0.38
	10	4.41 \pm 0.32	2.22 \pm 1.71

produced from "cider apples" or windfalls, which may be at unusually great risk of infiltration by bacteria on the ground. However, tree apples are also at risk, from dust, insects, birds, and handling practices. In general, cider producers are knowledgeable about good agricultural practices that should be used to prevent contamination. In one survey from 1993, 100% of producers in New England reported using drop apples (3). In part because of Good Agricultural Practices and increased awareness, the use of drop apples has generally decreased; however, about 5% of producers in Virginia allow grazing animals in their orchards, 8% fertilize with manure, 32% use drop apples,

and 37% do not use a sanitizer after washing the apples (20). These practices may still be fairly common among apple cider producers across the country, as similar practices were observed in Wisconsin (19). According to recent surveys (19, 20) the use of drop apples in cider is decreasing, which most likely indicates that juice producers and orchard managers are aware of microbial contamination on some level.

Even when drop apples are not used, the potential exists that apples may contain microorganisms in bruised or wounded areas (5). Most bacterial diseases of fruit require an opening in the plant tissue to cause infection. For example, fire blight (caused by *Erwinia amylovora*)

can infect apple trees during bloom by entering through openings in the flower tissues, or it can infect trees later in the season if the succulent tissues are wounded by hail or strong winds. Therefore, to control fire blight, commercial fruit producers spray trees with an antibiotic at times when the trees are susceptible to infection. The ability of *E. coli* to infiltrate non-injured tissue suggests that there may be several opportunities for bacterial infiltration in the production/harvest/handling system.

The route of entry for microorganisms into the apple may occur in two ways: through the leaves of the plant, or through the fruit itself (5, 6, 12). Microorganisms may enter the leaf through the stoma, tiny pores in the epidermis of a leaf or stem that allow the passage of gases and water vapor. Similarly, microorganisms may infiltrate the flesh of the fruit directly through the calyx, stem scar, or natural micropores in the lenticels of the skin. The infiltration of microorganisms may be enhanced by fruit surface damage, pre- or post-harvest, from hail, dust, insects, birds, strong winds, or wash water.

Bartz and Showalter (2) first demonstrated infiltration of fruit (tomato) tissues, based on the general gas law. This law states that any change in pressure in a closed container of constant volume is directly proportional to a change in the temperature of the gas. A fruit acts as a "closed container" (2). The morphological structures of the fruit contain pockets of gas at relatively constant volume. A decrease in temperature within the fruit results in a decrease in the internal gas pressure. The concern exists that as this pressure decrease occurs, uptake of gas and liquid may allow the influx of bacteria into the fruit. Researchers have demonstrated the formation of a vacuum capable of pulling a bacterial or dye suspension into the fruit core as a result of increased external pressure resulting from immersing fruit below the water surface (2, 4, 13). This phe-

TABLE 2. Location of *E. coli* ATCC 25922 infiltration in the skin and flesh of different apple varieties

Mean \pm standard deviation (sd) of *E. coli* in cores of two apples sampled during duplicate trials. Statistical analysis using ANOVA showed significant differences in the skin and flesh data by apple variety ($P < 0.05$). *E. coli* not detected (nd) in apples sampled on day zero.

Apple Variety	Day	Skin log CFU/ml \pm sd n = 6	Flesh log CFU/ml \pm sd n = 6
Rome Beauty	0	nd	nd
	1	2.70 \pm 1.40	1.91 \pm 0.28
	3	3.17 \pm 1.34	1.00 \pm 0.10
	8	1.97 \pm 0.07	3.10 \pm 0.71
	10	2.84 \pm 0.67	1.68 \pm 0.96
Red Delicious	0	nd	nd
	1	2.98 \pm 0.05	1.79 \pm 0.11
	3	2.12 \pm 0.28	1.93 \pm 0.38
	8	1.61 \pm 0.86	1.32 \pm 0.10
	10	1.47 \pm 0.21	1.70 \pm 0.98
Golden Delicious	0	nd	nd
	1	4.42 \pm 0.20	2.73 \pm 0.10
	3	3.14 \pm 0.20	1.31 \pm 0.43
	8	3.04 \pm 0.06	1.92 \pm 0.29
	10	3.08 \pm 1.13	1.00 \pm 0.1

nomenon may be enhanced by a difference in water temperature and fruit temperature (4).

A recent study identified the potential for infiltration of bacteria under laboratory conditions into specific structures of apples, including lenticels and the floral tube (5). Other studies have shown that bacteria can enter fruit tissues through puncture wounds (15), while we show here that bacteria can enter fully intact apples. This study describes the potential for bacterial infiltration outside a laboratory through lenticels, the stem scar, and the calyx/floral tube. The potential for bacterial infiltration under natural conditions was analyzed using three apple types: Red Delicious, Golden Delicious, and Rome.

Apple varieties were compared as to ease of bacterial infiltration, and electron microscopy was used to gain a better understanding of the role of cellular morphology. *Escherichia coli* ATCC 25922 was used as a surrogate organism, because this study was conducted in the field.

MATERIALS AND METHODS

Apples

Red Delicious, Golden Delicious, and Rome apples were harvested by hand from the Virginia Tech orchards (Montgomery County, VA) and stored at 2°C in an apple cooler at the Department of Food Science and Technology until

used. These apple varieties are used in the preparation of apple cider on the east coast of the United States. Red Delicious and Golden Delicious apples are used in the production of apple cider in many parts of the country.

Outdoor apple pen

A six-foot by six-foot pen was constructed from wire mesh to encase the apples. The entire floor of the pen was lined with a plastic tarp, which formed a barrier between the ground and a 3-inch layer of topsoil applied at the start of the experimental period (200 pounds, spread evenly). A thin wire mesh, supported at the four corners and by a center pole, was laid over the pen to prevent birds and other animals from interacting with the apples. Apples were sterilized in a solution containing 200 ppm sodium hypochlorite prior to being dropped on the soil. A total of seventy intact apples were dropped gently at random around the floor of the pen in two duplicate trials. When sampled, apples were still intact.

Inoculum

Escherichia coli ATCC 25922 (American Type Culture Collection, Rockville, MD) was incubated for approximately 24 hours at 37°C in Brain Heart Infusion Broth (Difco, Detroit, MI). Three hundred milliliters of inoculum containing 1.0×10^8 CFU/ml was then gently spread over the soil in the apple pen. One apple of each type was selected at random and tested as a control. Soil samples were tested for bacterial contamination before and after inoculation. The remaining apples were placed on the soil within thirty minutes after soil was inoculated.

Apple sample preparation

Six apples, two of each type, were randomly chosen and aseptically removed from the pen each day. The position of the apple on the soil was noted: calyx up, calyx down or on its side. Each apple was then cored and cut into sections:

Figure 1. Apple "Cage"

The 6' x 6' apple analysis cage in the backyard of the Food Science and Technology building on the Virginia Tech campus, Blacksburg, VA. Photo taken on day 3 of first trial.

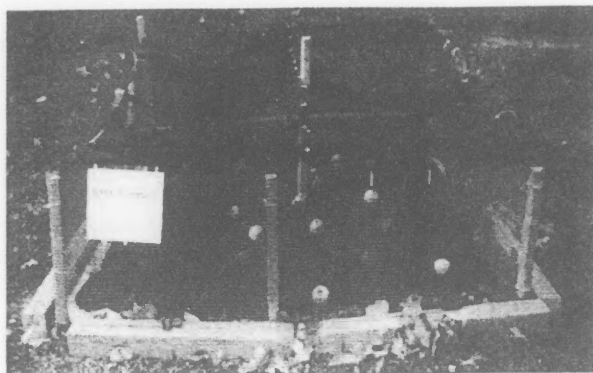


Figure 2. Lenticels

Lenticels from Rome Beauty (RB), Red Delicious (RD), and Golden Delicious (GD), indicated by white arrows.

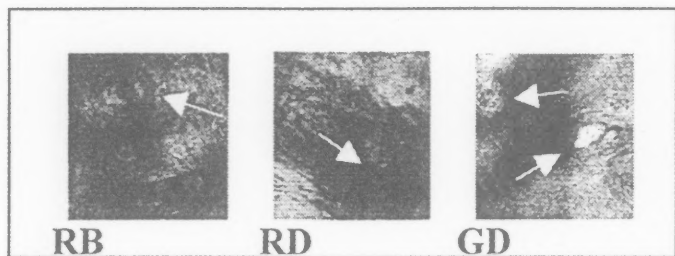


Figure 3. Cell wall structure

Thickness of cell wall differs by apple variety — Rome Beauty (RB), Red Delicious (RD), and Golden Delicious (GD). Cell wall structure may affect microbial internalization.



outer core, inner core, flesh, skin (4). Each section was placed into a filtered stomacher bag and stomached at 230 rpm for 30 s (Seward Lab Blender Stomacher 80). Twenty milliliters of sterile peptone solution (Difco, Detroit, MI) was added to the core and skin sections (flesh samples stomached with natural juices). Petri plates contained MacConkey agar (Difco, Detroit, MI) supplemented with cycloheximide (Sigma, St. Louis, MO) to control mold contamination and MUG (4-methylumbelliferyl- β -D-glucuronide, Sigma, St. Louis, MO) to facilitate identification of *E. coli*. Few to no bacterial colonies other than *E. coli* were observed from the plated apple samples. Dilutions were prepared individually, based on the weight of the apple skin, inner core, outer core, and flesh samples. In each case a 10^{-1} dilution was prepared on a wt/wt basis and duplicate plates were prepared using the Spiral Plating System (Spiral Biotech). All plates were incubated at 37°C for 24 hours and then counted according to Spiral Plating System directions. Plate counts (CFU/ml) were compared as log CFU/ml counts using ANOVA analysis and Tukey's test for least significant difference (P value < 0.05, SAS Software, Ogdensburg, NY). The effects of apple variety, apple position (calyx up, calyx down, or on its side), and day of trial were analyzed and compared.

Two identical trials were conducted, the first in the fall and the second in the early spring of the following year. Temperatures ranged from 50 to 70° during the days of both trials, falling into the 30s at night; however, apples did not show signs of ice crystals at any time. During the second trial, precipitation in the form of rain occurred (< 2 inches), but did not visibly disrupt the topsoil or apples within the pen.

Electron microscopy

Transmission electron microscopy (TEM) was performed on a JEOL 100 CX-II Scanning Transmission Electron Microscope (STEM) with a magnification range of 360

to 320,000 × in TEM mode. Apple slices were taken from clean intact apples of all three types and fixed in 2.5% glutaraldehyde in 0.1 M sodium phosphate buffer, pH 7.4, and processed for TEM.

RESULTS

Microbial analysis

Apples were obtained from an outside area as described above (Fig. 1). There was no visible difference in the soil level at the start of each study (uniformly 3.0 inches deep) compared to that at the end of each study (2.8 to 3.0 inches deep). Tables 1 and 2 show determined mean values in log CFU/ml ± standard deviation from two trials in which two apples were taken each day. All three apple varieties were sampled during each trial at 1, 3, 8, and 10 days. Data are separated according to values from inner and outer core (Table 1) and from skin and flesh (Table 2). There was a significant difference in flesh and skin data between apple varieties ($P < 0.05$ by ANOVA). This indicates that the skin or cuticle thickness and natural lenticel openings may influence bacterial entry to skin or flesh between apple varieties (Fig. 2 and 3), whereas there was a significant difference by both day and position for outer core values only ($P < 0.05$ by ANOVA). This indicates that apples with calyx facing down toward the soil had a greater chance for internalization to occur, compared to those with calyx facing up or those on their sides. Position was a significant factor only in data obtained from outer core samples; there was no significant difference in values for inner cores. Importantly, *E. coli* was not obtained from control apples sampled prior to the start of each study or from control apples placed on the ground prior to inoculation. MUG in the plates ensured proper identification of *E. coli*, and although *E. coli* was not found in control apples, any *E. coli* found in the apples after day zero was attributed to that placed on the soil. Differences in sample means

may be attributed in part to the rain in trial two or slight variation in temperatures during the two trials.

Electron microscopy

Transmission electron microscopy was used to analyze possible differences in apple skin and tissue structure. The skin and cell wall structure of three apple varieties (Rome Beauty, Red Delicious, and Golden Delicious) were observed. There are differences in lenticel size and number among apple varieties (Fig. 2). As lenticels are no longer needed for gas exchange in mature apples, such as those used in this study, they are often filled with waxy cells, as shown in the first two panels, Rome Beauty (RB) and Red Delicious (RD). In Golden Delicious (GD), lenticels may be filled with "cork" cells, as shown by the upper arrow, or may be unfilled and remain open, as shown by the lower arrow. In Golden Delicious apples, the lenticels are a possible source for internalization of bacteria.

There are also differences in cell wall structure (Fig. 3). The thickness of the cell wall is a characteristic often used to identify and differentiate apple varieties. The cellulose and hemicellulose fibers within the cell wall of a young fruit are often quite intact and dense. As the fruit ripens, vacuoles begin to grow and changes within the cell wall may occur. On average, the cells of a Golden Delicious apple have thinner walls than the cells of Rome Beauty and Red Delicious apples. The cells in Fig. 3 are believed to be at similar stages of ripening. A thinner cell wall is more prone to internalization of bacteria. As an apple ripens, the parenchyma cells move about, cell walls change, and internalization may occur more readily in all apple varieties.

DISCUSSION

Bacteria were found in all four parts (skin, flesh, inner core, outer core) of the intact "drop" apples used in this study. It appears that bacteria can infiltrate apple tissue

and the inner core under natural environmental conditions. Bacteria may enter these areas of the apple through stem and calyx openings or through openings in the skin. Some bacteria may actually have the ability to preferentially bind to the fruit surface through the formation of biofilms, especially near the stem and calyx areas (1, 16). This could increase the ease of infiltration of these microorganisms to the apple core.

The entrance of bacteria was different among the three apple varieties studied, Rome Beauty, Red Delicious, and Golden Delicious. This may be due to innate differences in the apple varieties, which may in turn influence how and if an apple becomes contaminated during development. Apples have a myriad of potential entry routes for bacteria. Studies are currently under way to evaluate routes of entry during development. In brief, as an apple develops, lenticels (Fig. 2) form as minute openings on the apple surface. These may or may not be visible to the naked eye, depending on the apple variety. Lenticels can range in number from 450 to 800 or from 1,500 to 2,500 per fruit (17). They form in the following ways: Stomata may develop into lenticels early in fruit development. Lenticels can also arise from breaks in the epidermis caused by a complete removal of epidermal hairs in that area, or from breaks brought about by the inability of the epidermis to keep pace with the expanding inner tissues of hypodermis and parenchyma during growth. During fruit development, lenticels usually become closed through cutinization or suberization processes, which prevent the free passage of gases from the inner tissues to the outside air.

