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DAIRY, FOOD AND ENVIRONMENTAL

# Sanitation

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

JULY 2002



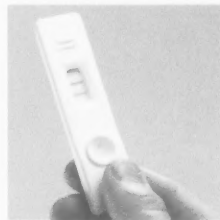
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DAIRY, FOOD AND ENVIRONMENTAL

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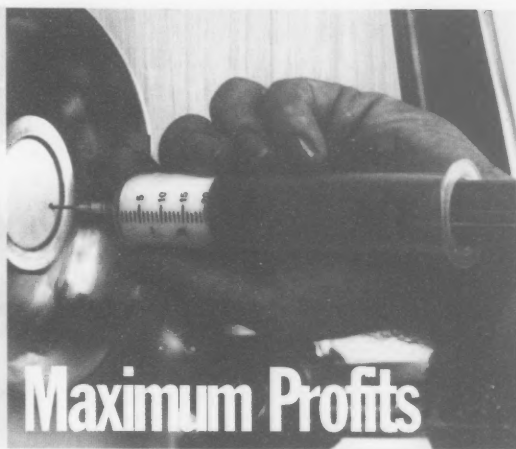
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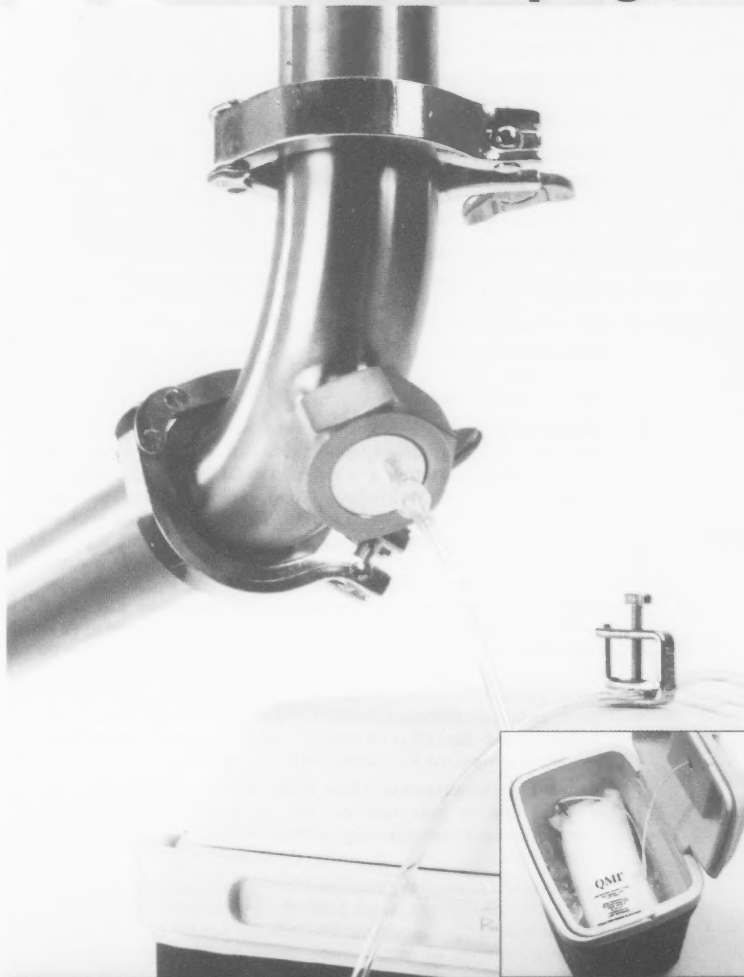
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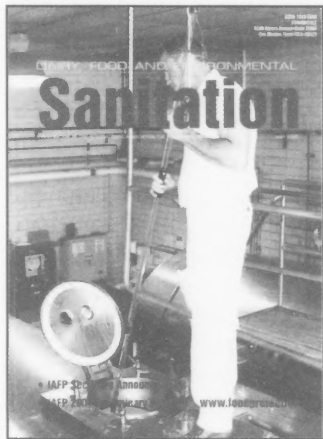
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# READER COMMENTS



I would like to comment on the photo which was on the cover of the May issue of *Dairy, Food and Environmental Sanitation*. The picture displays a method for testing milk, but it raises a red flag for GMPs and food safety.

The person is wearing a hairnet, but what about his exposed hairy arms? Also, it appears that he is standing on the vessel with street shoes and not standing on the platform next to the vessel. If he steps on the milk drops on the outside of the vessel, then he can be tracking milk on the processing floor. I assume he walked through a foot bath at the entrance to the room. If not, there is the possibility he could be adulterating the product with dirt carried in on the bottom of his shoes.

If similar conditions were noted during a food safety audit of a fresh-cut fruit or vegetable processing facility, the above issues would be considered serious infractions and possible audit failures.

Les Lipschutz  
Director, Product Safety  
Del Monte Fresh Produce N. A., Inc.  
Coral Gables, Florida

## Editor's Note:

We invite our readers' input. Please forward your comments to [dbahun@foodprotection.org](mailto:dbahun@foodprotection.org). or *Dairy, Food and Environmental Sanitation*, 6200 Aurora Ave., Suite 200W, Des Moines, IA 50322-2864.

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# Postcards from Iowa



By JAMES DICKSON  
President

**“I don’t think that there is any question about which meeting is *THE* food safety meeting to attend”**

This is my last column as President, and I can’t begin to describe the experiences that I have had last year. It has been wonderful and crazy, all at the same time. I wouldn’t have traded this experience for anything, although I have to admit, I was relieved to pass the gavel on to

Anna Lammerding at the end of the Award’s Banquet. For all of the wonderful memories, I am glad to pass the responsibilities on to the next President. It does take so much time and energy, and in the end, you simply get tired.

I am delighted with the outcome of the Annual Meeting. It is a tribute to everyone involved, from the staff, exhibitors, organizers, presenters and attendees, that the meeting was such a success. Each Annual Meeting outshines the previous one, and that is no discredit to the previous meetings. Our Members have made the Association what it is, and the Annual Meeting is a tribute to all of you. There were times in San Diego when I simply could not believe what we have accomplished together. Every one of us should be proud.

Of the memories that I have of the San Diego meeting, one really stands out. I spoke to the Student Professional Development Group’s luncheon, and as always, I continue to be impressed with the quality of our students. They really are a bright and energetic group, and they should be given credit for all that they do. Many of you may have had the opportunity to meet one or more of them at the sessions, either in their role as presenters or as session monitors, and I hope you took a few minutes to get to know them. They are the future, not only of our Association, but also the ones who will determine the future course of food safety. We are fortunate to have them as part

of our Association, and I look forward to seeing many of them as members of the Executive Board in the future. It would not surprise me at all to find out, twenty years from now, that several of our student members had become President of IAFP. In fact, I’m counting on it.

I could go on about the statistics of the meeting, but I think that would take away from the experience. Suffice to say that it was our largest, in terms of attendance, and largest, in terms of presentations. Bigger isn’t always better, but when you can combine quality and quantity, you definitely have a winning combination. And by any definition, IAFP 2002 in San Diego was a “winner”. Again, everyone should be proud of themselves and the Association for putting on such a meeting. I don’t think that there is any question about which meeting is *THE* food safety meeting to attend.

In closing, I would like to thank all of the staff, Donna, Karla, Beth, Donna, Pam, Bev, Didi, Shannon, Lisa, Julie, Lucia and especially David, for their patience with me. It isn’t easy working for an Association, where every year you get a new President and new members of the Executive Board. These folks are truly professionals, and take all of the difficulties in stride. I have rarely had the opportunity to work with such a dedicated (and fun loving!) group, and this may be the best memory of all.

Take care, and I’ll see you in New Orleans for IAFP 2003.

## **New Bioterrorism Web Site Now Online**

CDC has redesigned its bioterrorism Web site—<http://www.bt.cdc.gov>—offering new and updated information for health professionals and the public.

The redesigned Web site, which focuses on public health preparedness and emergency response, is the official federal site for medical, laboratory, and public health professionals to reference when providing information to the public and for updates on protocols related to health threats such as anthrax.

CDC redesigned the site in response to overwhelming demand for the public and professionals for credible information during the anthrax crisis.

The site offers easy-to-use categories by key audiences, including clinicians.

## **Hot Links for Educators**

Educators, this CDC Web page is one of the most useful you'll ever find: <http://cdc.gov.foodsafety/edu.htm>.

The page provides direct links to educational resources from a variety of federal agencies, state agencies, and associations.

You'll find links to the newest food safety education publications. You'll also be able to access key training resources including:

- Epidemiological information and software;
- Foodborne disease outbreak investigation case studies;
- Public Health Training Network; and
- USDA/FDA Foodborne Illness Education Information Center

# COMMENTARY

## From the Executive Director



By DAVID W. THARP, CAE  
Executive Director

**“I want to expand on all the ways our Student PDG participated this year at IAFP 2002”**

WOW! IAFP 2002 exceeded all of our expectations. Even with a somewhat sluggish US economy, we set records in number of attendees, exhibitors, Monday Night Social attendees and in number of rooms used at the host hotel! It is too early to report on the “final” numbers, so we will save that for a future column.

The growth we are experiencing is a direct result of the quality of the program material presented year after year at the IAFP Annual Meeting. You, as an active Member and participant, are to be commended for the work you put forth which benefits all Members and attendees. IAFP is one special organization with thousands of special Members working towards a common goal of protecting the food supply from contamination.

One group within the Membership should be recognized for their exceptional contribution. That group is the Student Professional Development Group (PDG). Since their beginnings after the 1999 Annual Meeting, participation has steadily grown. Student presence was recognized everywhere at IAFP 2002 from their booth in the exhibit hall foyer, to their involvement as session room monitors and audiovisual assistants. I want to expand on all the ways our Student PDG participated this year at IAFP 2002.

This year marked the third annual Student PDG Luncheon. It is inspiring to see the active participation of so many IAFP students at these luncheons and

this year was no exception, with close to 90 attendees. These students listened to Jim Dickson, IAFP President talk about his experiences as an educator in the food industry. Sharing information and experiences, that is what IAFP is all about!

Another way of sharing at IAFP 2002 was through many student presentations over the three-day conference. Over 125 students registered for this Annual Meeting and a good percentage of them presented papers at IAFP 2002. We know for sure that there were 57 students involved in the Developing Scientists Competition. That is a record number for this competition.

The Student PDG also organized and presented a symposium titled “Cooperating to Improve Foodborne Outbreak Investigations” with internationally recognized speakers from FDA, CDC, the California Department of Health Services, and Texas Tech University. There was a lot of interest in this symposium as was witnessed by the session attendance. Isn't it wonderful to have such an energetic group of students looking for more ways to become actively involved? Let me answer that for you – YES it is!

Over the past few years, the IAFP staff has come to rely upon the students to help us prepare for the poster sessions. Usually, late on Sunday evening, after the Opening Session and Reception are completed, students and staff

set the poster boards in place for Monday morning's poster session. Their involvement with the poster sessions during the entire conference has helped a great deal.

Another place where the Student PDG stepped up and really helped out this year was by volunteering to assist as session room monitors and audiovisual assistants. These volunteers perform crucial functions such as dimming the lights for LCD presentations and assisting convenors with audiovisual complications. We were glad to have the extra workforce this year in San Diego!

IAFP 2002 provided the setting for the second Job Fair sponsored and organized by the Student PDG. Again this year, there were a good number of students involved and a nice selection of potential employers. Each year, the Job Fair has grown and we look forward to continued growth next year and in to the future.

In addition to all of the student involvement, the Student PDG has undertaken the production of a newsletter. The Student PDG newsletter is distributed via E-mail and is available on the

Student PDG page of IAFP's Web site.

As you can see, the IAFP students are actively involved in many ways within IAFP. If you are a student and are not "in touch" with the Student PDG, I suggest you contact Manan Sharma at [msharma@cfs.griffin.peachnet.edu](mailto:msharma@cfs.griffin.peachnet.edu) to learn how you can become involved. Everyone is welcome! You may also contact me at the IAFP office to join the Student PDG. Thanks to all of the students for your participation in IAFP 2002 and special thanks to Kali Kniel and Manan Sharma for your leadership this past year!

## **LOOK WHAT'S NEW**

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# Potential Use of Staphylococci as Indicators of Post-Heating Contamination of Hot-Smoked Fish

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## SUMMARY

This study was done to evaluate the potential use of staphylococci as an indicator of direct or indirect manual contamination of fish after hot-smoking. Twenty-two samples of hot-smoked fish, representing six processors and four species, were obtained from a grocery store and surface-sampled for presence of staphylococci by use of Baird-Parker agar base with added mannitol, phenol red, and tellurite. Confirmed staphylococci (28 isolates) were detected on 15 samples, with *S. epidermidis*, a predominant organism on human skin, being the most prevalent species (14 isolates). The thermotolerance of 11 *S. epidermidis* and 3 *S. aureus* isolates was evaluated using a variation of the thermotolerant plate count. All isolates decreased in numbers by at least 3.5 log CFU/ml. In addition, the five most thermotolerant *S. epidermidis* isolates did not survive a commercial hot-smoking process on inoculated rainbow trout, suggesting that the presence of staphylococci in properly heat processed hot-smoked fish would almost certainly result from post-heating contamination. These *S. epidermidis* isolates also died when inoculated on cooled hot-smoked rainbow trout that were then commercially packaged and stored for 18 days at 4 or 10°C. Collectively, these results show that staphylococci are an appropriate indicator organism for evaluating post-heating manual contamination of hot-smoked fish.

A peer-reviewed article.