Dingham (10) reported that susceptibility to bacterial contamination or bacterial growth varies with apple varieties. Differences in apple varieties that may influence infiltration may be a function of ripening, perhaps by association with pH, which was not studied

TABLE 3. The effects of frequency of cleaning agent usage on the prevalence of microbial contamination in the sink environment

Count /cm ²	Frequency of cleaning agent usage	TVC (%)				Total Coliforms (%)			
		Sink	Draining board	Tap	Around tap	Sink	Draining board	Tap	Around tap
<10 ²	At least daily	57	38	77	33	69	87	86	29
	>Weekly	5	29	50	28	21	76	100	59
	Less frequently	0	0	0	0	0	40	29	0
10 ² -10 ³	At least daily	29	62	23	50	31	13	14	71
	>Weekly	37	42	13	18	50	6	0	23
	Less frequently	0	0	17	0	38	10	42	0
10 ³ -10 ⁴	At least daily	14	0	0	17	0	0	0	0
	>Weekly	32	21	25	12	8	6	0	6
	Less frequently	11	13	66	25	49	10	29	36
10 ⁴ -10 ⁵	At least daily	0	0	0	0	0	0	0	0
	>Weekly	16	0	6	18	0	12	0	6
	Less frequently	23	50	17	25	13	20	0	46
10 ⁵ -10 ⁶	At least daily	0	0	0	0	0	0	0	0
	>Weekly	0	7	6	12	21	0	0	6
	Less frequently	33	13	0	16	0	10	0	18
10 ⁶ -10 ⁷	At least daily	0	0	0	0	0	0	0	0
	>Weekly	10	0	0	12	0	0	0	0
	Less frequently	33	24	0	32	0	10	0	0

here, or along with natural anatomical differences. Lenticels, cuticle structure, cuticle area, and the width of stem and calyx areas are all used in differentiating apple varieties (17). In the Golden Delicious apple variety, lenticels may not close or may only partially close after the formation of 'cork' cells (17). Additionally, cork cells may form in response to tissue damage and therefore may be less efficient than waxy cells at inhibiting infiltration of microorganisms through lenticels.

Golden Delicious apples have a cracked and discontinuous cuticle, unlike other varieties, which have a fairly oily cuticle. Environmental factors can also influence cuticle formation. For example, parts of the fruit that develop in the shade, such as the skin located directly around the stem, have a thinner cuticle. While the fruit ripens, air spaces within fruit cells may grow or expand, allowing increased infiltration of microorganisms. The process of ripening may lead to changes in apple tissue. The further influence of environmental factors and fruit growth are currently being evaluated in field studies for their potential role in microbial infiltration.

This study indicates that bacteria can infiltrate apple tissues outside laboratory conditions. It appears that environmental conditions may be most influential on infiltration of bacteria into the core, where subsequent studies (data not shown) have yielded preliminary data that suggest that bacteria can survive for fourteen days. Such findings indicate the possible need for the inclusion of a final processing step such as ultra-violet light, high pressure, or heat pasteurization to assure a proper kill or reduction of microorganisms (5-log reduction of the target microorganism). These findings also suggest that careful culling of apples may not be enough to ward off potential microbial contamination, since bacteria may be inside the tissue of intact apples.

To our knowledge, the infiltration of bacteria in dropped apples has not been demonstrated before outside a laboratory.

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Commercial Application of Lactic Acid to Reduce Bacterial Populations on Chilled Beef Carcasses, Subprimal Cuts and Table Surfaces during Fabrication

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SUMMARY

This study evaluated the efficacy of a lactic acid solution, applied at three in-plant locations, alone and in combination, in reducing or controlling bacterial populations on beef carcasses and subprimal cuts, and on table surfaces, during carcass fabrication. Total plate counts (TPC), total coliform counts (TCC), and *Escherichia coli* counts (ECC) on carcass surfaces immediately before entering fabrication were low, as 9.0, 89.5, and 93.8% of samples had TPC, TCC, and ECC, respectively, below detection limits of 2.2, 0.9, and 0.9 log CFU/100 cm². Lactic acid solution rinsing (1.5 to 2.5%; 29.5°C; 182 kPa; 3 s) of carcasses, immediately before entering the fabrication process, minimally reduced mean TPC from 3.3 log CFU/100 cm² to 3.0 log CFU/100 cm², and increased the percentage of non-detectable TCC and ECC from 89.5 and 93.8%, to 92.4% and 94.3%, respectively. Lactic acid solution rinsing of fabrication table surfaces, alone or in combination with lactic acid solution rinsing of carcasses, reduced ($P < 0.05$) TPC, TCC and ECC of 5.5, 3.2 and 2.8 log CFU/100 cm² on table surfaces, by an average of 1.2, 0.8 and 0.7 log CFU/100 cm², respectively. Lactic acid solution rinsing of top sirloin butts, alone or in combination with lactic acid solution rinsing of carcasses and fabrication tables, reduced ($P < 0.05$) their TPC, TCC and ECC of 5.7 and 5.1, 3.8 and 3.5, and 3.3 and 3.2 log CFU/100 cm², respectively, by less than 0.5 log CFU/100 cm². Bacterial populations on the surface of carcasses entering the fabrication process remained constant over time (3-h period), while TPC, TCC and ECC on surfaces of fabrication tables and top sirloin butts increased by an average of 1.4, 1.1 and 1.0 log CFU/100 cm², respectively. In contrast to decontamination of hot carcasses with lactic acid rinses, application of lactic acid solutions had little effect in reducing contamination of beef carcass, subprimal cut, and table surfaces during beef carcass fabrication.

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INTRODUCTION

In response to food safety concerns associated with fresh meat contamination, the Food Safety and Inspection Service of the United States Department of Agriculture (FSIS-USDA) mandated industry-wide implementation of HACCP principles and associated microbiological performance criteria in an attempt to emphasize the importance of controlling microbiological populations on beef carcass surfaces (17). Subsequently, the beef industry adopted technologies such as hot water/steam vacuuming, steam pasteurization, and ambient temperature or hot water spray washing with or without organic acid solution rinsing, to reduce contamination and meet performance criteria (12, 15, 22, 26, 32, 33).

These technologies have resulted in decreased microbiological contamination on carcass surfaces. Bacon et al. (5) sampled chilled (18 to 24 h) beef carcasses in five fed cattle and three non-fed cattle packing plants and reported that 19.4% of total plate counts (TPC; 62 of 319 samples), 86.2% of total coliform counts (TCC; 275 of 319 samples) and 98.4% of *Escherichia coli* counts (ECC; 315 of 320 samples) were not detected at detection limits of 2.2, 0.9 and 0.9 log colony-forming-units (CFU)/100 cm², respectively.

Traditionally, the sustained refrigeration temperatures following the exsanguination/dressing process (i.e., carcass chilling through fabricating, packaging, distributing and retailing) have been considered sufficient to control or reduce proliferation of, and/or toxin production by, foodborne pathogens (25). However, psychrotrophic and surviving mesophilic bacterial populations may proliferate readily in conditions approximating mild to moderate temperature abuse, and subprimal cuts and trimmings can be further contaminated during fabrication (25, 28). Employees and improperly sanitized contact surfaces, such as belts, tables, saw blades and cutting boards, serve as potential sources of contamination. Cross-contamination occurring directly, between carcasses, primal

cuts and trimmings, or indirectly, from repeated contact with employees (e.g., hands, knives and meat hooks) or contact surfaces is probable (34). Gill et al. (19) sampled product immediately before it entered and after it left the fabrication process in four commercial beef packing facilities. Results indicated increased ECC on final fabricated product surfaces, which, following closer inspection of equipment, were attributed to obscurely located detritus associated with large populations of aerobic bacteria, including *Escherichia coli*. When bacteria-harboring equipment was running, even before product passage, bacteria were transferred to meat contact surfaces, ultimately resulting in product contamination (19).

In another study (20), surfaces of beef carcasses, primal cuts and tables were swabbed immediately before, during and following carcass fabrication, respectively. TCC and ECC recovered from carcass surfaces were 4.0 and 3.5 log CFU/500 sides, respectively, while corresponding populations on primal cuts were > 6.0 and 5.5 log CFU/500 cuts. Because TCC and ECC on primal cut surfaces were higher than those recovered from carcasses (i.e., by approximately 2.0 logs), and were comparable to those recovered from fabrication tables, contamination of primal cuts from table surfaces was implicated (20).

Bacterial populations on the surfaces of tables and primal cuts may be controlled by employing interventions immediately before, during and/or immediately following (before vacuum packaging) beef carcass fabrication. The objective of this study was to determine the efficacy of lactic acid solution rinsing in reducing or controlling bacterial populations on beef carcasses and subprimal cuts, and on table surfaces, during carcass fabrication.

MATERIALS AND METHODS

Sample collection

Samples (n = 805) were collected during a period of six weeks (A through F) from the surfaces of

beef carcasses, fabrication tables and top sirloin butts before, during and immediately following the carcass fabrication process in a commercial fed-beef packing plant. Decontamination treatments evaluated included: (a) post-chilling lactic acid solution (1.5 to 2.5%; 29.5°C; 182 kPa; 3 sec) carcass rinsing, applied as a mist using a commercial spray-wash cabinet located immediately before the chilled carcass scale; (b) table rinsing, lactic acid solution (1.5 to 2.5%; 29.5°C) continuously applied as a fine mist by means of a spray bar mounted to the proximal end of the loin fabrication table; and, (c) sub-primal rinsing with lactic acid solution (1.5 to 2.5%; 29.5°C) applied as a mist, manually in two passes using a compressed air sprayer (8l; Spray Doc Model 2000P, Gilmour, Somerset, PA) to top sirloin butts removed from the distal end of the loin fabrication table.

Sampling occurred before, during and immediately following the fabrication process at five different in-plant sampling sites: (1) carcass (site 1), immediately after entering the fabrication area but before the lactic acid solution carcass rinsing cabinet; (2) carcass (site 2), immediately after the lactic acid solution carcass rinsing cabinet but before the chilled carcass scale; (3) fabrication table (site 3), at the distal end of the loin line; (4) top sirloin butt (site 4), immediately after being removed from the distal end of the loin fabrication table but before lactic acid solution subprimal rinsing; and, (5) top sirloin butt (site 5), following lactic acid solution subprimal rinsing but before vacuum packaging.

During each week (A through F) at each in-plant sampling site required by the assigned treatment, samples (n = 7) were collected each day (Monday through Friday) every half-hour, for three hours, beginning at the start of the first shift. The sampling protocols for weeks A through F are detailed in Table 1. Week A included the collection of samples at three in-plant sampling sites with no decontamination treatments applied, to develop a complete baseline-data subset of

TABLE 1. Decontamination treatments applied and number of samples collected during each week, by in-plant sampling site^a before, during and immediately following beef carcass fabrication

Week	Decantamination Treatments Applied ^b	In-Plant Sampling Sites ^a				
		Carcass Site 1	Carcass Site 2	Fabrication Table Site 3	Tap Sirloin Butt Site 4	Tap Sirloin Butt Site 5
A	None	35	—	35	35	—
B	Carcass Rinsing	35	35	35	35	—
C	Table Rinsing	35	—	35	35	—
D	Subprimal Rinsing	35	—	35	35	35
E	Carcass + Table Rinsing	35	35	35	35	—
F	Carcass + Table + Subprimal Rinsing	35	35	35	35	35
Total		210	105	210	210	70

Total number of samples collected: 805.

^a Sampling occurred at five different in-plant sampling sites, including: (1) carcass (site 1), immediately after entering the fabrication area but before the lactic acid solution carcass rinsing cabinet; (2) carcass (site 2), immediately after the lactic acid solution carcass rinsing cabinet; (3) fabrication table (site 3), at the distal end of the lain line; (4) tap sirloin butt (site 4), immediately after being removed from the distal end of the lain fabrication table; and, (5) top sirloin butt (site 5), following lactic acid solution subprimal rinsing but before vacuum packaging.

^b Decantamination treatments included: (a) post-chilling lactic acid solution carcass rinsing, immediately before the chilled carcass scale; (b) lactic acid solution fabrication table rinsing, applied by means of a spray bar mounted to the proximal end of the lain fabrication table; and (c) lactic acid solution subprimal rinsing, applied to tap sirloin butts removed from the distal end of the lain fabrication table.

biological populations on carcass, fabrication table and top sirloin butt surfaces. Week B included the collection of samples at four in-plant sampling sites with the application of lactic acid solution carcass rinsing, to determine the efficacy of this decontamination treatment in reducing or controlling bacterial populations on carcasses, and subsequently on fabrication table and top sirloin butt surfaces. Week C included the collection of samples at three in-plant sampling sites with the application of lactic acid solution table rinsing, to determine the contribution of this decontamination treatment to the microbiological quality of table surfaces and subsequently removed top sirloin butts. Week D included collection of samples at four in-plant sampling sites with lactic acid solution subprimal rinsing, to determine the

efficacy of this decontamination treatment in reducing or controlling bacterial populations on top sirloin butt surfaces. Week E included the collection of samples at four in-plant sampling sites with lactic acid solution rinsing of carcasses and tables, to determine the collective contribution of the decontamination treatments to the microbiological quality of table surfaces and subsequently removed top sirloin butts. Week F included collection of samples at five in-plant sampling sites with lactic acid solution rinsing of carcasses, tables, and subprimals, to determine the collective efficacy of all decontamination treatments in reducing or controlling bacterial populations on top sirloin butts (Table 1).

Sponge sampling was performed following procedures de-

scribed in the FSIS-USDA Meat and Poultry Inspection regulations (17). Immediately before sampling, sterile sponges (BioPro Enviro-Sponge Bags, International Bio-Products, Redmond, WA) were hydrated with 10 ml of sterile 0.1% buffered peptone water (BioPro, International BioProducts). Sampling of carcass sides (sites 1 and 2) was performed using a 100 cm² disposable, sterile template (USDA Template, International BioProducts) at each of three anatomical locations, which were: (a) flank, where the cutaneous flank muscle comes to within 7.62 cm of the midline; (b) brisket, at a point on the midline level with the elbow; and, (c) rump, where a line from the posterior aspect of the aitch bone to the achilles tendon intersects the cut surface of the round (17). Sampling of table surfaces

micro(site 3) and subprimal cuts (sites 4 and 5) was performed using a 100 cm² disposable, sterile template (USDA Template, International BioProducts). Table surfaces were sampled (100 cm²) at the distal end of the loin fabrication line, while subprimal cuts (top sirloin butts) were sampled (100 cm²) immediately after being removed from the loin fabrication line, on the surface associated with external adipose tissue.