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**TABLE 1. Hot-smoked fish samples tested for presence of staphylococci**

Company	Fish Type	Samples (n; Identification Number)
A	Smoked Chub	2; (14, 15)
B	Smoked Cajun Salmon	1; (21)
B	Citrus Pineapple Smoked Salmon	1; (22)
C	Smoked Salmon	2; (4, 12)
D	Smoked Chub	5; (1, 2, 8, 13, 18)
D	Smoked Salmon Chunk	3; (6, 11, 16)
E	Smoked Chub	1; (5)
E	Smoked Salmon Chunk	1; (20)
F	Smoked Whitefish Chunk	4; (3, 10, 17, 19)
F	Smoked Trout Chunk	2; (7, 9)

## INTRODUCTION

The genus *Staphylococcus* is comprised of several species of spherical Gram-positive, catalase-positive bacteria that form irregular clusters. Members of the genus are generally tolerant of high salt concentrations. *Staphylococcus* is commonly divided into two categories, species that produce the enzyme coagulase, which clots fibrin in blood (coagulase-positive), and species that don't (coagulase-negative). The main pathogenic *Staphylococcus* species is *S. aureus*, which can produce one or more heat-stable enterotoxins when growing. The ability to produce enterotoxin is commonly associated with coagulase production, although enterotoxigenic coagulase-negative staphylococci have been described (2). *S. aureus* is present in the nasal cavity of an estimated 50% of adult humans, while 5-30% of humans are reported to carry *S. aureus* on the hands and other skin surfaces (2). Direct or indirect hand-to-food contact is an important route by which indigenous *S. aureus*, and transient pathogens such as *Listeria mono-*

*cytogenes*, can contaminate previously heated ready-to-eat foods. As part of a program to minimize hand-to-food contact by employees, food processors may wish to test previously heated ready-to-eat foods for the presence of skin-borne bacteria. Testing of previously heated ready-to-eat foods for *S. aureus* is common. However, the absence of *S. aureus* does not necessarily indicate that hand-to-food contact was avoided, i.e., false-negative results are probable. An alternative approach is to perform a test that would detect coagulase-negative *Staphylococcus* spp. and *S. aureus*. Coagulase-negative staphylococci are very common on human skin and are important inhabitants of human hands (4). Skin-borne coagulase-negative staphylococci are generally pathogenic only if they can gain entry to the body through broken skin. *S. epidermidis* is the dominant skin-borne coagulase-negative staphylococcal species. For staphylococci to be used as an indicator of hand contact with ready-to-eat foods after heating, these organisms must have a low enough thermotolerance that cells contaminating the food prior to heating will be destroyed

during heat processing. Otherwise, it would not be possible to tell whether the presence of staphylococci indicated contamination before or after heat processing. This study investigated the use of staphylococci as an indicator of post-heating contamination of hot-smoked fish.

Hot-smoked fish are generally processed in small operations in which there are many manual processing steps prior to hot-smoking. Staphylococcal contamination could occur at any of these steps. Before hot-smoking, the fish are commonly brined. As a result, the fish contain high levels of salt that provide salt-tolerant staphylococci a potential selective advantage. However, enterotoxin production by *S. aureus* on fish prior to hot-smoking is unlikely because this pathogen competes poorly with other microorganisms. Further, Wisconsin regulations require that the brining step must be done at  $\leq 3.3^\circ\text{C}$ , a temperature unsuitable for growth or enterotoxin production (7). The heating treatment legally required for hot-smoked fish in Wisconsin, which consists of achieving a cold-point temperature of at least  $62.8^\circ\text{C}$  for at least 30 minutes (7), is adequate to ensure absence of pathogenic *S. aureus* and other vegetative pathogenic bacteria. However, it is unclear whether non-pathogenic coagulase-negative staphylococci such as *S. epidermidis* would survive. Following hot-smoking, manual processing and packaging steps are common and may result in staphylococcal re-contamination. If hot-smoking eliminated foreseeable levels of staphylococci, high numbers of staphylococci on hot-smoked fish could indicate either gross contamination of the hot-smoked fish with no subsequent growth, or a lower level of contamination followed by growth. Wisconsin regulations specify that hot-smoked fish must be stored aerobically at a temperature no higher than  $3.3^\circ\text{C}$  (7). *Staphylococcus aureus* will not grow at such temperatures, but it is not known whether coagulase-negative staphylococci can.

**TABLE 2. Confirmed staphylococci isolates from hot-smoked fish**

Sample Number	Identity <sup>a</sup> of Isolate
3	<i>S. epidermidis</i>
3	<i>S. epidermidis</i>
8	<i>S. hominis</i>
9	<i>S. aureus</i>
10	<i>S. epidermidis</i>
10	<i>S. epidermidis</i>
10	<i>S. epidermidis</i>
10	<i>S. epidermidis</i>
11	<i>S. epidermidis</i>
11	<i>S. epidermidis</i>
12	<i>S. lentus</i>
13	<i>S. epidermidis</i>
13	<i>S. epidermidis</i>
13	<i>S. aureus</i>
15	<i>S. aureus</i>
16	<i>S. epidermidis</i>
17	<i>S. epidermidis</i>
18	<i>S. xylosum</i>
18	<i>S. epidermidis</i>
19	<i>S. warneri</i>
20	<i>S. warneri</i>
21	<i>S. hominis</i>
21	<i>S. warneri</i>
21	<i>S. warneri</i>
21	<i>S. epidermidis</i>
22	<i>S. hominis</i>
22	<i>S. warneri</i>
22	<i>S. warneri</i>

<sup>a</sup> identified using the API Staph biochemical characterization system

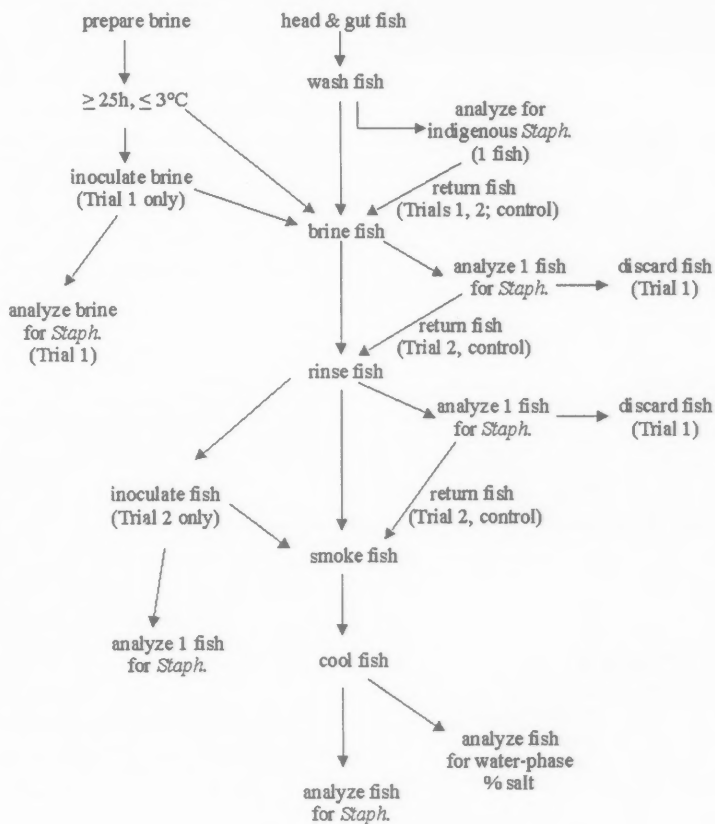
The objectives of this study were to (1) evaluate the prevalence of staphylococci on hot-smoked fish available in a Wisconsin grocery store, (2) use a laboratory assay to evaluate the thermotolerance of isolated staphylococci, (3) directly test thermotolerance of selected staphylococcal isolates on fish during a commercial hot-smoking process, and (4) evaluate the potential for growth of selected staphylococcal isolates on hot-smoked fish stored in commercial packaging at marginal (4°C) and abusive (10°C) conditions.

## MATERIALS AND METHODS

### Survey of retail smoked fish for prevalence of staphylococci

Hot-smoked fish were analyzed for the presence of staphylococci, and isolates from contaminated samples were identified. Hot-smoked fish samples (n = 22, Table 1) were purchased weekly from a local grocery store over an 8-week period and transported to the laboratory within 20 minutes. Samples represented six different processors/distributors and four species of fish: salmon, chub, trout, and whitefish. Upon receipt, the samples were refrigerated at 4°C, and analysis was done within 8 h. The entire surface of each sample was swabbed using a sponge that had previously been wetted with ca. 10 ml sterile Butterfield's phosphate diluent (BPD; USDA beef/pork carcass sponge-sampling kit, International BioProducts, Redmond, WA). After swabbing, the sponge was returned to a sterile plastic bag and ca. 15 ml BPD was added to the bag and absorbed by the sponge. The BPD was then expressed from the sponge by manually squeezing the sponge through the bag and the expressed liquid was spread-plated in triplicate (0.3, 0.3, and 0.4 ml) on Baird-Parker agar base (Difco, Becton-Dickinson, Mansfield, MA) with added mannitol (10g/l; Sigma Chemical Co., St. Louis, MO), phenol red [2.5 ml of 1% (w/v) solution/l; Sigma], and potassium tellurite (10 ml of 0.1 g/l solution; Sigma). This selective medium, BP

**Figure 1.** Evaluation of thermotolerance of selected staphylococcal isolates in hot-smoked fish. Fish were inoculated either via brine (Trial 1), by swabbing after rinsing (Trial 2), or were not inoculated (control). Six fish were used in each experiment.



+ MPRT, had been shown in preliminary studies to support growth of several *Staphylococcus* spp. and allow easy differentiation of these organisms on the basis of colony size, morphology and the black color resulting from tellurite reduction. Plates were incubated for 48 hours at 35°C. After incubation, presumptive *Staphylococcus* colonies (small-to-medium size, black, circular with smooth edge) were transferred to Brain Heart Infusion (BHI) agar (Difco) plates and incubated for 24 hours at 35°C. These isolates then underwent tests for Gram reaction, cell morphology, catalase production, anaerobic utilization of glucose and mannitol, and biochemical characterization using the API Staph kit (bioMérieux, Hazelwood, MO).

#### Evaluation of staphylococcal thermotolerance using a laboratory assay

The thermotolerance of 14 confirmed staphylococcal isolates (11 *S. epidermidis* and 3 *S. aureus*) was evaluated by means of a variation of the thermotolerance plate count described in the 16th edition of Standard Methods for the Examination of Dairy Products (5). Each isolate was transferred from stock cultures frozen in double-strength BHI broth + 20% (v/v) glycerol (Sigma) to BHI agar (Difco); incubated for 24 hours at 35°C; and transferred to 5 ml of BHI broth (Difco), which was also incubated for 24 hours at 35°C. Following incubation, serial dilutions were made in BPD and spread-plated onto BHI agar to enumerate cells (8-9 log CFU/ml), and 0.1 ml of

undiluted culture was transferred to 9.9 ml of sterile skim milk (Difco), resulting in an initial load of 6-7 log CFU/ml. The inoculated skim milk was placed into a 62.8°C water bath and held there for 30 minutes. Following the 30 minutes, the skim milk samples were cooled down immediately in ice, and then diluted, as appropriate, in BPD and spread-plated on BHI agar. All BHI agar plates were incubated for 24 hours at 35°C, colonies were counted, and the number of survivors calculated, typically 2-4 log CFU/ml. The difference in log CFU/ml between heated and unheated milk was used to compare the thermotolerance of each isolate. Thermotolerance experiments were done in triplicate, and the mean decrease in log CFU/ml and standard deviation were calculated for each isolate.

#### Evaluation of the thermotolerance of selected staphylococcal isolates in hot-smoked fish

After the general thermotolerance of staphylococcal isolates had been evaluated, rainbow trout were inoculated with the five most thermotolerant staphylococci and the survival of these organisms was evaluated during a commercial hot-smoking process. Three experiments were done. In the control experiment, fish were not inoculated. The other two experiments simulated two different contamination points: during brining and during handling of the brined and washed fish prior to smoking (see Fig. 1 for a schematic representation of the experimental design). The five isolates tested were all *S. epidermidis*, isolated from three different hot-smoked fish samples. Isolates were individually grown from frozen stock cultures, as described earlier, with each final culture in 5.0 ml of BHI broth. The cultures were then combined in a sterile centrifuge tube and 1.0 ml of the mixture was used to enumerate cells by dilution in BPD and spread-plating on BP+MPRT agar. The mixture was then centrifuged at 5,000 × g for 8 min, following

**TABLE 3. Thermotolerance of *S. epidermidis* and *S. aureus* isolated from hot-smoked fish. Thermotolerance was evaluated using a variation of the thermotolerant plate count (16th edition, Standard Methods for Examination of Dairy Products)**

Species / Sample Number	Decrease in log CFU/ml	
	Mean (n = 3)	Standard Deviation
<i>S. epidermidis</i> / 3	3.7	1.0
<i>S. epidermidis</i> / 8	4.1	1.0
<i>S. aureus</i> / 9	4.1	0.7
<i>S. epidermidis</i> / 10	4.0	0.6
<i>S. epidermidis</i> / 10	4.0	1.0
<i>S. epidermidis</i> / 10	3.5	0.2
<i>S. epidermidis</i> / 11	4.0	0.3
<i>S. epidermidis</i> / 13	3.9	0.3
<i>S. epidermidis</i> / 13	4.3	0.3
<i>S. aureus</i> / 13	4.4	0.1
<i>S. aureus</i> / 15	4.6	0.2
<i>S. epidermidis</i> / 16	4.3	0.2
<i>S. epidermidis</i> / 18	4.5	0.1
<i>S. epidermidis</i> / 21	4.5	0.1

which the supernatant was decanted and cells were re-suspended in 25 ml distilled water. To simulate brine contamination, this mixture was then poured into the brine, which was thoroughly mixed prior to the addition of fish. A 1.0 ml sample of inoculated brine was removed and analyzed to determine numbers of staphylococci, as described previously. To simulate contamination after fish were brined and washed, a swab was inserted into the mixed and re-suspended culture, following which the thickest portion of the fish flesh was inoculated by surface swabbing.