Sponge swabbing at each carcass, fabrication table, or subprimal cut sampling site, within the 100 cm² template area, consisted of 10 passes vertically (up-and-down being considered as 1 pass) and 10 passes horizontally (side-to-side being considered as 1 pass) with a pressure equivalent to that which would be used to remove dried blood (17). Sampling was performed aseptically using sterile latex gloves (International BioProducts), which, like the template, were changed between samples. Following sample collection, an additional 15 ml of refrigerated (4 to 5°C) sterile 0.1% buffered peptone water (Difco Laboratories, Detroit, MI) was added, increasing the total buffer volume to 25 ml. When daily sample collection was finished (3h after commencement of carcass fabrication), excess air was expelled and sponge bags were folded down and packed into shipping coolers for same-day delivery to the analytical laboratory (Warren Analytical Laboratory, Greeley, CO).

Microbiological analyses

The sponges and associated buffer were pummeled in a stomacher (Seward Model 400, Tekmar Company, Cincinnati, OH) for 1 min, and analyzed for total plate counts (TPC), total coliform counts (TCC) and *Escherichia coli* counts (ECC). To determine TPC, appropriate dilutions were plated on Plate Count Agar (PCA; Difco Laboratories) using a spiral plating system (Spiral Systems Instruments, Inc., Cincinnati, OH). Following aerobic incubation at 35 ± 2°C for 48 h, colonies were counted by use of a laser bacteria colony counter

(Model 500A, Spiral Systems Instruments, Inc.) and a computer assisted spiral bio-assay (CASBA) data processor with Bacterial Enumeration Program E20 (Spiral Systems Instruments, Inc.).

To determine TCC and ECC, appropriate dilutions were transferred (1 ml) to Petrifilm™ *E. coli* Count Plates (3M Health Care, St. Paul, MN) and, following a 24 ± 2 h incubation period (18) at 35 ± 2°C, colonies were manually counted by means of a Quebec Darkfield Counter (AO Scientific Instruments). Colonies closely associated with entrapped gas (approximately one colony diameter) and possessing a bright red or blue color were counted as coliforms (TCC), while colonies closely associated with trapped gas and possessing a blue to red-blue color were counted as *E. coli* biotype 1 (ECC).

Data analysis

Microbiological counts for each enumerated set (TPC, TCC and ECC) were transformed to log₁₀ CFU/100 cm² for statistical analyses. Minimum detection limits for TPC, TCC and ECC were 2.2, 0.9 and 0.9 log CFU/100 cm² (20, 1 and 1 CFU/ml of diluent), respectively, for carcass samples (adjusted for 300 cm² sample area), and 2.7, 1.4, and 1.4 log CFU/100 cm² (20, 1 and 1 CFU/ml of diluent), respectively, for fabrication table and subprimal samples, based on maximum sensitivity of the tests with no further dilution beyond the original buffer volume (25 ml). Undetectable TPC, TCC and ECC were recorded as 2.2, 0.9, and 0.9 log CFU/100 cm², respectively, for carcass samples, and 2.7, 1.4, and 1.4 CFU/100 cm², respectively, for fabrication table and subprimal samples, so statistical analysis could be performed without overestimating antimicrobial efficacy. Values for the mean log count and standard deviation of each enumerated set (log CFU/100 cm² for TPC, TCC and ECC) were calculated on the assumption of a log-normal distribution of microorganisms (7, 23). Data for each enumerated set were evaluated with

analysis of variance (AOV) using the model $y = a + x_1 + x_2 + x_1x_2$ and least-squares means were computed for TPC, TCC and ECC by week (x_1), in-plant sampling site (x_2), and week \times in-plant sampling site (x_1x_2) fixed effects using the General Linear Models procedure of SAS® (30). Because of the significant week \times in-plant sampling site interaction ($P = 0.0001$), only interaction subclass least squares means are reported (Tables 2 - 5). When AOV detected effects ($P \leq 0.05$), mean log values for bacterial populations (\bar{y}) on carcass and table surfaces (Tables 2 and 4) were separated using the pairwise t-test of SAS® (30). Lactic acid solution rinsing of carcasses (weeks B, E and F) and subprimals (week D) were evaluated by determining mean log value differences (mean log value before treatment application minus mean log value after treatment application) for each enumerated set. Treatment effects (lactic acid solution rinsing of carcasses and subprimals) based on bacterial population differences ($D\bar{y}$; Tables 3 and 5) were determined using a two-tailed t-test (30).

RESULTS AND DISCUSSION

Mean log TPC, TCC, and ECC on carcass surfaces immediately after entering the fabrication area (in-plant sampling site 1) ranged from 2.9 to 4.0, ≤ 0.9 to 1.0, and ≤ 0.9 to ≤ 0.9 log CFU/100 cm², respectively, among the six sampling weeks. Of the total carcass samples collected ($n = 210$) across all sampling weeks, 19 (9.0%), 188 (89.5%) and 197 (93.8%) yielded non-detectable TPC, TCC and ECC, respectively (Table 2).

Mean log TPC, TCC, and ECC on carcass surfaces immediately before lactic acid solution carcass rinsing (weeks B, E and F) were 3.3, 1.0 and 0.9 log CFU/100 cm², respectively. Lactic acid solution carcass rinsing reduced ($P < 0.05$) TPC, increasing the number of samples below the detection limit from 12.4% (13 of 105) to 21.9% (23 of 105) (Table 3). TCC and ECC on carcass surfaces were reduced, but

TABLE 2. Least squares means (\bar{x}) and standard deviations (s) for the \log_{10} values of total plate counts (TPC), total coliform counts (TCC), and *Escherichia coli* counts (ECC) (CFU/100 cm²), and the number of samples (n (%)) in which counts were not detected, on carcasses immediately prior to fabrication, by sampling week

Microbiological Counts on Carcass Surfaces									
Week	Total Plate Counts			Total Coliform Counts			<i>Escherichia coli</i> Counts		
	\bar{x}	s	n	\bar{x}	s	n	\bar{x}	s	n
A	4.0 ^a	1.40	5 (14.3)	0.9 ^b	0.10	32 (91.4)	0.9 ^a	0.06	34 (97.1)
B	3.1 ^{bc}	0.81	5 (14.3)	1.0 ^a	0.56	29 (82.9)	0.9 ^a	0.33	33 (94.3)
C	3.3 ^b	0.63	1 (2.9)	0.9 ^b	0.12	31 (88.6)	0.9 ^a	0.01	33 (94.3)
D	3.9 ^a	0.65	0 (0.0)	0.9 ^{ab}	0.26	33 (94.3)	0.9 ^a	0.26	33 (94.3)
E	3.7 ^a	1.37	2 (5.7)	0.9 ^b	0.18	32 (91.4)	0.9 ^a	0.01	33 (94.3)
F	2.9 ^c	0.67	6 (17.1)	0.9 ^b	0.14	31 (88.6)	0.9 ^a	0.14	31 (88.6)
Total	3.5	1.00	19 (9.0)	0.9	0.28	188 (89.5)	0.9	0.18	197 (93.8)

Number of samples analyzed during each week: 35 for each enumerated set (TPC, TCC and ECC); total number of samples analyzed: 210 for each enumerated set.

Detection limits for TPC, TCC, and ECC were 2.2, 0.9, and 0.9 log CFU/100 cm², respectively.

^{abc} Means in the same column bearing a common superscript letter are not different ($P > 0.05$).

the reduction was not statistically significant ($P > 0.05$), following treatment application, although the efficacy of the treatment in reducing these microbiological populations may have been masked by the extremely high number of samples failing to yield detectable bacterial counts. Nonetheless, the percentage of non-detectable samples increased from 87.6% (92 of 105) and 92.4% (97 of 105) to 92.4% (97 of 105) and 94.3% (99 of 105) for TCC and ECC, respectively (Table 3).

Mean log TPC, TCC, and ECC on fabrication table surfaces, without any decontamination treatment, were 5.5 and 5.5, 2.8 and 3.6, and 2.4 and 3.2 log CFU/100 cm² during weeks A and D, respectively (Table 4). Microbiological populations (TPC, TCC, and ECC) on fabrication table surfaces, following lactic acid solution rinsing of carcasses only (week B), were similar (mean log values of 5.2 for TPC, 3.7 for TCC and 3.5 for ECC) to populations recovered without treatment application (weeks A and D). Lactic acid solution rinsing of fabrication tables (week C) resulted in

mean TPC, TCC, and ECC populations of 4.6, 2.7, and 2.1 log CFU/100 cm², respectively, which were lower ($P < 0.05$) than all three of the populations during week D and lower ($P < 0.05$) than TPC and ECC populations during week A. Combined lactic acid solution rinsing of carcasses and of fabrication table surfaces resulted in mean TPC, TCC, and ECC of 4.1 and 4.2, 2.1 and 2.5, and 1.8 and 2.3 log CFU/100 cm² during weeks E and F, respectively (Table 4). TPC, TCC, and ECC were lower during week E than during weeks A and D ($P < 0.05$). Populations (TPC, TCC, and ECC) during week F were lower ($P < 0.05$) than during week D, but only TPC were lower ($P < 0.05$) during week F than during week A (Table 4).

The application of lactic acid solution rinsing to subprimals (week D) resulted in minimal reductions ($P < 0.05$; < 0.5 log CFU/100 cm²) in TPC, TCC and ECC on top sirloin butts from initial mean log values of 5.7, 3.8 and 3.3 log CFU/100 cm², respectively (Table 5). Lactic acid solution rinsing of

subprimals, applied in combination (as multiple decontamination treatments) with lactic acid solution rinsing of carcasses and fabrication tables (week F), reduced ($P < 0.05$) ECC, but only by 0.3 logs, and had no effect ($P > 0.05$) on mean log TPC and TCC (Table 5). The application of multiple decontamination treatments "upstream" in the fabrication process (i.e., lactic acid solution rinsing of carcasses and fabrication tables) may have had an effect on the efficacy of "downstream" treatments (i.e., lactic acid solution subprimal rinsing), due to previous reductions in microbiological populations.

Microbiological populations on carcass surfaces entering the fabrication process did not ($P > 0.05$) depend on sampling time, as mean TPC, TCC, and ECC at the first sampling time (0 min) were 3.4, 0.9, and 0.9 log CFU/100 cm², respectively, while corresponding counts after three hours of sampling were 3.5, 1.0, and 0.9 log CFU/100 cm², respectively (Table 6). In contrast,

TABLE 3. Least squares means ($D\bar{x}$)^a and standard deviations (s) for the difference in \log_{10} values of total plate counts (TPC), total coliform counts (TCC) and *Escherichia coli* counts (ECC) (CFU/100 cm^2), number of samples in which counts were not detected before (n_1 (%)) and after (n_2 (%)) treatment application, and $D\bar{x}$ test statistic (T), P-value, and 95% confidence interval (C.I.) associated with lactic acid solution carcass rinsing

Decontamination Effects of Lactic Acid Solution Carcass Rinsing^b

Microbiological counts on carcass surfaces	$D\bar{x}$	s	n_1 (%)	n_2 (%)	T	P-value	C.I.
TPC	0.22	0.98	13 (12.4)	23 (21.9)	2.26	0.03	0.03 - 0.40
TCC	0.06	0.35	92 (87.6)	97 (92.4)	1.77	0.08	-0.01 - 0.10
ECC	0.03	0.21	97 (92.4)	99 (94.3)	1.25	0.22	-0.02 - 0.07

^a $D\bar{x}$ is the difference in least squares means for each enumerated set (TPC, TCC and ECC) between sampling sites 1 and 2 (site 1 minus site 2).

^bMean log values for TPC, TCC and ECC on carcass surfaces immediately before treatment application were 3.3, 1.0 and 0.9 log CFU/100 cm^2 , respectively.

Number of samples analyzed at each of the two in-plant sampling sites was 105 for each enumerated set.

Detection limits for TPC, TCC, and ECC were 2.2, 0.9, and 0.9 log CFU/100 cm^2 , respectively.

TABLE 4. Least squares means (\bar{x}) and standard deviations (s) for the \log_{10} values of total plate counts (TPC), total coliform counts (TCC), and *Escherichia coli* counts (ECC) (CFU/100 cm^2) on table surfaces, by sampling week

Microbiological Counts on Table Surfaces^a

Week	Total Plate Counts		Total Coliform Counts		<i>Escherichia coli</i> Counts	
	\bar{x}	s	\bar{x}	s	\bar{x}	s
A	5.5 ^a	1.08	2.8 ^b	0.81	2.4 ^c	0.77
B	5.2 ^a	1.12	3.7 ^a	0.91	3.5 ^a	0.92
C	4.6 ^b	1.00	2.7 ^b	0.66	2.1 ^{de}	0.58
D	5.5 ^a	0.81	3.6 ^a	0.79	3.2 ^b	0.78
E	4.1 ^c	1.13	2.1 ^c	0.99	1.8 ^e	0.83
F	4.2 ^{bc}	1.16	2.5 ^b	0.90	2.3 ^{cd}	0.89

^aLactic acid solution rinsing of tables alone (as no decontamination treatment) occurred during week C, and lactic acid solution rinsing of tables in combination (as multiple decontamination treatments) with lactic acid solution carcass rinsing occurred during weeks E and F.

Number of samples analyzed during each week was 35 for each enumerated set (TPC, TCC and ECC).

^{abcde} Means in the same column bearing a common superscript letter are not different ($P > 0.05$).

TABLE 5. Least squares means ($D\bar{x}$)^a and standard deviations (s) for the difference in log₁₀ values of total plate counts (TPC), total coliform counts (TCC) and *Escherichia coli* counts (ECC) (CFU/100 cm²), and the $D\bar{x}$ test statistic (T), P-value, and 95% confidence interval (C.I.) associated with lactic acid solution subprimal rinsing in each of two decontamination systems

Microbiological Counts on Subprimal Surfaces	Decontamination Effects of Lactic Acid Solution Subprimal Rinsing in Two Systems ^b									
	Applied as the Only Decontamination Treatment ^c					Applied Following Carcass and Table Rinsing ^d				
	$D\bar{x}$	s	T	P-value	C.I.	$D\bar{x}$	s	T	P-value	C.I.
TPC	0.34	0.74	2.76	0.01	0.09 - 0.60	-0.07	0.78	-0.54	0.59	-0.34 - 0.20
TCC	0.41	0.57	4.33	0.00	0.22 - 0.61	0.15	0.83	1.09	0.29	-0.14 - 0.44
ECC	0.32	0.73	2.62	0.02	0.07 - 0.58	0.32	0.86	2.17	0.04	0.02 - 0.62

^a $D\bar{x}$ is the difference in least squares means for each enumerated set (TPC, TCC and ECC) between sampling sites 4 and 5 (site 4 minus site 5).

^bLactic acid solution rinsing of top sirloin butts alone (as a decontamination treatment) occurred during week D; lactic acid solution rinsing of top sirloin butts in combination (as multiple decontamination treatments) with lactic acid solution carcass and table rinsing occurred during week F.

^cMean log values for TPC, TCC and ECC on subprimal surfaces immediately before treatment application were 5.7, 3.8 and 3.3 log CFU/100 cm², respectively.

^dMean log values for TPC, TCC and ECC on subprimal surfaces immediately before treatment application were 5.1, 3.5 and 3.2 log CFU/100 cm², respectively.