For each experiment, six farm-raised rainbow trout were obtained live from a local grocery store and transferred on ice in insulated coolers to the laboratory. Once the fish had died, they were headed, gutted

and washed. The entire surface of one fish was analyzed for indigenous staphylococci as described previously. Because this analysis was non-destructive, the analyzed fish continued in the process. Six fish were transferred to a saturated brine solution [4.1 kg salt plus 11.3 liters of water; approx. 24% (w/v)] that had been chilled at  $\leq 3^{\circ}\text{C}$  for at least 24 h. Fish were brined for 24 h at  $\leq 3^{\circ}\text{C}$ . After brining, the entire surface of one of the fish was analyzed for staphylococci, with serial dilutions of BPD prepared, as appropriate, and spread-plated in triplicate on BP+MPRT agar. If the brine was inoculated, this analyzed fish did not continue in the process. When brine was uninoculated, the analyzed fish did continue in the process. Next, the brined fish were immediately rinsed in fresh tap

water. If the brine had previously been inoculated, the surface of one fish was analyzed after rinsing and that fish did not continue in the process. If the experiment involved post-washing inoculation, the inoculation was done immediately after washing and one fish was subsequently analyzed for inoculum organisms and did not continue in the process. Depending on the experiment, four, five, or six fish were then placed on screens and underwent a commercial hot-smoking process in the University of Wisconsin-Madison, Meat Science & Muscle Biology Laboratory smokehouse. The hot-smoking process was 30 minutes at  $48.9^{\circ}\text{C}$  with no added humidity or smoke, 90 minutes at  $57.2^{\circ}\text{C}$  with 30% relative humidity and added smoke, heating at  $71.1^{\circ}\text{C}$  with no smoke until the wet bulb temperature reached  $62.8^{\circ}\text{C}$ , and then holding the fish for 30 minutes under conditions of  $62.8^{\circ}\text{C}$  wet bulb and  $68.3^{\circ}\text{C}$  dry bulb. These conditions resulted in the cold-point of the largest fish being held at  $62.8^{\circ}\text{C}$  for 30 minutes, as measured by an internal temperature probe. After the hot-smoking process, fish were aseptically removed and refrigerated for at least 1 hour to a temperature of  $\leq 3^{\circ}\text{C}$ . After the cooling period, the entire surface of each of three fish (inoculated via brine) or the thickest part of the flesh for each of four fish (inoculated via direct swabbing) or the entire surface of each of five fish (uninoculated controls) was sponge-sampled as described before and plated in triplicate on BP+MPRT agar. Following incubation at  $35^{\circ}\text{C}$  for 48 hours for all samples, presumptive staphylococcal colonies underwent the confirmation tests described earlier. In each experiment, the one remaining fish was sent to a commercial testing laboratory for water-phase % salt analysis. Wisconsin regulations require that hot-smoked fish to be packaged under air must contain at least 2.5% water-phase salt (7). Finished hot-smoked fish in this study had 4.9 - 6.1% water-phase salt upon completion of the process described.

**TABLE 4. Survival of *S. epidermidis* on rainbow trout during a commercial hot-smoking process. Inoculation of fish occurred either via brining (Trial 1) or direct swabbing of the fish surface (Trial 2)**

Trial 1:				
Replicate	log CFU/mL		log CFU/ fish	
	inoculated brine	brined fish	washed fish	smoked fish
A	5.9	5.6	4.5	<1.4*
B	5.2	4.7	4.1	<1.4*

Trial 2:		
Replicate	log CFU/fish	
	inoculated fish	smoked fish
A	7.7	<1.4*
B	7.6	<1.4*

\*less than detection limit of 1.4 log CFU/fish

#### Evaluation of staphylococcal growth potential on stored hot-smoked fish

A final study evaluated the potential for survival or growth of staphylococci contaminating fish after hot-smoking. The rainbow trout were headed and gutted, brined, washed, smoked, and cooled as described before, and inoculation took place after the hot-smoked fish were cooled. The five most thermotolerant *S. epidermidis* isolates were grown, mixed, centrifuged and re-suspended as described previously, and then diluted 100-fold in BPD. On four of the six fish, 0.05 ml of the diluted culture was applied on each side of the body cavity and on the skin by using an Eppendorf pipet. Inoculum was then distributed over the surface using a sterile glass "hockey stick". The remaining two uninoculated fish were used as controls. On day 0 the body cavity and skin of a control fish were analyzed separately for indigenous staphylococci as described previously. An inoculated fish was also analyzed in the same manner. The other four fish (one

control and three inoculated) were placed separately on polystyrene trays and wrapped in an oxygen-permeable plastic film used commercially for displaying smoked fish in a retail grocery store. Packaged fish were then stored either at 4°C (marginal refrigeration for smoked fish) or 10°C (abusive conditions). After 6, 12, and 18 days of storage, the body cavity surface and the skin surface of one fish were analyzed separately. The second control fish was analyzed for indigenous staphylococci after 18 days of storage and then sent to a commercial testing laboratory for water-phase % salt analysis.

#### RESULTS AND DISCUSSION

Confirmed staphylococci were isolated from 15 of the 22 smoked fish samples (Table 2). All types of fish and all smoked fish processors were represented among samples with confirmed isolates. For all samples, the number of presumptive staphylococci was less than 3 log CFU/fish, indicating either that low numbers of cells had contami-

nated the fish or that numbers of staphylococci had decreased during refrigerated storage. These levels of presumptive staphylococci were considerably lower than those reported for several fish species processed by various cold-smoking regimes (1), suggesting that cold-smoked fish generally have higher levels of staphylococci than hot-smoked fish. From 49 presumptive isolates, 28 were confirmed as staphylococci (Table 2). There was also one *Micrococcus* sp. isolated, and four isolates of catalase-positive, Gram-positive glucose-fermenting cocci that were not identifiable with use of the API Staph database. All other presumptive isolates differed from staphylococci in at least cell morphology, Gram reaction, catalase reaction, or ability to ferment glucose. The relatively high confirmation rate obtained (57.1%) is evidence that the BP + MPRT agar medium had good selectivity. Among confirmed staphylococci, the common skin-borne organism *S. epidermidis* was the most prevalent (14 of 28 isolates, 50%), with *S. warneri* (6 of 28 isolates, 21.4%), *S. aureus* (3 of 28 isolates, 10.7%),

**TABLE 5. Survival of *S. epidermidis* on hot-smoked fish in commercial packaging stored at 4°C or 10°C**

4°C		log CFU/fish			
Replicate	Time (d)				
	0	6	12	18	
A	5.0	2.4	1.9	<1.4*	
B	5.0	3.0	2.2	<1.4*	

10°C		log CFU/fish			
Replicate	Time (d)				
	0	6	12	18	
A	4.9	3.0	1.9	1.7	
B	4.8	2.2	<1.4*	2.0	

\* less than detection limit of 1.4 log CFU/fish

*S. hominis* (3 of 28 isolates, 10.7%), *S. xylosus* (1 of 28 isolates, 3.6%) and *S. lentus* (1 of 28 isolates, 3.6%) also isolated. *S. hominis* has been described as a major species inhabiting the human skin. *Staphylococcus warneri* and *S. xylosus* have been described as minor or occasional inhabitants of the human skin. *Staphylococcus lentus* has been isolated from goat and sheep udders (3, 6). Collectively, the isolates represented staphylococci commonly associated with human skin.

By use of a standard laboratory assay, the thermotolerance of 11 *S. epidermidis* and 3 *S. aureus* isolates was evaluated. These species were chosen for testing because of their importance as a predominant skin inhabitant and a food-borne pathogen, respectively. From the 14 *S. epidermidis* isolates, the 11 selected for testing had biochemical characteristics most closely matching *S. epidermidis* in the API Staph database. Each isolate tested decreased in numbers by  $\geq 3.5$  log CFU/ml in the assay, with an aver-

age decrease of 4.1 log CFU/ml (Table 3), suggesting that isolates would not have survived the hot-smoking process and thus had contaminated the fish after smoking. Collectively, these results suggested that the thermotolerance of staphylococci is generally low enough that their presence on hot-smoked fish indicates that either post-heating contamination or inadequate heat processing had occurred.

#### **Direct testing of staphylococcal thermotolerance on fish during a commercial hot-smoking process**

To verify that staphylococci would not survive a commercial hot-smoking process, rainbow trout were inoculated with the five most heat-tolerant *S. epidermidis* isolates and hot-smoked. The rainbow trout were inoculated prior to smoking, either via the brine or by directly swabbing organisms onto the fish surface. Surviving staphylococci were enumerated after the hot-smoked fish had cooled (Table 4).

When inoculation was done via the brine solution (5.9 and 5.2 log CFU/ml in two trials), the brined fish contained an estimated 5.6 and 4.7 log CFU/fish (2 trials). Washing the brined fish reduced contamination levels to 4.5 and 4.1 log CFU/fish, respectively. Following the hot-smoking process, no surviving staphylococci were detected. Direct swabbing inoculation of the fish resulted in the presence of 7.7 and 7.6 log CFU/fish in the two trials. Again, the commercial hot-smoking process completely eliminated the inoculum species. These results strongly suggested that staphylococci transferred from hands to fish surfaces prior to a commercial hot-smoking process would be completely eliminated and that the presence of staphylococci on hot-smoked fish would indicate that inappropriate direct or indirect hand-to-food contact had occurred.

#### **Evaluation of potential for staphylococcal growth on hot-smoked fish stored in commercial packaging at marginal (4°C) and abusive (10°C) conditions**

The final inoculation study evaluated staphylococcal growth on inoculated fish stored for 18 days at either 4°C or 10°C. From initial levels of 4.8 to 5.0 log CFU/fish, numbers of staphylococci fell at least 2.8 log CFU/fish during 18 d at both temperatures (Table 5). These results clearly show that the staphylococci tested are incapable of growth on rainbow trout brined and hot-smoked according to procedures used in this study. It is possible, however, that procedures resulting in a lower water-phase % salt would allow growth of staphylococci at abusive temperatures. The death of staphylococci observed in these experiments suggests that testing of hot-smoked fish for staphylococci should be done soon after the fish are packaged to maximize the likelihood of detecting these organisms. Testing late in the product's shelf-life may result in a

false indication that hand-to-food contact had not occurred when, in fact, contaminant staphylococci on the hot-smoked fish had already died.

In summary, our results strongly support the use of staphylococci as an indicator of inappropriate post-heating hand contact (either direct or indirect) with hot-smoked fish. The BP + MPRT agar medium can easily be used to detect staphylococci with a suitably high confirmation rate for presumptive isolates. Adopting a testing program for staphylococci using this medium would enable processors to verify that appropriate measures are being taken to prevent contamination

of smoked fish with hand-borne pathogenic bacteria.

#### ACKNOWLEDGMENTS

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## The Food Safety Training and Education Alliance (FSTEА): <http://www.fstea.org>

FSTEА is an alliance of government, industry, and academicians working to improve food safety training at the retail level.

The Web site offers training materials and links to national and local rules and regulations, directories, and information on food safety funding.

# Chemistry of Chlorine Sanitizers in Food Processing

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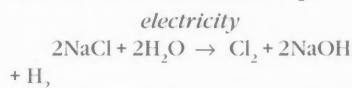
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## SUMMARY

Chlorine compounds are the most common antimicrobial substances used to sanitize food processing environments and food processing water in the United States. Chlorine compounds, like other chemical sanitizers, are used for their ability to kill pathogenic or spoilage microorganisms such as bacteria, viruses, and fungi. Chlorine sanitizer efficacy is affected by chlorine compound concentrations, pH, temperature, microbial exposure time and the presence of organic material. Aqueous chlorine solutions are not stable; therefore, these solutions must be carefully prepared, diluted and monitored. Frequent measurement and monitoring of chlorine sanitizer concentrations will further enhance their antimicrobial effectiveness. In many situations, other chemical sanitizers such as iodine, quaternary ammonium or organic acid compounds may be more appropriate or effective to use. However, a thorough understanding of the chemistry of chlorine compounds can maximize their sanitizing ability and minimize the quantities needed to achieve effective concentrations.

## CHLORINE CHEMISTRY

Chlorine (Cl) is a nonmetallic halogen element of atomic number 17 and atomic weight 35.45. Chlorine is widely distributed in nature, although not as a free element. The primary method of chlorine production uses electrolysis of an aqueous solution of sodium chloride. In this process, an electrical current passes through the salt water. Since opposite charges attract, the negative chloride ions collect at the positive pole and form molecular chlorine gas (7). In other words, the electrical current breaks down salt (NaCl) and water (H<sub>2</sub>O) into hydrogen (H<sub>2</sub>), sodium hydroxide (NaOH), and chlorine gas (Cl<sub>2</sub>):



Chlorine gas is dried, chilled and pressurized, or converted to liquid for storage and shipping. The price of chlorine gas is dependent on the price of electricity. Liquid chlorine is clear and amber colored, and chlorine gas (Cl<sub>2</sub>) is a greenish-yellow color. Both chlorine liquid and gas are non-flammable and produce irritating fumes.

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**TABLE 1. Common chlorine sanitizer compounds**

Chemical	Synonyms	Molecular Formula	Molecular Mass
sodium hypochlorite ~5% active chlorine	hypochlorous acid, sodium oxychloride, bleach	NaOCl	74.4
sodium hypochlorite 10 - 15% active chlorine	hypochlorous acid, Sodium oxychloride	NaOCl	74.4
calcium hypochlorite	hypochlorous acid, calcium hypochloride	CaCl <sub>2</sub> O <sub>2</sub>	143.0
sodium dichloroisocyanurate	Dichloro-s-triazine-2,4,6-trione; sodium salt	C <sub>3</sub> HCl <sub>2</sub> N <sub>3</sub> NaO <sub>3</sub>	220.9
chlorine dioxide	chlorine oxide, chlorine peroxide	ClO <sub>2</sub>	67.5
sodium chlorite	none	NaO <sub>2</sub> Cl	90.4

The chemical reaction resulting from the addition of chlorine gas to water (H<sub>2</sub>O) can be written as follows:



In this reaction, chlorine is hydrolyzed to produce hypochlorous acid (HOCl), hydrogen ions (H<sup>+</sup>), and chlorine (Cl<sup>-</sup>) ions. The antimicrobial properties of chlorine compounds are primarily due to the hypochlorous acid formed when chlorine is hydrolyzed (4).

Sodium hypochlorite solutions are commonly used for sanitizing in food processing industries, foodservice operations, and home kitchens. Household bleach is a 5.25% solution of sodium hypochlorite in water. The chemical reaction resulting from the addition of sodium hypochlorite (NaOCl) to water can be written as follows:



In this reaction, sodium hypochlorite (NaOCl) is hydrolyzed to produce hypochlorous acid and sodium hydroxide (NaOH). Hypochlorous acid is the most effective antimicrobial of all the chlorine residual fractions (9). Hypochlorous acid, in water, may further dis-

sociate to produce a hydrogen ion and a hypochlorite ion (OCl<sup>-</sup>), as follows (6):



The dissociation of hypochlorous acid is dependent on pH. Hypochlorous acid is more prevalent at more acidic pH values, while the less effective hypochlorite ion is more prevalent at more basic pH values.