Number of samples analyzed during each week, at each of the two in-plant sampling sites was 35 for each enumerated set.

microbiological populations on surfaces of fabrication tables and top sirloin butts changed over time, as initial (0 min) TPC, TCC, and ECC on fabrication table surfaces were 3.8, 1.9, and 1.8 log CFU/100 cm², while corresponding counts after three hours of sampling were 5.2, 3.1, and 2.7 log CFU/100 cm², respectively. Initial (0 min) TPC, TCC, and ECC on top sirloin butt surfaces were 4.5, 2.6, and 2.2 log CFU/100 cm², respectively, while corresponding counts after three hours of sampling were 5.8, 3.6, and 3.2 log CFU/100 cm², respectively (Table 6).

The application of organic acid solutions to beef carcass surfaces during the slaughter/dressing process, as a means of improving microbiological quality, has been extensively examined and reviewed

(8, 12, 15, 21, 22, 27). In general, data support spray washing/rinsing as effective means of eliminating, reducing, or controlling the proliferation of pathogenic and non-pathogenic bacterial populations on hot beef carcass surfaces. In contrast, the efficacy of organic acids in reducing bacterial populations is significantly less when they are applied to chilled tissue surfaces (1, 6, 11, 12, 13, 14). It has been suggested that this may be due, in part, to the lower temperatures associated with post-chilling carcass fabrication, since organic acid application temperature influences the extent to which bacterial populations are reduced (2, 3, 4, 12), and application to chilled tissue may result in an instantaneous rinsing solution temperature reduction. Samelis et al. (29) reported on the ability of *Escherichia coli* O157:H7,

Salmonella Typhimurium DT 104 and *Listeria monocytogenes* to survive or grow in spray-washing fluids, including lactic acid (2%; 55°C), collected following application to fresh beef top rounds. The researchers concluded that pathogen survival in acidic spray-washings was better at 4°C than at 10°C (29).

Castillo et al. (10) evaluated the decontamination efficacy of a lactic acid solution applied to chilled, outside beef rounds inoculated with *E. coli* O157:H7 and *S. Typhimurium* (7.0 to 7.3 log CFU/cm²). Samples were chilled for 24 h at 4°C, at which time the post-chilling lactic acid solution treatment (500 ml; 4% L-lactic acid; 30 s; 55°C) was applied. The post-chilling lactic acid solution application reduced existing inoculated bacterial populations by 1.6 to 2.4 log cycles, depending on the pre-chill treatment group, and the researchers

TABLE 6. Least squares means (standard deviations) for the log₁₀ values of total plate counts (TPC), total coliform counts (TCC), and *Escherichia coli* counts (ECC) (CFU/100 cm²) for each sampling time^a and by in-plant sampling site, averaged across all weeks

Sampling Time (min)	In-plant Sampling Site								
	Carcass (Site 1)			Table (Site 3)			Subprimal (Site 4)		
	TPC	TCC	ECC	TPC	TCC	ECC	TPC	TCC	ECC
1 (0)	3.4 (0.82)	0.9 (0.25)	0.9 (0.25)	3.8 (1.12)	1.9 (0.85)	1.8 (0.76)	4.5 (1.30)	2.6 (1.27)	2.2 (1.02)
2 (30)	3.5 (1.16)	0.9 (0.13)	0.9 (0.06)	4.9 (0.98)	2.6 (0.91)	2.3 (0.87)	5.2 (1.23)	2.9 (1.14)	2.7 (1.11)
3 (60)	3.3 (0.86)	0.9 (0.15)	0.9 (0.15)	4.9 (1.06)	3.0 (0.95)	2.6 (0.95)	5.7 (1.02)	3.2 (1.09)	2.8 (1.03)
4 (90)	3.5 (1.07)	0.9 (0.20)	0.9 (0.01)	4.9 (1.20)	3.1 (0.98)	2.8 (0.95)	5.6 (0.92)	3.1 (1.15)	2.8 (1.10)
5 (120)	3.5 (0.94)	0.9 (0.14)	0.9 (0.01)	5.2 (1.17)	3.3 (0.93)	2.9 (1.01)	5.7 (1.08)	3.4 (1.06)	3.1 (1.04)
6 (150)	3.7 (1.21)	0.9 (0.15)	0.9 (0.14)	5.0 (1.31)	3.1 (1.10)	2.8 (1.08)	5.8 (1.02)	3.8 (0.97)	3.4 (1.02)
7 (180)	3.5 (1.23)	1.0 (0.60)	0.9 (0.36)	5.2 (1.03)	3.1 (0.94)	2.7 (0.96)	5.8 (0.85)	3.6 (0.82)	3.2 (0.89)

^aSampling time 1 occurred with the commencement of fabrication; subsequent samples were taken every half-hour over a three-hour period of time.

Number of samples analyzed at each time was 30 for each enumerated set (TPC, TCC and ECC).

Detection limits for TPC, TCC, and ECC were 2.2, 0.9, and 0.9 log CFU/100 cm², respectively, for samples taken from carcass surfaces; corresponding detection limits for samples taken from table or subprimal surfaces were 2.7, 1.4, and 1.4 log CFU/100 cm², respectively.

concluded that significant reductions in bacterial populations could be achieved by application of a 4% lactic acid solution (500 ml; 55°C) for 30 s to chilled beef carcass sides (10). In a follow-up study (9), researchers evaluated the antimicrobial efficacy of a lactic acid solution rinse (4% L-lactic acid; 55°C; 35 s) applied to chilled beef carcasses (n = 40) in a commercial packing facility. The researchers reported 3.0 to 3.3 log CFU/100 cm² reductions in aerobic plate counts (APC), and increased numbers (*P* < 0.05) of undetectable TCC and ECC (9). Factors contributing to the reported increase of antibacterial efficacy might have included higher application concentrations, (4% as compared to 1.5 to 2.5%), increased exposure time (i.e., 35 s), and method of delivery (handheld compressed-air sprayer as compared to commercial carcass rinsing cabinet).

For a given organic acid solution, the extent to which it reduces bacterial populations may differ be-

tween fresh (hot) and chilled beef tissue surfaces. Typically, bacterial contamination on fresh or hot beef carcass tissue has been recently transferred, while that on chilled beef carcass tissue has had time (24 to 72 h) to attach, penetrate and/or form biofilms. Bacterial attachment to surfaces (e.g., meat) occurs in two distinct stages, including an initial reversible interaction, followed by a time-dependent phase involving irreversible attachment (24). There is a linear relationship between the concentration of bacteria attached to a surface and the time allowed for the attachment process to occur (8, 16). It is this second phase, involving glycoalyx development and subsequent biofilm formation of a microcolony, that provides additional protection against environmental stresses and thus promotes bacterial survival (31). It has been reported (8), that, as the time of beef carcass tissue exposure to fecal contamination in-

creases, the number of bacteria removed during subsequent spray washing/rinsing treatments decreases.

The lactic acid solution applications evaluated during this study resulted in only slight (≤ 1 log CFU/100 cm²) reductions in microbiological populations on the surfaces of carcasses, subprimals and fabrication tables. The reduced antimicrobial efficacy of lactic acid when applied to cold as compared to hot carcasses, as reported in the literature, may be due to more extensive bacterial attachment and lower carcass temperatures associated with chilling. While none of the decontamination strategies evaluated during this study completely prevented or significantly reduced (> 1 log CFU/100 cm²) contamination on fabrication table and subprimal surfaces, there was evidence, albeit slight, of additional reductions through multiple applications of the decontaminant. Additional studies

should be designed to test decontamination intervention sequences that may improve the microbiological quality of beef during fabrication.

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International Association for
Food Protection®

CALL FOR NOMINATIONS 2003 SECRETARY

A representative from industry will be elected in March of 2003 to serve as IAFP Secretary for the year 2003-2004.

Send letters of nomination along with a biographical sketch to the Nominations Chairperson:

John Cerveny
17 Ridgeview Ct., No. 7
Madison, WI 53704
Phone: 608.242.0760
Fax: 608.245.8895
E-mail: jcerveny@itis.com

The Secretary-Elect is determined by a majority of votes cast through a mail vote taken in March of 2003. Official Secretary duties begin at the conclusion of IAFP 2003. The elected Secretary serves as a Member of the Executive Board for a total of five years, succeeding to President, then serving as Past President.

For information regarding requirements of the position, contact David Tharp, Executive Director, at 800.369.6337 or 515.276.3344; Fax: 515.276.8655; E-mail: dtharp@foodprotection.org.

NOMINATIONS CLOSE NOVEMBER 1, 2002.



International Association for
Food Protection®

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. To request nomination criteria, contact:

International Association for Food Protection
6200 Aurora Ave., Suite 200W
Des Moines, Iowa 50322-2864
Phone: 800.369.6337; 515.276.3344
Fax: 515.276.8655
Web site: www.foodprotection.org
E-mail: info@foodprotection.org

Nominations deadline is March 17, 2003. You may make multiple nominations. All nominations must be received at the IAFP office by March 17, 2003.

- ◆ Persons nominated for individual awards must be current IAFP Members. Black Pearl Award nominees must be companies employing current IAFP Members. NFPA Food Safety Award nominees do not have to be IAFP Members.
- ◆ Previous award winners are not eligible for the same award.
- ◆ Executive Board Members and Awards Committee Members are not eligible for nomination.
- ◆ Presentation of awards will be during the Awards Banquet at IAFP 2003 - the Association's 90th Annual Meeting in New Orleans, Louisiana on August 13, 2003.

Nominations will be accepted for the following Awards:

Black Pearl Award – Award Showcasing the Black Pearl

Presented in recognition of a company's outstanding achievement in corporate excellence in food safety and quality.

Sponsored by Wilbur Feagan and F&H Food Equipment Company.

Fellow Award – Distinguished Plaque

Presented to Member(s) who have contributed to IAFP and its Affiliates with quiet distinction over an extended period of time.

Honorary Life Membership Award – Plaque and Lifetime Membership in IAFP

Presented to Member(s) for their devotion to the high ideals and objectives of IAFP and for their service to the Association.

Harry Haverland Citation Award – Plaque and \$1,000 Honorarium

Presented to an individual for years of devotion to the ideals and objectives of IAFP.

Sponsored by Silliker Inc.

Harold Barnum Industry Award – Plaque and \$1,000 Honorarium

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

Sponsored by NASCO International, Inc.

Educator Award – Plaque and \$1,000 Honorarium

Presented to an individual for outstanding service to the public, IAFP and the arena of education in food safety and food protection.

Sponsored by Nelson-Jameson, Inc.

Sanitarian Award – Plaque and \$1,000 Honorarium

Presented to an individual for outstanding service to the public, IAFP and the profession of the Sanitarian.

Sponsored by Ecolab, Inc., Food and Beverage Division.

Maurice Weber Laboratorian Award – Plaque and \$1,000 Honorarium

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.

Sponsored by Weber Scientific.

International Leadership Award – Plaque, \$1,000 Honorarium and Reimbursement to attend IAFP 2003

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.

Sponsored by Kraft Foods.

NFPA Food Safety Award – Plaque and \$3,000 Honorarium

Presented to an individual, group, or organization in recognition of a long history of outstanding contribution to food safety research and education.

Sponsored by National Food Processors Association.



Call for Abstracts

IAFP 2003

The Association's 90th Annual Meeting

August 10-13, 2003

New Orleans, Louisiana

General Information

1. Membership in the Association is not required for presenting a paper at IAFP 2003.
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 registrants may submit. However, presenters must present their presentations.
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. Abstracts must be submitted Online or via E-mail.

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. Other equipment may be used at the presenter's expense. Prior authorization from the office must be obtained. Overhead projectors will not be allowed.
2. Poster — Freestanding boards will be provided for presenting posters. Poster presentation surface area is 4' high by 8' wide. Handouts may be used, but audiovisual equipment will not be available. The presenter will be responsible for bringing pins and velcro.

Instructions for Preparing Abstracts

1. Title — The title should be short but descriptive. The first letter in each word in the title and proper nouns should be capitalized.
2. Authors — List all authors using the following style: first name followed by the surname.
3. Presenter Name & Title — List the full name and title of the person who will present the paper.
4. Presenter Address — List the name of the department, institution and full postal address (including zip/postal code and country).
5. Phone Number — List the phone number, including area, country, and city codes of the presenter.
6. Fax Number — List the fax number, including area, country, and city codes of the presenter.
7. E-mail — List the E-mail address for the presenter.
8. Format preferred — Check the box to indicate oral or poster format. The Program Committee makes the final decision on the format of the abstract.
9. Developing Scientist Awards Competitions — Check the box to indicate if the paper is to be presented by a student in this competition. A signature and date is required from the major professor or department head. See "Call for Entrants in the Developing Scientist Awards Competitions."
10. Abstract — Type abstract, double-spaced, in the space provided or on a separate sheet of paper, using a 12-point font size. Use no more than 250 words.

Abstract Submission

Abstracts submitted for IAFF 2003 will be evaluated for acceptance by the Program Committee. Be sure to include all ten (10) items requested in the "Instructions for Preparing Abstracts" above; 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 6, 2003. Submit abstracts through one of the following methods:

1. Online: Use the online abstract submission form located at www.foodprotection.org. You will receive an E-mail confirming receipt of your submission.
2. E-mail: Submit via E-mail as an attached text or MS Word™ document to abstracts@foodprotection.org.

Selection Criteria

1. Abstracts must accurately and briefly describe:
 - (a) the problem studied and/or objectives;
 - (b) methodology;
 - (c) essential results; and
 - (d) conclusions and/or significant implications.
2. Abstracts must report the results of original research pertinent to the subject matter. Papers should report the results of applied research on: food, dairy and environmental sanitation; foodborne pathogens; food and dairy microbiology; food and dairy engineering; food and dairy chemistry; food additives and residues; food and dairy technology; food service and food administration; quality assurance/control; mastitis; environmental health; waste management and water quality. Papers may also report subject matter of an educational and/or nontechnical 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. Papers should not appear in print prior to the Annual Meeting.
5. Results should be summarized. Do not use tables or graphs.

Rejection Reasons

1. Abstract was not prepared according to the "Instructions for Preparing Abstracts."
2. Abstract does not contain essential elements as described in "Selection Criteria."
3. Abstract reports inappropriate or unacceptable subject matter or is not based on accepted scientific practices, or the quality of the research or scientific approach is inadequate.
4. Work reported appears to be incomplete and/or data are not presented. Indication that data will be presented is not acceptable.
5. Abstract was poorly written or prepared. This includes spelling and grammatical errors.
6. Results have been presented/published previously.
7. Abstract was received after the deadline for submission.
8. Abstract contains information that is in violation of the International Association for Food Protection Policy on Commercialism for Annual Meeting Presentations.

Projected Deadlines/Notification

Abstract Submission Deadline: January 6, 2003.
Submission Confirmations: On or before January 7, 2003.
Acceptance/Rejection Notification: February 14, 2003.