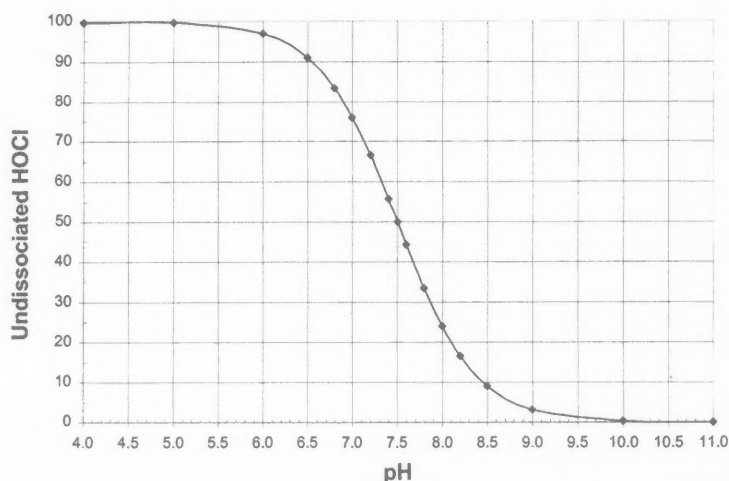
### CHLORINE SANITIZERS

Chlorine gas or liquid solutions are used to create a variety of compounds such as bleaches, plastics, and sanitizers (7, 8). Chlorine-based chemicals are among several different types of sanitizers used in the food processing industry. Examples of food industry uses are pasteurizer cooling water (1 ppm free chlorine, contact time 20 min, pH 6.0 - 7.5); fruit or vegetable washing (25-250 ppm free chlorine, contact time 2-3 min, pH 5.0 - 5.8); and hard surface disinfection (500 ppm free chlorine, contact time 5 min). Detailed discussions of chlorine sanitizers and other disinfectants are provided in books edited by Block (2) and by White (9). Some of the chlorine compounds used as

sanitizers include liquid chlorine, hypochlorites, acidified sodium chlorite, inorganic chloramines, organic chloramines, sodium dichloroisocyanurate, and chlorine dioxide (6). Table 1 lists the molecular formula of common chlorine compounds used for sanitation in the food industries.

Chlorine sanitizers are effective against microorganisms such as Gram-positive and Gram-negative bacteria, some spore-forming bacteria, and certain viruses (6). All chlorine products form hypochlorous acid in solution. This is the most germicidal form of aqueous chlorine solutions. As a sanitizing agent, hypochlorous acid is 80 times as effective than an equivalent concentration of hypochlorite ion. Although chlorine is known to be an antimicrobial agent, it is not fully understood how chlorine kills microorganisms. It is believed that hypochlorous acid kills cells by inhibiting glucose oxidation by sulfhydryl certain enzymes that metabolize carbohydrates and that contain sulfhydryl groups sensitive to chlorine. Also, since hypochlorous acid has a structure similar to that of water, it can penetrate cell walls rather easily (9). Other proposed theories include changes affecting the cell

Figure 1. The effect of pH on percent undissociated hypochlorous acid (HOCl)



membrane, disruption of protein synthesis, inhibition of oxygen uptake, and damage to cellular DNA (6).

Liquid chlorine, which is a solution of sodium hypochlorite (NaOCl) in water, can be applied to processing and cooling waters to prevent bacterial growth and slime formation. Hypochlorite sanitizers, such as sodium or calcium hypochlorite, are more expensive than elemental chlorine, but are more readily applied to equipment surfaces. Inorganic chloramines are formed from the reaction of chlorine with compounds that contain nitrogen or ammonia ( $\text{NH}_3$ ), while organic chloramines are formed by reacting hypochlorous acid (HOCl) with amines, amides, imines, and imides (6). These compounds release chlorine slowly, and produce a slower kill rate. The reduced activity of chloramines allows them to penetrate organic matter, which may be advantageous when they are used against biofilms. The antimicrobial effectiveness of inorganic chloramines can be enhanced through an adjustment of the pH of its solution. Finally, the effects of chlorine dioxide compounds are still not known, but interest in this type of sanitizer has increased. Chlorine dioxide usually has to be generated on site, but newer chemi-

cal formulations of this compound, as sodium chlorite, allow for shipment of the sanitizer (7). Sodium chlorite must be acid-activated to obtain the active antimicrobial, chlorine dioxide. Chlorine dioxide does not react with nitrogenous compounds, has 2.5 times the oxidizing power of chlorine, and is more effective at an alkaline pH of 8.5 (6).

### FACTORS AFFECTING CHLORINE EFFICACY

Certain physical or chemical factors can either optimize or reduce the sanitizing power of chlorine compounds. Factors that can affect the efficacy of chlorine include pH, temperature, chemical compound concentration, exposure or contact time, and presence of inorganic and organic material. All of these factors make the interactions of chlorine in water complex, leading to confusion and disagreement about how to best use chlorine (5).

### pH

The pH of a diluted solution of chlorine-based sanitizer has a major effect on its antimicrobial activity. The pH of an aqueous solution is a value used to represent its acidity or alkalinity, and is defined as

the logarithm of the reciprocal of the hydrogen ion concentration of the solution. For pure water, the concentration of these ions is approximately  $10^{-7}$  moles per liter, which can also be expressed as  $\text{pH} = 7.0$ . A change of one point on the pH scale represents a tenfold change in concentration. Thus, an acidic solution with pH 4.0 is ten times as acidic as a solution with pH 5.0. Hypochlorite sanitizers are most effective at pH values near 4. However, at this pH the product would be unstable. Many chlorine sanitizer products are formulated at a high basic pH (10 - 11) to extend their storage life. Another chlorine-based sanitizer, acidified (citric acid activated) sodium chlorite, forms chlorine dioxide that is less affected by pH than other forms of chlorine-based sanitizers.

The hypochlorous acid formed when hypochlorite sanitizers are dissolved in water can dissociate into hypochlorite ions and hydrogen ions. The proportion of acid that dissociates is greatly dependent on the overall pH, or acidity, of the solution. In Figure 1, the proportion of HOCl that remains undissociated is plotted as a function of pH. Most of the germicidal hypochlorous acid will remain undissociated if the pH is less than 7. The proportion of undissociated hypochlorous acid is greatest at  $\text{pH} < 5$ . If the pH falls below 4, the production of potentially hazardous chlorine gas increases. As the pH rises from 4.0, the ratio of hypochlorous acid to hypochlorite ion decreases. At pH 8, the proportion of hypochlorous acid that remains undissociated will be less than 25%. Since hypochlorite ions are less germicidal than hypochlorous acid, a sanitizer solution with a pH range of 6.5 to 7.0 may have optimum antimicrobial efficacy under near-neutral pH conditions. Unfortunately, U.S. Environmental Protection Agency (EPA) regulations and chlorine sanitizer label use directions may prohibit users from adjusting the acidity of their chlorine solutions to a specific pH value.