Contact Information

Questions regarding abstract submission may be directed to Bev Corron, 515.276.3344 or 800.369.6337; E-mail: bcorron@foodprotection.org.

Program Chairperson

Lynn McMullen
University of Alberta
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Abstract Form

DEADLINE: Must be Received by January 6, 2003

(1) Title of Paper _____

(2) Authors _____

(3) Full Name and Title of Presenter _____

(4) Institution and Address of Presenter _____

(5) Phone Number _____

(6) Fax Number _____

(7) E-mail _____

(8) Format preferred: Oral Poster No Preference

The Program Committee will make the final decision on presentation format.

(9) Developing Scientist Awards Competition Yes Graduation date _____

Major Professor/Department Head approval (signature and date) _____

(10) TYPE abstract, DOUBLE-SPACED, in the space provided or on a separate sheet of paper, using a 12-point font size. Use no more than 250 words.

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 30, 2003.
7. All entrants with accepted abstracts will receive complimentary, one-year Association Membership, which includes their choice of *Dairy, Food and Environmental Sanitation* or *Journal of Food Protection*.
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 signature and date is required from the major professor or department head.

Judging Criteria

A panel of judges will evaluate abstracts and presentations. Selection of up to five 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 30, 2003. Only competition finalists will be judged at the Annual Meeting and will be eligible for the awards.

All other entrants with accepted abstracts will be expected to be present as part of the regular Annual Meeting. Their presentations will not be judged and they will not 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 must be present at the banquet where the awards winners will be announced and recognized.

Awards

- First Place – \$500 and an engraved plaque
- Second Place – \$300 and a framed certificate
- Third Place – \$100 and a framed certificate

Award winners will also receive a complimentary, one-year Membership including *Dairy, Food and Environmental Sanitation* and *Journal of Food Protection*.

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 convener, 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 convener, 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.

Highlights of the Executive Board Meeting

June 28 – July 4, 2002

Following is an unofficial summary of actions from the Executive Board Meeting held June 28 – July 4, 2002 in San Diego, CA:

Approved the following:

- Minutes of May 5-6, 2002 Executive Board Meeting
- Change *DFES* name to *Food Protection Trends*
- Ron Schmidt and David Tharp to represent IAFP on 3-A Sanitary Standards, Inc. Board of Directors

Discussed the following:

- Name change for *DFES*
- *JFP* — possible supplement for risk assessment conference papers
- Membership remains steady
- Advertising sales in line with budget projections
- May financial statements reviewed and compared to budget
- Summer Affiliate Newsletter distributed via E-mail. Positive response received
- IAFP Officers made presentations at one Affiliate meeting this summer. Eight are scheduled for fall meetings
- Plan to address non-compliant Affiliates
- Affiliate Membership Achievement Award restructuring
- Potential new Affiliate organizations

- Progress on the International Food Safety Icons being developed by the Retail Food Safety and Quality PDG
 - New Committee Member and Chairpersons appointments
 - Foundation Fund considerations
 - Publishing of extended abstracts from symposium
 - Board schedule and responsibilities for IAFP 2002
 - Fall planning trip for IAFP 2003
 - Future Annual Meeting site selection
 - Co-sponsorships — Michigan State Conference
 - IAFP on the Road — USDA / FSIS — Thinking Globally-Working Locally, Conference on Food Safety Education, September 18-20, 2002 and Food Safety Summit, March 18-20, 2003
 - Organizing session(s) for Food Safety Summit
 - Corporate Challenge update
 - International Food Information Council overview
 - World Health Organization Non-Governmental Organization
 - European Association Services offered
- Next Executive Board meeting: Teleconference, September 23, 2002

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Reader Comments

At the risk of bringing additional attention to a minor issue, I still feel compelled to respond to the letter from Les Lipschutz, Director of Product Safety for Del Monte Fresh Produce Company, as published in the July issue of this journal. Lipschutz critiques the cover photograph from the May issue, which depicts sampling from a dairy tanker.

I was involved in making this particular photograph available. Last January Donna Bahun, Production Editor of this journal, wrote to me, "I am looking for colored slides or photos of products to place on the cover of *Dairy, Food and Environmental Sanitation*. We thought of you and wondered if Weber Scientific has anything they would like to submit." I forwarded Bahun's request to Weber's marketing department, asking that they send a suitable photograph for her consideration. Several days later we selected and E-mailed Bahun an action photograph, she wrote back thanking us, saying that she will try to use the photo in an upcoming issue, and requesting a 10 to 15 word description of the product. Marketing responded with a brief caption describing the device and its use and identifying the individual pictured.

When I received my May issue of *DFES* I became aware that the photograph we made available was on the cover. The content page contained a box describing the cover. It said

the photo is courtesy of Weber Scientific and included the verbatim description as supplied by us to Bahun, "Q.C. Manager, Patrick Boyle, demonstrates how to obtain a truly representative sample from a stratified tanker using the Weber-Boyle Milk Tank Sampler." If I personally had been asked to review the submitted product description I would have omitted the words "truly representative," out of concern that this two-word phrase might be construed as opinion and not documented fact. However, I felt that to be a relatively minor point and was pleased that we were able to respond to Bahun's request and could help the Association.

During the IAFP Annual Meeting in San Diego, I was approached by Lipschutz. He said that he had written (or was to going to write) *DFES* about some sanitation concerns that he observed in this photograph. I recall my basic response to be that he was entitled to voice his opinion and I would read his letter. When I received the July issue of *DFES* and read his letter it was immediately clear that Lipschutz does not understand the dairy industry and I consider his concerns to be irrelevant and without merit. It would be enlightening for a knowledgeable IAFP member to rebut his criticisms in more detail.

However, of greater concern is how the editors of *DFES* handled this matter. First, *DFES* is recognized as an authority on practi-

Continued on page 710

Editor's Note:

Mr. Weber requested that his letter not receive the same prominence given to the Reader Comments printed in the July 2002 issue of *DFES*. In future issues, Reader Comments (if any) will appear immediately following the New Member listing. Letters to the Editor (if any) relating to the scientific articles will be placed in the Journal preceding the scientific articles.

We invite our readers' input. Please forward your comments to dbahun@foodprotection.org, via E-mail or mail to Donna Bahun, *Dairy, Food and Environmental Sanitation*, 6200 Aurora Ave., Suite 200W, Des Moines, IA 50322-2864.

Food: Commission Proposes EU-Wide Safety Assessment and Authorization of Smoke Flavorings

The European Commission has acted to safeguard public health by proposing new procedures for the safety assessment and authorization of 'smoke' flavorings. A smoky flavor is attributed to a lot of products, from smoked ham to smoked salmon. Smoke flavorings are often used instead of fresh smoke to impart a smoky flavor to foods such as meat, fish or snacks. The chemical composition of smoke is complex and smoked foods in general give rise to health concerns. Smoke flavorings are produced by condensing fresh smoke in water. The condensed smoke is then fractionated and purified during the production of smoke flavorings. Because of this purification process, the use of smoke flavorings is generally considered to be of less health concern than the traditional smoking process.

A wide range of different smoke flavorings is produced from smoke condensates. The Scientific Committee on Food, an independent committee that advises the Commission on questions concerning consumer health and food safety, has concluded that the existing multitude of smoke flavorings is based on only a limited number of commercially available smoke condensates and that, therefore, the toxicological evaluation should focus on these condensates rather than on the multitude of derived smoke flavorings.

Based on this advice, the Commission has proposed to establish a procedure for the safety assessment and authorization of smoke condensates. For an application for authorization of a smoke condensate, the producer



International Association for
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will need to provide detailed information on the production method as well as on the further steps in the production of derived smoke flavorings, the intended uses in or on specific food or food categories, chemical specifications, toxicological studies and validated methods for sampling and detection. The evaluation will be carried out by the European Food Safety Authority according to a transparent procedure within a specific timeframe. The Commission will make a decision on each application based on the outcome of the evaluation.

The Commission proposes to restrict the authorizations to a period of ten years after which the authorizations will need to be renewed. This provision would ensure that products were regularly re-evaluated according to the latest scientific and technical knowledge. The Commission's proposal for a regulation on smoke flavorings used or intended for use in or on foods will be submitted to the European Parliament and the Council for adoption under the so-called co-decision procedure.

Further information is available on the flavorings web site of the Commission's Health and Consumer Protection Directorate General: http://europa.eu.int/comm/food/fs/sfp/addit_flavor/flavorings/index_en.html.

U of G Researchers Testing *E. coli* O157 Vaccine for Cattle

The risk of *E. coli* O157:H7 infections may soon be dramatically reduced, thanks to University of Guelph researchers who are assessing the benefits of a cattle vaccine for this bacterium. There is consensus among researchers that reduction of *E. coli* O157:H7 in cattle is the key to minimizing the risk of infection in humans. Cattle are thought to be the primary source of the bacteria, which are found in the animals' intestines. It's estimated that 40 percent of the 14 million cattle in Canada may be carriers of the bacterium. "It doesn't cause disease – the cattle are quite healthy – so we suspect that most cattle carry this organism at some stage," said pathology professor Carlton Gyles.

Cattle shed the bacteria in their feces, which then contaminate meat, produce and water sources. Some 1,500 human cases of *E. coli* O157:H7 illnesses are reported in Canada each year. Gyles and Roger Johnson, head of the research section at Health Canada's laboratory in Guelph, are part of a Canadian Research Institute for Food Safety research team at the University of Guelph headed by population medicine professor Scott McEwen. They will be testing how well a vaccine developed by Bioniche Life Sciences Inc. eliminates the bacteria from cattle.

The food safety division of Bioniche Life Sciences, a Canadian biopharmaceutical company, develops veterinary products to improve the safety of food and water supplies worldwide. Two preliminary studies comparing vaccinated and non-vaccinated cattle conducted by Bioniche showed a 90 percent reduction of *E. coli* O157:H7 bacteria in the feces of the vaccinated cattle.

The vaccine stimulates production of antibodies to prevent

E. coli O157:H7 from attaching to the intestinal wall of cattle. Because the antibodies limit colonization by the bacteria, replication and multiplication of the bacteria are impeded and the number of bacteria carried by the animal or shed into the environment is reduced.

"Developing an effective vaccine is complex because cattle naturally carry *E. coli* O157:H7. It is much more challenging to try to reduce or remove normal bacterial flora, compared with disease organisms. And I say that because normal flora represent bacteria that have developed mechanisms to live in peaceful coexistence with the host and so it's very hard to dislodge them," said Gyles.

Preliminary tests are still being done to ensure the vaccine is safe and has potency. The vaccine is administered subcutaneously into the cow's shoulder and does not appear to cause any side effects. The researchers are in the process of gathering information on shedding of *E. coli* O157:H7 by cattle in cow/calf operations in Ontario. "This will allow us to better estimate how many animals need to be vaccinated and tested in order to determine the effectiveness of the vaccine. Once that's through and everything is in place, we expect to be able to test the vaccine," said Gyles.

McEwen's team will test more than 100 herds in Ontario to compare the shedding of *E. coli* O157:H7 by vaccinated and non-vaccinated animals. "An important aspect of the study is that we won't know which animals have been vaccinated," said Gyles.

"Local farmers are eager to participate in the study because they are committed to safe and wholesome food," said McEwen.

Beginning this fall, they will perform over 130 tests from each farm, sampling manure, surrounding soil and surface water for traces of the bacteria. They will

collect the samples five times over the course of a year, giving them evidence from some 65,000 tests.

"If this vaccine is found to be effective against *E. coli* O157:H7, it could have profound benefits for people worldwide because it would significantly reduce the bacteria at the source, eliminating the chance of contaminating food or water. It would have an impact on the direct transmission, when, say, meat is contaminated or when unpasteurized milk is contaminated or when children go to a petting zoo and pick up the organisms," said Gyles. "It would also have an impact on indirect transmission when bacteria in cattle manure contaminate water that is used for irrigation or for washing fruits and vegetables which go to consumers."

The results of the University of Guelph researchers' study will complement other clinical trials being conducted by Bioniche in Western Canada for regulatory approval of the vaccine in Canada and the United States. Martin Warmelink, president of Bioniche food safety, is optimistic about the results of the study. "We have a very high level of confidence that this will be developed into a product that will reduce the risk of contamination of hamburger meat – or meat in general – and of water sources," he said. The *E. coli* vaccine is an all Canadian development project of the University of British Columbia, the Alberta Research Council, the Veterinary Infectious Disease Organization and Bioniche.

Dairy Queen Expands the Availability of Surebeam Processed Burgers to More Twin Cities Locations

SureBeam Corporation – innovator of the electron beam technology that safely removes dangerous bacteria from

food – has announced that American Dairy Queen Corporation (ADQ) is expanding the use of SureBeam® irradiated ground beef to 30 Twin Cities metro-area Dairy Queen® locations. With a total of 43 restaurants in Minnesota offering customers irradiated hamburgers by July 17, Dairy Queen is the first national quick-service restaurant chain to publicly serve SureBeam irradiated beef.

"Food safety and food quality have always been top priorities in the Dairy Queen system. In addition to providing consumers peace of mind about the safety of their hamburgers, electronic irradiation does not compromise the taste and eating quality of our products," says Glenn Lindsey, ADQ vice president of research and development.

Jan Malcolm, Minnesota health commissioner, applauded Dairy Queen for being the first national quick-service restaurant chain to offer SureBeam processed beef. "We're very pleased to see that the food industry is taking another step forward in introducing irradiated products to the public," said Malcolm.

"By introducing irradiated products – and taking steps to actively promote it – Dairy Queen is setting an example that we hope the rest of the industry will quickly emulate. We're especially pleased that Dairy Queen has embraced the SureBeam® technology and has taken a leadership position in the Quick Service Restaurant business," said Larry Oberkfell, SureBeam's president and CEO.

"Dairy Queen's commitment to its customers is demonstrated by this leadership position. This growth in consumer acceptance and understanding mirrors the success we are also experiencing in other food venues across the nation," Oberkfell continued.

Similar to a microwave oven, SureBeam® technology uses ordinary electricity as its energy source to irradiate and help eliminate with ionizing energy harmful bacteria – such as *E. coli*, *Listeria*, and *Salmonella* – enhancing a food's quality without compromising its taste, texture, or nutritional value. Friendly to the environment, the technology also provides a post-harvest treatment that effectively rids fresh fruit and vegetables of harmful environmental pests, eliminating the need for toxic chemical fumigants.

Trust Beats Service, Price or Brand in Food-Service Buying

Trust and effective communication are more important to food-service purchasing agents than good service, price or brand, according to a new study from the Center for Hospitality Research at the School of Hotel Administration at Cornell University.

"Strong partnerships between purchasers and suppliers have come to be viewed as a competitive advantage for food and beverage purchasers who are looking for long-term economic success," says Judi Brownell, professor of organizational communication at Cornell. "This partnership is cemented by trust, communication and personal connections. Turnover in supplier representatives, therefore, is emerging as one of the most troublesome challenges facing purchasers today."

With Dennis Reynolds, Cornell assistant professor of food and beverage management, Brownell surveyed 73 food-service purchasing agents from several segments of the food-

service industry nationwide. The study was sponsored by Cornell's Center for Hospitality Research (CHR) and Richmond Events, an organizer of strategic business forums on cruise ships based in London and New York. The four-part survey included open-ended questions regarding which supplier behaviors and characteristics were most important to purchasing agents in developing strong partnerships. The findings are published in a 30-page CHR report, "Strengthening the Purchaser-Supplier Partnership: Factors That Make a Difference," which is available online at no cost from Cornell at <http://www.hotelschool.cornell.edu/chr/>.

"Trust may be the single most important ingredient in making the purchaser-supplier partnership work. Trusted suppliers are described as communicating effectively, listening well and demonstrating a willingness to work collaboratively to anticipate and solve problems," says Reynolds. They also were perceived as being straightforward and enjoyable to interact with. The researchers found that more than 55 percent of the purchasers surveyed communicated in person with their suppliers at least once a month and nearly half also communicated by E-mail at least once a week.

Multistate Outbreak of *Escherichia coli* O157:H7 Infections Associated with Eating Ground Beef

During July 2002, the Colorado Department of Public Health and Environment (CDPHE) identified an outbreak of *Escherichia coli* O157:H7 infections among

Colorado residents. This report summarizes the results of an ongoing epidemiologic and laboratory investigation that has linked 28 illnesses in Colorado and six other states to eating contaminated ground beef products recalled by ConAgra Beef Company on June 30, 2002. To date, seven patients have been hospitalized; five developed hemolytic-uremic syndrome (HUS).

For this investigation, a case was defined as culture-confirmed *E. coli* O157 infection in a Colorado resident with symptom onset on or after June 1, and an isolate matching the outbreak pulsed-field gel electrophoresis (PFGE) pattern by two-enzyme analysis. To date, 18 cases have been identified. The median age of patients was 15 years (range: 1 to 72 years). Dates of symptom onset ranged from June 13 to July 7. Two cases of HUS have been diagnosed among Colorado residents who have epidemiologic links to the outbreak but do not have laboratory-confirmed *E. coli* O157 infection.

Interviews with 16 of 18 patients with confirmed infection revealed that all ate ground beef during the 7 days before illness. All 16 patients ate ground beef that was purchased at grocery chain A during June 10–24. *E. coli* O157 was cultured from an opened package of ground beef collected from a patient's home. A traceback by CDPHE of ground beef collected from a patient's home indicated that it was reground by grocery chain A with meat produced on May 31 by ConAgra Beef Company. On June 30, independent of the outbreak investigation, ConAgra Beef Company issued a nationwide recall of 354,200 lbs of ground beef products produced on May 31. This recall was based on the detection of *E. coli* O157 during

routine microbiologic testing conducted by the US Department of Agriculture (USDA).

PFGE analysis conducted by CDPHE and CDC using two restriction enzymes indicated that the 18 outbreak-related human isolates of *E. coli* O157 from Colorado were indistinguishable from isolates of *E. coli* O157 recovered from the opened ground beef package from a patient's home and from the ConAgra Beef Company recalled ground beef product. To identify potential cases outside Colorado, the outbreak-related PFGE patterns were posted on PulseNet, the National Molecular Subtyping Network for Foodborne Disease Surveillance. On the basis of epidemiologic data and molecular subtyping, eight additional *E. coli* O157 cases related to the Colorado cluster have been identified in six states (California, Iowa, Michigan, South Dakota, Washington, and Wyoming). The dates of onset ranged from June 17 to 27. Of the eight patients outside Colorado, six had PFGE patterns that were indistinguishable from the outbreak pattern by two-enzyme analysis, and two were siblings of a PFGE-matched patient. State and local health departments are investigating additional cases to establish epidemiologic and molecular links to the outbreak.

Subsequent to the detection of this multistate outbreak and the initiation of an in-plant inspection of the ConAgra Beef Company by USDA, the nationwide recall of 354,200 lbs. of ground beef was

expanded to a nationwide recall of 18.6 million lbs. of fresh and frozen ground beef and beef trimmings. The expanded recall included fresh and frozen ground beef products produced during April 12-June 29, and beef trimmings produced during April 12-July 11.

Salmonella Outbreak in Girona, Spain

On June 24, 2002 the Departament de Sanitat i Seguretat Social de Generalitat de Catalunya (department of health and social security of the regional government of Catalonia) was notified of several cases of gastroenteritis with fever in people who had all eaten pastries known as 'cocas.' These pastries, which are made with eggs and have a custard filling, are produced for the festival of San Juan, which takes place annually in Catalonia on the evening of June 23. The 'cocas' were all made and purchased at the same bakery in a tourist town in the province of Girona. The eggs used to make the custard in this bakery were pasteurized and cooked. The bakery is now under investigation. Three other bakeries also made and sold 'cocas' on June 23, but none of the cases have been linked to these establishments.

There have been 1,243 cases, according to attending hospitals and outpatient emergency wards of the area. Four-hundred nine cases were in patients who live in the town in which the bakery is located. Most of the other patients are from other towns in Catalonia.

Sixteen patients are from other regions of Spain, and 47 patients are foreign tourists (14 from the United Kingdom, nine from France, seven from Italy, five from Germany, five from the Netherlands, three from Ireland, two from Belgium, one from Denmark, and one from Switzerland).

One-hundred nine patients required hospital admission. All of them are recovering well and only two patients remain in hospital. Clinical features of the cases have been diarrhea (97%), fever (78%), abdominal pain (73%), nausea (42%), and vomiting (42%).

The onset of symptoms was analyzed for 162 cases. The mean incubation period was 16 hours, with a range of 3 to 59 hours. Altogether 6.2% of the patients experienced symptoms within six hours of having been exposed, 49.2% between six and 12 hours after exposure, and 44.5% after 12 hours. The sex distribution of all cases was 49.2% males and 50.8% females. Microbiological testing of feces has produced 47 isolates of *Salmonella enterica*. Two of these patients also have positive blood culture for isolates of *Salmonella enterica*. *Salmonella enterica* has also been isolated in custard samples from the suspected pastry. Phage typing and molecular epidemiology results of these isolates are pending.

Reported by Neus Camps Maria Company, Rosa Sala and Angela Domínguez (angelad@dsss.scs.es), Departament de Sanitat i Seguretat Social, Generalitat de Catalunya; and Teresa Llovet, microbiology department, Hospital de Sant Pau, Barcelona, Spain.

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Industry Products



BD Diagnostic Systems

Quality Media and the Largest Breadth of Line from the BD Sterile Pack Media Family of Products

BD Diagnostic Systems has announced the immediate availability of the BD Sterile Pack Media family of products, offering the largest breadth of line for clean sterile Pack Prepared Plated Media, ED Sterile Pack Swabs and BD Sterile Pack Bottles – all featuring the quality and dependability of BEL™ and Difco™ media. The Sterile Pack line also incorporates unique double and triple wrap packaging that minimizes the risk of false contamination both going into and coming out of the critical environment.

BD BBL™ Sterile Pack Prepared Plated Media are now available as BBL™ Isolator Pack Plated Media, specially packaged for isolators and developed with the same quality standards as the original. The media have been

performance-validated after exposure to the vaporized hydrogen peroxide atmosphere used during isolator facility decontamination cycles. Whereas media in other packaging configurations may show diminished growth promotion capabilities under these conditions, BBL™ Isolator Pack Prepared Plated Media maintain excellent growth promotion characteristics, with packaging that prevents exposure of the media to vaporized hydrogen peroxide.

A recent addition to the Sterile Pack Media family are BD BBL™ Sterile Pack Swabs – the first ready-to-use sterile swabs for surface sampling, combined with a rinse solution-filled tube. Sterile Pack Swabs are the first prefilled swab/rinse solution set with a Sterility Assurance Level (SAL) of 10^{-6} , setting an industry standard. The high level of sterility is achieved because Sterile Pack Swabs are gamma-irradiated and performance-validated after exposure to the vaporized hydrogen peroxide in an isolator. Sterile Pack Swabs are ideal for the stringent sterility requirements of surface sampling in cleanrooms and isolators at pharmaceutical and medical device manufacturing facilities. In addition, Sterile Pack Swabs are designed to fit easily into hard-to-reach places: equipment recesses, nooks and crevices.

Another addition to the Sterile Pack family of products are

BD Sterile Pack Bottles. The bottles are terminally sterilized inside autoclavable double-bags. This unique manufacturing process eliminates the need for exterior disinfection, but the color, consistency and growth promotion properties of the sterility media are preserved. In addition, BD Fluid Thioglycollate Medium (FTM), which remains clear, makes results easier to read and enables easier detection of growth. In addition, BD Sterile Pack Bottles are validated sterile at a Sterility Assurance Level (SAL) of 10^{-6} and comply with requirements for ready-to-use media as described in USP 25-NF 20 <71> Sterility Tests.

BD Diagnostic Systems,
Sparks, MD

Reader Service No. 267

Eriez Magnetic Grate's Design Improves Separation and Cleaning

Eriez has redesigned its most popular Easy to Clean Magnetic Grate in Housing for improved product purity and more efficient cleaning. The improved design features an enlarged magnetic discharge area, longer magnetic tubes, stronger clamps, improved stripping assembly and redesigned center divider. Easy to Clean grates ensure long term purity in free flowing, gravity fed materials by making regular

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contaminant removal a simple process.

The unit's design changes improve tramp iron separation and discharge while eliminating product accumulation within the assembly. The enlarged separation area ensures positive tramp metal separation and eliminates product buildup within the discharge chute.

The new stripping assembly eliminates material accumulation behind the housing's wipers by ending the tubes flush at the housing. It also provides for easy access and viewing of the metallic stripping process. Larger door clamps produce more force on the stripper assembly, improving the seal against the grate housing. Once the tramp metal is stripped, the widened ferrous discharge chute reduces plugging and the chance that contaminants will back up into the flow.

Eriez' grates, easy-to-clean and self-cleaning grate in housing models, featuring Erium® powerful ceramic and rare earth magnet circuits, are available for next day shipment through ERIEZ Xpress in a range of sizes.

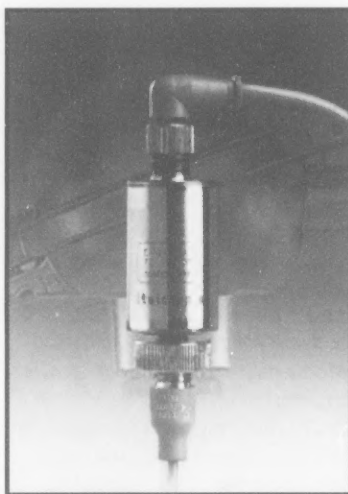
Eriez Magnetics, Erie, PA

Reader Service No. 268

Evolutionary Italcoppie EVO Series Temperature Transmitters and Switches from the Instrumentation Group

The Instrumentation Group has introduced a new series of evolutionary, high performance brand temperature transmitters and switches from Italcoppie.

EVO Series Transmitters are the latest for versatility and ease of use in temperature transmitters. Italcoppie transmitters are



The Instrumentation Group

compact and employ a one-way only, screw on, watertight connection that tightens by hand. This eliminates time consuming problems associated with termination heads. No more wiring mistakes and cumbersome tools to worry about, no more wiring and unwiring every time there is a probe change. In addition, the 4-20 mA output is factory programmed to customer specifications. Stock only one transmitter and program and reprogram it yourself with a PC. EVO Series Transmitters connect easily to the wide variety of Italcoppie PT100 sensors.

The EVO Series Switches are also compact and use the one-way only, screw on connection that hand tightens. This provides for fast, easy, and simple installation and maintenance. Switches are factory programmed to customer specifications, and operating parameters may be reset at any time by PC. EVO Series Switches connect easily to the wide variety of Italcoppie PT100 and thermocouple sensors.

Both the transmitter and switch have stainless steel,

hermetically sealed housing for superior strength and protection.

The Instrumentation Group, Asheville, NC

Reader Service No. 269

Systemate Numafa's Auto-Feed Improves Convenience of CWM Vat Washer, Offers Better Ergonomics and Reduced Cross Contamination

A new automatic in-feed and discharge system from Systemate Numafa improves the operational efficiency of the company's CWM series washers, which are suitable for cleaning large stainless steel vats and plastic combo-bins, which are typically 48" tall by 50" wide.

The conveyor system provides a near-continuous feed of bins and vats to the washer. This allows for increased throughput while maintaining consistent wash quality.

An electric gear motor, rather than hydraulic or pneumatic cylinders, lifts the vat into the washer, which reduces operating and maintenance problems and costs. Vats are tilted 180 degrees, which permits the stainless steel nozzles to have closer contact with the sidewalls and bottom to improve cleaning and promote faster drainage. The vats are then unloaded in the original position.

Vats soiled with heavy emulsions can be cleaned at a rate of 20 per hour. A capacity of 30 vats per hour can be achieved with light to moderate soil loads. The washer's adjustable timer can meet the individual need for shortened or prolonged wash applications.

The CWM washers are ergonomically engineered to reduce handling, lifting and the risk of injury to personnel.

Systemate Numafa, Canton, GA

Reader Service No. 270

**Labconco Corp. Protector®
Stainless Steel Perchloric Acid
Hood Uses Wash Down System
to Self-clean**

Labconco Corporation offers the Protector® Stainless Steel Perchloric Acid Laboratory Hood for working safely with perchloric acid. A built-in washdown system facilitates the removal of hazardous perchlorates from the hood interior.

Features include an ergonomic air foil with aerodynamic Clean-Sweep™ airflow openings and a by-pass airflow design. The seamless Type 316 stainless steel liner with integral work surface and drainage trough is welded and polished to provide a smooth, seamless and safe work area. Pre-wired T8 fluorescent lighting provides a bright work area.

A tempered safety glass vertical-rising sash provides clear visibility. Removable exterior front and side panels and front access panels provide access to plumbing and electrical wiring. The glacier white, dry powder epoxy-coated steel exterior is smooth and durable.

The Protector Perchloric Acid Hood is available in 4-, 5-, 6-, and 8-foot widths.

Labconco Corporation,
Kansas City, MO

Reader Service No. 271

**New High Accuracy Pressure
Gage from Sensotec**

Sensotec presents the new Model AG400, a combination pressure transducer and digital readout, calibrated as a unit and housed together in a rugged 318 DIN package. These units require no wiring or set up, deliver exceptional temperature specs, and are accurate up to 0.05%, making them suitable for the most demanding laboratory or industrial applications.

The AG Series features an easy-to-read 6-digit vacuum fluorescent display, 50,000 counts of resolution, and field selectable units of measure. The Model AG400 is available in gage and absolute ranges from 0-15 through 0-10,000 psi. Standard output is 0-5 volts and the operating temperature is 60°F to 130°F. Standard pressure ports are 114-18 NPT Male for ranges up to and including 1000 psi, and 114-18 NPT Female for higher ranges.

The AG Series is NIST traceable and offers convenient features such as auto-zero, tare, peak/hold, RS232 interface, and quad limits.

Sensotec, Inc., Columbus, OH

Reader Service No. 272

**Thermo Orion Introduces
a New Family of Incubators**

Thermo Electron has announced its new product line of water jacketed incubators. The Water Jacketed Incubators Models 5060 and 5062 offer excellence in cell culture environment control. The water surrounding the incubator moderates ambient temperature changes, allowing for a rapid return to settings after door openings or power failures. The water jacketed models also feature the HEPA (High Efficiency Particulate Air) Filter Airflow System located inside the incubator, which provides gentle, directed airflow with a minimum of 99.97% efficiency at 0.3 microns to provide a continuous aseptic culturing atmosphere. Within five minutes of the door's closing, Class 100 air quality is achieved, to provide optimum environmental conditions.

The Air Jacketed Incubators Models 5050 and 5052 are designed for those users preferring the freedom from water

maintenance and excess unit weight along with an accurate, reliable incubator for cell culture needs.

The CO₂ level is monitored by a microprocessor through Infrared (IR) or Thermal Conductivity (TIC) sensors inside the chamber. All models control the pre-programmed levels of carbon dioxide to better than ± 0.1%. The Model 5062 and 5052 IR sensor units feature automatic electronic calibration for accuracy and precision. Models 5060 and 5050 utilize TIC sensor technology.

The TIC (thermal conductivity) sensor is recommended for use when the chamber temperature and humidity are relatively constant, and the IR (infrared) sensor is recommended for use whenever the temperature and humidity levels change frequently. All units are packed with features such as continuous status of temperature and CO₂, space-saving stackable units, remote alarm contacts for documentation, programmable alarms, and an independent over-temperature alarm.

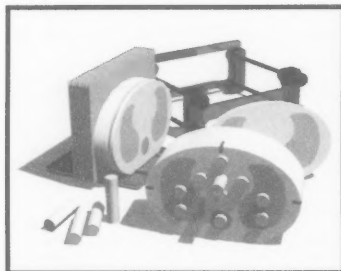
The design of the incubators optimizes in-service time and reduces downtime due to decontamination and cleaning procedures by minimizing the sources of contamination with removable parts and easily cleaned surfaces, inner and outer doors with external latches and tight gasket seals, and microbiological filters on all gas inlets and sample ports. The heated outer door and non-CFC insulation reduces condensation, maximizes operational efficiency, eliminates potential contamination and allows a rapid return to set temperature after opening.

Product features include the following: Models 5060 and 5062 Water Jacketed Incubators feature

better resistance to ambient temperature fluctuations and HEPA air filtration to Class 100 air quality in under five minutes; Models 5050 and 5052 Air Jacketed Incubators feature less weight and no water maintenance issues.

Thermo Orion, Beverly, MA

Reader Service No. 273



Nuclear Associates

New IMRT QA Solutions

Nuclear Associates has announced a new product offering for performing IMRT QA in radiation oncology. Three new simplified products include an Advanced Pelvic 3-D Phantom, a Thorax Phantom and an all-purpose Homogenous Phantom.

Nuclear Associates' IMRT phantoms are crucial to this important technology. They are designed to address the complex issues surrounding commissioning and comparison of treatment planning systems while providing a simple yet reliable method for verification of individual patient plans and delivery.

The IMRT Phantoms accurately check 2D dose distributions (3D distributions optional), point dose measurements in multiple planes, calibrate film with iron

chamber, quickly verify individual patient plans and correlate CTU to electron density.

Nuclear Associates, Cleveland, OH

Reader Service No. 274

EKA Chemicals Inc. Acquires Patent for Process Using Proprietary Purate® Formulation

Eka Chemicals, Inc., Akzo Nobel's North American Pulp & Paper Business Unit, has acquired the patent to a process using a hydrogen peroxide/alkali metal chlorate blend as a feed chemical for the production of chlorine dioxide.

This patented process (US Patent No. 6,387,344; issued May 14, 2002) is particularly advantageous when using Eka's proprietary Purate® chemical formulation in the company's small-scale SVP-Pure® chlorine dioxide generators. Purate® generated chlorine dioxide is used in applications that include drinking water treatment, wastewater treatment, cooling tower treatment, industrial process water treatment, odor control, water chemical destruction and specialty bleaching.

"This new patent strengthens our small-scale chlorine dioxide technology intellectual property portfolio. We continue to lead the industry with innovative chlorine dioxide technology and have several new developments in the pipeline," said Dr. Patrick Bryant, director of Purate.

The SVP-Pure® chlorine dioxide generators utilize Purate®,

a proprietary formulation of sodium chlorate and hydrogen peroxide, to generate chlorine dioxide at rates of one to 100 pounds per hour. Purate®-generated chlorine dioxide is used as a biocide for water treatment and as a specialty oxidant in applications such as odor control.

"More than 90 percent of the chlorine dioxide produced globally is generated from sodium chlorate and is used for pulp bleaching. The introduction of Purate® continues to stimulate growth of chlorine dioxide use outside of pulp bleaching," said Dr. Bryant.

"Purate® technology offers a low-cost and efficient path for the generation of chlorine dioxide that has resulted in many customers taking a serious look at chlorine dioxide use for the first time," added Dr. Bryant.

EKA Chemicals, Inc., Marietta, GA

Reader Service No. 275

seepex New BCS CIPable Pump is Less Expensive, is Easier to Repair and Has Few Parts

Seepex now has a new model, the BCS. This model features molded-to-size stators, so neither gaskets nor "O" rings are needed and the mechanical seal is still directly in the suction line fluid flow to ensure full clean-in-place. seepex has a new universal joint that allows complete drive train disassembly without compromising component life or cleanability. seepex, Inc., Enon, OH

Reader Service No. 276



National Food Safety Education MonthSM

September 2002

September marks the eighth annual *National Food Safety Education MonthSM*, (NFSEM) created by the National Restaurant Association Educational Foundation's (NRAEF) International Food Safety Council, an awareness initiative that promotes food safety education to the restaurant and food-service industry. This year's theme is "Check It Out Before You Check It In." For additional information, contact NRAEF Web site at www.nraef.org/ifsc.



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Our Experience Is Your Protection

Reader Service No. 148



FIGHT BAC![®]

WHY PARTICIPATE?

The FIGHT BAC![®] campaign is one of the most far-reaching and ambitious public education efforts ever to focus on safe food handling. It was created by the Partnership for Food Safety Education, a unique coalition of industry, government and consumer groups. FIGHT BAC![®] will help consumers who have poor knowledge of basic sanitation and food preparation take steps to greatly reduce their risks of foodborne illness. Join this effort and you can help close the gap! For information on joining the FIGHT BAC![®] campaign, contact: The Partnership for Food Safety Education, Phone: 202.544.5927; E-mail: info@fightbac.org; Web site: www.fightbac.org.

cal food sanitation and protection. By publishing this photograph on their cover they sent a distinct message to their readers that they evaluated its worthiness and that it warranted cover placement. A disclaimer appropriately states that IAFP does not imply endorsement of any product, but there is no mention whether the editors considered the correctness of any of the procedures or techniques as shown. Upon receipt of the Lipschutz letter, I believe they should have contacted Boyle and offered him an opportunity to submit his point-of-view. He is an experienced quality control manager at a large fluid dairy and juice processing plant, an active board member with the Dairy Practices Council, and the current president of the Metropolitan Association for Food Protection.

Secondly, the prominence given to the Lipschutz letter was surprising. It filled an entire page, was located in the front of the journal across from the masthead, and featured a bold "reader comments" color headline. *DFES* rarely publishes letters to the editor and in my recollection has never published a reader comment with this much emphasis. Without a simultaneous editor response it almost had the look and feel of a published correction. Any rebuttal published one to two months later inevitably has diminished impact.

Frankly, when I received my July issue of *DFES* and saw how the Lipschutz letter had been presented I was annoyed, thinking, "no good deed shall go unpunished." Maybe the next picture I submit to *DFES* will be of myself wearing my "Stop Me Before I Volunteer Again" T-shirt.

From a personal perspective this issue gets even more complicated. In 2001 I was Chairperson of a *DFES* Management

subcommittee responsible for the creation of a strategic plan. The goal of the plan is to improve this publication and make it more valuable to our members by defining its mission and objectives, including a detailed implementation strategy to accomplish these goals. Part of this plan focused on ways to "increase active participation by members". One objective states, "create and promote a featured letters to the editor section." Indeed, the strategic plan contains a number of other recommendations to invite member involvement, such as point/counterpoint on a topic, and opinion articles.

While this strategic plan was being formulated, the IAFP Board also commissioned a comprehensive publication survey, which was conducted by Research USA. The results of this survey were published in last October's issue of *DFES*. These survey results clearly confirm the views of the strategic plan that point/counterpoint columns and reader comments/letters are of strong interest to readers.

I am currently the Vice Chairperson of the *DFES* Management Committee and continue to support the objectives of the strategic plan that this publication needs to enhance and increase active member participation. However, I also think the Committee has some new business to address. Guidelines should be determined about the use of cover photographs, the consistent placement and emphasis of reader comments, and a clear policy needs to be stated regarding rebuttals to reader comments.

Fred Weber
President
Weber Scientific
Hamilton, New Jersey

Coming Events

OCTOBER

• **1-4, Florida Association for Food Protection Annual Educational Conference**, Melbourne Beach Holiday Inn, Indiatlantic, FL. For more information, contact Zeb Blanton at 850.488.3951.

• **8-10, Kansas Association of Sanitarians Annual Fall Meeting**, Holidome, Manhattan, KS. For more information, contact Tim Wagner at 800.527.2633.

• **13-16, UW-River Falls Food Microbiology Symposium**, University of Wisconsin-River Falls, River Falls, WI. For additional information, contact Doreen Cegielski at 715.425.3704; E-mail: foodmicro@uwrf.edu.

• **16, Good Manufacturing Practices and Food Safety**, Cook College, Rutgers, New Brunswick, NJ. For additional information, contact Keith Wilson at 732.932.9271; E-mail: kwilson@aesop.rutgers.edu.

• **18, FoodSteps™: Processing Foods Safely**, Guelph Food Technology Centre, Guelph, Ontario, Canada. For additional information, contact Marlene Inglis at 519.821.1246 Ext. 5028; E-mail: gftc@gftc.ca.

• **21-22, Thermal Process Development Workshop**, Monarch Hotel, Dublin, CA. For additional information, contact The Food Processors Institute at 202.393.0890; E-mail: www.fpi-food.org.

• **22-24, A Food Industry Approach to Quality System Evaluation**, Atlanta, GA. For additional information, call AIB at 785.537.4750.

• **23-24, Associated Illinois Milk, Food, and Environmental Sanitarians Annual Meeting**, Stony Creek Inn & Conference Center, East Peoria, IL. For more information, contact Larry Terando at 217.278.5900.

• **24-25, Thermal Processing Deviations Workshop**, Monarch Hotel, Dublin, CA. For additional information, contact The Food Processors Institute at 202.393.0890; E-mail: www.fpi-food.org.

• **29, Statistical Process Control in the Food Industry, Part 1 of 2**, Guelph Food Technology Centre, Guelph, Ontario, Canada. For more information, call Marlene Inglis at 519.821.1246; E-mail: gftc@gftc.ca.

• **30-31, Iowa Association for Food Protection Annual Meeting**, Starlite Village Motel, Ames, IA. For more information, contact Phyllis Borer at 712.754.2511; E-mail: borerp@ampi.com.

• **30-31, Statistical Process Control in the Food Industry, Part 2 of 2**, Guelph, Ontario, Canada. For more information, contact Marlene Inglis at 519.821.1246; E-mail: gftc@gftc.ca.

• **31, Brazil Association for Food Protection Annual Meeting**, University of São Paulo, São Paulo, Brazil. For more information, contact Maria Teresa Destro at 55.113.818.2399.

• **31, North Dakota Environmental Health Association Annual Meeting**, Holiday Inn Riverside, Minot, ND. For more information, contact Debra Larson at 701.328.6150.

NOVEMBER

• **4-5, GMP Workshop for Packaging Supplier**, Manhattan, KS. For additional information, call AIB at 785.537.4750.

• **4-6, Basic HACCP**, University of California-Davis, Davis, CA. For additional information, contact Jennifer Epstein at 202.637.4818; E-mail: jepstein@nfpa-food.org.

• **7-8, Advanced HACCP**, University of California-Davis, Davis, CA. For additional information, contact Jennifer Epstein at 202.637.4818; E-mail: jepstein@nfpa-food.org.

• **8-9, Mexico Association for Food Protection Annual Fall Meeting**, Mission Carlton Hotel, Guadalajara, Mexico. For more information, contact Lydia Mota De La Garza at 01.5794.0526.

• **18-19, HACCP I: Documenting your HACCP Prerequisite Program**, Guelph, Ontario, Canada. For more information, contact Marlene Inglis at 519.821.1246; E-mail: gftc@gftc.ca.

• **20-21, Alabama Association for Food Protection Annual Meeting**, Holiday Inn-Homewood, Birmingham, AL. For more information, contact G. M. Gallaspy at 334.206.5375.

• **20-22, HACCP II: Development of Your HACCP Plan**, Guelph Food Technology Centre, Guelph, Ontario, Canada. For more information, call Marlene Inglis at 519.821.1246; E-mail: gftc@gftc.ca.

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* Asterisk indicates author for correspondence.

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A Food ISAC (Information Sharing and Analysis Center), hosted by the Food Marketing Institute, has been established to provide a national focus for gathering information on threats to the food supply and provide timely, accurate and actionable warnings of threats and attacks. Other, more comprehensive Food ISACs are being considered. A Food Security Research Roadmap, a database for cataloging contacts, resources and research on bioterrorism, is under development through the Joint Institute for Food Safety and Applied Nutrition at the University of Maryland.

A new law on bioterrorism has a number of provisions related to the food industry, including the registration of all facilities processing, packing or holding foods; FDA detention authority; and prior notification for imported foods. Discussions on a proposed Department of Homeland Security have noted that the US food supply would be an attractive terrorist target and have raised the issue of possible consolidation of food safety

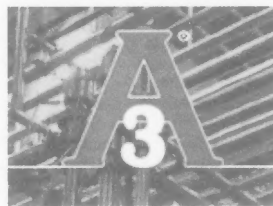
agencies into the Department, although this appears unlikely to happen.

So we see that any discussion of food security brings up the issue of food safety. However, although we are concerned about the intentional contamination of our food supply, we are also concerned about destruction of manufacturing, storage and retail food facilities; we are concerned about protecting the personnel who work in the food industry; and we are concerned about agroterrorism (e.g., the introduction of animal or plant diseases that could significantly impact food production).

So, although we should not equate food security and food safety, we must keep in mind that terrorism is a real issue for the food industry. Timely information is key to preparedness and to prevention. We must all continue to work together (industry, government, academia, the public health community, media, consumers and others) to ensure that our food supply remains secure and that terrorist threats do not result in a food safety problem.

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Career Services Section

FACULTY POSITION ADVERTISEMENT

The Poultry Science Department at Auburn University, is seeking candidates for two 9 month tenure-track positions: **Assistant or Associate Professor** in the poultry products microbiology area and an **Assistant, Associate or Full Professor** in the poultry products area. Both positions have an emphasis in food microbiology and food safety and are located in the AU Poultry Products Safety and Quality Program. The expected start date of both positions is January 1, 2003. **Women and Ethnic Minorities are encouraged to apply.**

The appointment for the **Assistant or Associate Professor** is a 20% instruction and 80% research in the area of fundamental food microbiology and/or safety. Responsibilities include: develop an instructional and fundamental research program in further processing, value-added poultry products and/or product microbiology; instruction of Principles of Food Safety and Advanced Principles of Food Safety core Poultry Science courses; advise ~10 undergraduate student/semester; develop distance education courses; and advise graduate students.

The appointment for the **Assistant, Associate or Full Professor** is 20% instruction, 55% research and 25% outreach in the area of food microbiology and/or safety. Responsibilities include: develop an instructional, research and outreach program in further processing, value-added poultry products and/or product microbiology; develop undergraduate and graduate courses in Poultry Project Safety and/or Quality.

Minimum qualifications for both positions include a Ph.D. in Poultry Science, Food Science, Food Microbiology or a closely related area with documented experience in poultry products research and outreach. Documented evidence of individual and collaborative research resulting in peer reviewed publications in internationally recognized journals and a successful personal record as the principal investigator on peer reviewed, externally funded grants and contracts. Excellent organizations skills and the ability to work with others to develop collaborative research and outreach programs. Ability to communicate effectively, both orally and in writing. The candidate selected for this position must be able to meet eligibility requirements for work in the United States.

Rank and salary commensurate with qualifications.

Applicants should submit a letter of application, current resume, transcripts and names, phone number, addresses and e-mail addresses of three references to:

Dr. Patricia Curtis, Chair, Search Committee
Department of Poultry Science
236 Upchurch Hall
Auburn University, AL 36849
Phone: (334) 844-2679
Fax: (334) 844-2641
E-Mail: curtipa@acesag.auburn.edu

Review will begin September 1, 2002 and continue until a suitable candidate is selected. The position start date is January 1, 2003.

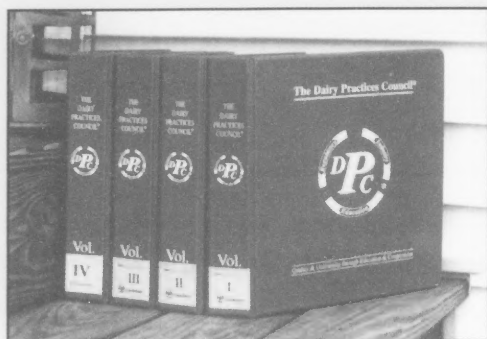
Information on the AU Poultry Product Safety and Quality Program can be found at: www.ag.auburn.edu/dept/ph/peak.html.

Auburn University is an Affirmative Action/Equal Opportunity Employer.

Supervisory Research Microbiologist

The USDA/ARS Poultry Microbiological Safety Research Unit in Athens, GA is seeking a Research Microbiologist GS 14-15 (\$76,271-\$89,715) salary commensurate with experience. Incumbent conducts personal research and provides leadership to basic and applied research to develop knowledge and technologies that will support action agencies and the poultry industry by preventing or controlling the presence of human bacterial pathogens in fertile broiler/breeder eggs, on-farm chickens, and spent litter for distribution onto agricultural lands. The three program areas for this unit are (1) controlling colonization of poultry by *Campylobacter*, (2) controlling colonization by *Salmonella* and *Clostridium perfringens*, and (3) assessing and controlling pathogens in poultry manures. As Research Leader incumbent is responsible for managing the Unit's physical, personnel, and financial resources in application to project objectives. Incumbent also serves as Coordinator of Poultry Food Safety Research at the Athens, GA location. United States citizenship is required. Comprehensive benefits package included. For information on the research program/position, contact Jane Robens, Acting Research Leader at 706-546-3549 or jane.robens@ars.usda.gov. For the full text of the vacancy announcement, which includes application materials and forms, contact Genell G. Powers at 706-546-3029 or powersg@saa.ars.usda.gov or visit the ARS vacancy website at www.afm.ars.usda.gov/divisions/hrd/index.html, Announcement number ARS-X2S-2295. Applications must be postmarked by September 30, 2002.

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IAFP Offers "Guidelines for the Dairy Industry" from The Dairy Practices Council®

This newly expanded Four-volume set consists of 66 guidelines.

- | | |
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| <ol style="list-style-type: none"> 1 Planning Dairy Freestall Barns 2 Effective Installation, Cleaning, and Sanitizing of Milking Systems 3 Selected Personnel in Milk Sanitation 4 Installation, Cleaning, & Sanitizing of Large Parlor Milking Systems 5 Directory of Dairy Farm Building & Milking System Resource People 6 Natural Ventilation for Dairy Tie Stall Barns 7 Sampling Fluid Milk 8 Good Manufacturing Practices for Dairy Processing Plants 9 Fundamentals of Cleaning & Sanitizing Farm Milk Handling Equipment 10 Maintaining & Testing Fluid Milk Shelf-Life 11 Sediment Testing & Producing Clean Milk 12 Tunnel Ventilation for Dairy Tie Stall Barns 13 Environmental Air Control and Quality for Dairy Food Plants 14 Clean Room Technology 15 Milking Center Wastewater 16 Handling Dairy Products from Processing to Consumption 17 Prevention of & Testing for Added Water in Milk 18 Fieldperson's Guide to High Somatic Cell Counts 21 Raw Milk Quality Tests 22 Control of Antibacterial Drugs & Growth Inhibitors in Milk and Milk Products 23 Preventing Rancid Flavors in Milk 24 Troubleshooting High Bacteria Counts of Raw Milk 25 Cleaning & Sanitation Responsibilities for Bulk Pickup & Transport Tankers 27 Dairy Manure Management From Barn to Storage 28 Troubleshooting Residual Films on Dairy Farm Milk Handling Equipment 29 Cleaning & Sanitizing in Fluid Milk Processing Plants 30 Potable Water on Dairy Farms 31 Composition & Nutritive Value of Dairy Products 32 Fat Test Variations in Raw Milk 33 Brucellosis & Some Other Milkborne Diseases 34 Butterfat Determinations of Various Dairy Products 35 Dairy Plant Waste Management | <ol style="list-style-type: none"> 36 Dairy Farm Inspection 37 Planning Dairy Stall Barns 38 Preventing Off-Flavors in Milk 39 Grade A Fluid Milk Plant Inspection 40 Controlling Fluid Milk Volume and Fat Losses 41 Milkrooms and Bulk Tank Installations 42 Stray Voltage on Dairy Farms 43 Farm Tank Calibrating and Checking 45 Gravity Flow Gutters for Manure Removal in Milking Barns 46 Dairy Odor Management 48 Cooling Milk on the Farm 49 Pre- & Postmilking Teat Disinfectants 50 Farm Bulk Milk Collection Procedures 51 Controlling the Accuracy of Electronic Testing Instruments for Milk Components 53 Vitamin Fortification of Fluid Milk Products 54 Selection of Elevated Milking Parlors 55 Hazard Analysis Critical Control Point System - HACCP For The Dairy Industry 56 Dairy Product Safety (Pathogenic Bacteria) for Fluid Milk and Frozen Dessert Plants 57 Dairy Plant Sanitation 58 Sizing Dairy Farm Water Heater Systems 59 Production and Regulation of Quality Dairy Goat Milk 60 Trouble Shooting Microbial Defects: Product Line Sampling & Hygiene Monitoring 61 Frozen Dessert Processing 62 Resources For Dairy Equipment Construction Evaluation 63 Controlling The Quality And Use Of Dairy Product Rework 64 Control Points for Good Management Practices on Dairy Farms 65 Installing & Operating Milk Precoolers Properly on Dairy Farms 66 Planning A Dairy Complex - "100+ Questions To Ask" 69 Abnormal Milk - Risk Reduction and HACCP 71 Farmers Guide To Somatic Cell Counts In Sheep 72 Farmers Guide To Somatic Cell Counts In Goats 73 Layout of Dairy Milk Houses for Small Ruminant Operations 80 Food Allergen Awareness In Dairy Plant Operations 83 Bottling Water in Fluid Milk Plants |
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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 throughout the United States. In addition, its membership roster lists individuals and organizations throughout the world.

For the past 32 years, DPC's primary mission has been the development and distribution of educational guidelines directed to proper and improved sanitation practices in the production, processing, and distribution of high quality milk and milk products.

The DPC Guidelines are written by professionals who comprise six permanent task forces. Prior to distribution, every guideline is submitted for approval to the state regulatory agencies in each member state. Should any official have an exception to a section of a proposed guideline, that exception is noted in the final document.

The guidelines are renown 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.

If purchased individually, the entire set would cost \$306. We are offering the set, packaged in four looseleaf binders for \$230.00.

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THOUGHTS on Today's Food Safety...

Food Security ≠ Food Safety

Jenny Scott, Rhona Applebaum,
and Alice Johnson
National Food Processors Association
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Washington, D.C. 20005
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E-mail: jscott@nfpa-food-org

As September rolls around and we mark the one-year anniversary of the horrible terrorist events of 9/11, it is appropriate to look back on how those events have impacted the food industry and what we are doing to enhance the security of the food supply. Make no mistake about it; the potential for the food supply to be a target or tool of terrorism can no longer be viewed in hypothetical terms. Although there is no evidence to suggest that food will be a target, the food industry cannot be complacent and continue to do business as it did pre-9/11.

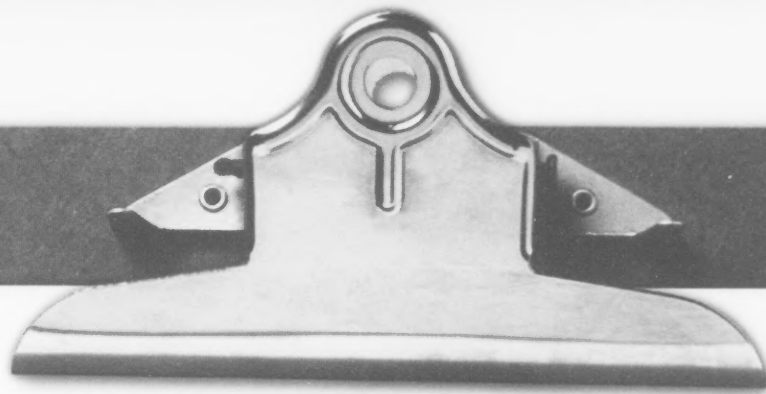
The food industry has a long history of dealing with threats to foods – we constantly have to address inadvertent contamination, we have periodically had to deal with foodborne illness outbreaks, and we have occasionally had to address intentional food tampering. But we now have to contend with what was once unthinkable – the intentional, widespread contamination of the food supply. This is what we mean when we talk about food security – countering intentional attacks on the food supply that are designed to cause illness and injury, to disrupt domestic food production and delivery systems, and/or to disrupt international food trade. Food security is NOT synonymous with food safety. Their disciplines and their underpinnings are different, and the expertise and experience needed to address each of these are different. Food safety deals with hazards that are reasonably likely to occur, and that occur naturally or by accident (cross-contamination, process failures). Food security deals with intentional acts that are only remotely likely (we hope). The distinction between the intentional versus the accidental is immensely important to industry, particularly as it relates to our management and prevention practices. We need microbiologists and food safety experts (sci-

entists) to address food safety; we need law enforcement personnel to help set up food security programs. Food security encompasses three "P's" – Protecting Personnel, Protecting Products, and Protecting Property. Since "Protecting Product" encompasses the food safety aspects of food security, we can see food security as an umbrella under which food safety operates.

So, what has the food industry done since September 11 to ensure food security? We immediately took steps to evaluate current practices, identify weaknesses in the current systems, and implement appropriate, effective controls. Within two weeks, the National Food Processors Association had organized the Alliance for Food Security, which consists of more than 130 organizations representing all segments of the food industry, as well as experts from government agencies and other groups. This Alliance proactively seeks and has shared information on food security issues in order to prevent threats (to the extent we can) to the safety of the nation's food supply. The focus of the Alliance is communication, consultation, coordination, collaboration, and cooperation, because better information results in better decisions. NFPA has developed two documents, a Threat Exposure Assessment and Management (TEAM) Process, based on operational risk management, and a Security Checklist of questions. The TEAM document provides a structured approach to identify threats to the food supply, assess the severity and probability of these threats, and analyze controls for them. Where could a contaminant be introduced? How likely is it to happen? What would be the result? The document can help set priorities as to where controls should be put. The check list helps identify factors to consider in assessing food security measures. A Food Security Manual is under development. Other associations have also developed food security information specific to their sectors.

FDA and FSIS have provided guidelines for food security, with additional guidance planned. The amount of food security-related information available from a variety of sources, in particular the Internet, has grown almost exponentially. FDA and FSIS both have an extensive amount of food security information on their Web sites (see the link to Food Safety and Terrorism at www.cfsan.fda.gov and Biosecurity/Homeland Security at www.fsis.usda.gov). In addition, there is food security information at www.foodsafety.gov (Countering Bioterrorism and Other Threats to the Food Supply).

Continued on page 714



National Food Safety
Education MonthSM 2002

CHECK IT OUT

before you check it in

- Who is it From?**
- Is it the Right Temperature?**
- How Does it Look, Feel, Smell?**
- Is it in Good Condition?**
- Is it Fresh?**

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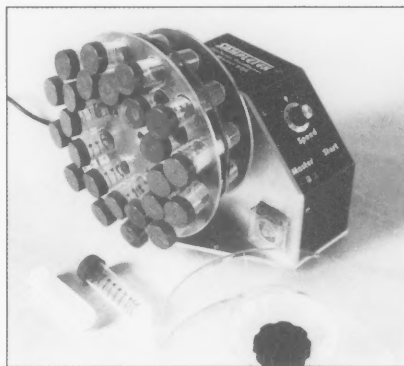
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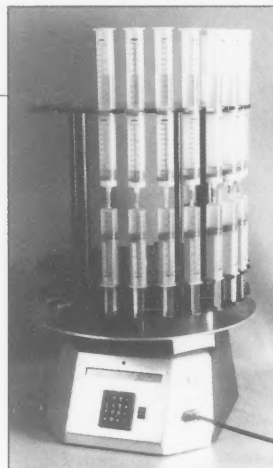
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