To calculate the percentage of undissociated hypochlorous acid at a specific pH, the following equa-

tion can be used:  $a = 1 / (10^{\text{pH} - \text{pKa}} + 1) \times 100$ , where the variable "a" is the percentage of undissociated hypochlorous acid. The  $\text{pK}_a$  value is the pH at which 50% of the molecules have lost a hydrogen ion. The  $\text{pK}_a$  for hypochlorous acid is 7.5. The following example illustrates the calculation of percent-undissociated hypochlorous acid at a pH of 8.

$$\begin{aligned} a &= 1 / (10^{\text{pH} - \text{pKa}} + 1) \times 100 \\ a &= 1 / (10^{8 - 7.5} + 1) \times 100 \\ a &= 1 / (10^{0.5} + 1) \times 100 \\ a &= 1 / (3.16 + 1) \times 100 = 24 \\ &\text{(hypochlorous acid)} \end{aligned}$$

### Temperature

Temperature is another factor that can affect chlorine efficacy. Generally, chlorine demonstrates increased antimicrobial activity with increasing temperatures. For chlorine and other chemicals, reaction rates double for every 10°C increase in temperature up to 52°C, beyond which point chlorine efficacy and solubility decrease (6). However, the concentration of hypochlorous acid in solution does not necessarily increase with temperature. The proportion of chlorine as hypochlorous acid is slightly lower at 20°C than at 0°C, especially when the pH falls between 6 and 9. Even though the hypochlorous acid concentration is lower at the warmer temperature (20°C), the overall antimicrobial efficacy can be greater because of the interaction of elevated temperature with other factors, such as increasing pH, decreasing viscosity, and lowering of surface tension (5). It is important to note that as temperature increases and pH decreases, the potential for corrosion of equipment can also increase.

### Concentration

Increasing chlorine concentrations, much like increasing antimicrobial concentrations, can increase the kill rate of microorganisms. However, there are limits to available chlorine concentrations that can be used in food process-

ing. Therefore, it is important that the sanitizer manufacturer's directions (and EPA regulations) are followed. Highly concentrated solutions of chlorine can be an explosion hazard and be excessively corrosive to stainless steel and other metals. Also, high concentrations can negatively impact the odor, flavor and color of products. Another concern with using higher levels of chlorine is the adverse effects on the health of workers who are exposed to these aqueous solutions or chlorine vapors. Exposure to high levels of chlorine gas (> 1 part per million (ppm) within any 15-minute period) is extremely irritating to the eyes, skin and respiratory tract of humans. Also, the U.S. Occupational Safety and Health Administration (OSHA) has stated that the permissible constant daily exposure of chlorine gas is 0.5 ppm for an eight-hour period (7).

Under some conditions, it may be necessary to use a high chlorine concentration (e.g., 10× combined chlorine level) to shock the chemical balance of a treated water system. The term "breakpoint chlorination" has been used to describe the addition to water of chlorine sufficient to generate an excess of free available chlorine that can oxidize other chlorine compounds and quickly kill most microorganisms (3). When chlorine is added to water, some of it is immediately consumed by reactions with organic or inorganic impurities. This consumption is called satisfying the chlorine demand of the water. The point at which added chlorine exceeds the chlorine demand of the water is called the breakpoint (5).

### Contact time

The bactericidal activity of chlorine increases with longer exposure times (6). When the pH of the solution is near or below 7, a contact time between 1.5 and 100 seconds may be sufficient. Again, care must be taken because chlorine can be corrosive to metal if left on for too long.

### Organic material

Chlorine reacts with many organic compounds, sometimes violently, being inactivated in the process. Examples of organic material include soil, fats, proteins, blood, and plant tissue. Therefore, the degree of environmental and equipment cleanliness can affect the sanitizing ability of chlorine compounds. Equipment surfaces must be cleaned prior to chlorine application to eliminate any residual organic material that can react with or bind with chlorine, and so reduce the sanitizer's effectiveness.

## PREPARATION AND USE OF EFFECTIVE CHLORINE SOLUTIONS

### Dilution

Chlorine sanitizers can be purchased in a liquid, solid or gaseous form. Hypochlorite liquid solutions, commonly used both in food industries and the home, can often be diluted with water to produce a sanitizer that is less corrosive, and less hazardous, but still effective as an antimicrobial. The following example provides a method of determining the dilution necessary to achieve a specific hypochlorite concentration. In this calculation, 100 liters of a 50-parts-per-million (ppm) chlorine solution is prepared from 12.5% sodium hypochlorite (NaOCl).

Initial chlorine solution concentration: 0.125 × 1,000,000 = 125,000 ppm NaOCl

Final chlorine solution concentration desired: 50 ppm

Initial chlorine solution volume: Z

Final chlorine solution volume desired: 100 l

Initial Volume × Initial Concentration = Final Volume × Final Concentration

$$Z \times 125,000 \text{ ppm} = 100 \text{ l} \times 50 \text{ ppm} = 100,000 \text{ ml} \times 50 = 5,000,000 \text{ ml}$$

$$Z \div 5,000,000 \div 125,000 = 40 \text{ ml}$$

In other words, to prepare 100 liters of a 50 ppm solution of sodium hypochlorite, dilute 40 ml of a 12.5% sodium hypochlorite solution with water.

## MEASUREMENT AND MONITORING

Food production and preparation surfaces must be cleaned prior to chlorine application. If chlorine comes into contact with organic material, the chlorine will begin oxidizing the organic material and be consumed by this reaction, rendering it inactive or less effective as an antimicrobial. If chlorine has bound to organic material, the amount of chlorine available to react with bacteria decreases, thus decreasing its sanitizing ability. Therefore it may be important to measure free available chlorine and, in some cases, total residual chlorine concentrations. Total residual chlorine (TRC) is defined as the amount of chlorine in the water, including that which has bound to organic material. However, TRC may be important only for water treatment, not hard surface sanitizing. Free available chlorine (FAC), the amount of excess chlorine that has not reacted with bacteria and other organic material (7), may be much lower than the total chlorine concentration. Aqueous FAC concentrations less than 3 ppm can have adequate antimicrobial activity. For example, in a carcass chill tank in a poultry processing plant, the target level for TRC in the chiller overflow should be 20 to 25 ppm and the target FAC should be 0.5 to 1 ppm (7).

Chlorine in aqueous solution is not stable, and the chlorine content of samples or solutions may decrease rapidly. Exposure to strong light and agitation, as well as elevated temperatures, will accelerate the reduction of chlorine. Therefore chlorine determinations should be started immediately after sampling. Several analytical methods are available to measure free/available, combined, or total chlorine in treated water or wastewater (1). An appropriate method should be carefully selected since some methods may not be applicable to water containing organic matter. Also, the available methods vary in their complexity and sensitivity.

Free and total chlorine levels can be tested with commercially available test strips or monitors, including on-line chlorine and redox probes. Test strips can be immersed into the water or into a sample. After a short time, a color reaction that corresponds to the free chlorine level concentration will occur on the strip. Test strips can be purchased that measure free available chlorine levels in a range within 0 to 750 ppm.

Chlorine sanitizer solutions may be applied manually or mechanically. Although a mechanical operation for chlorine addition can monitor itself during processing, pH and free chlorine levels must be monitored manually to ensure that the equipment is functioning properly.

## COMMENTS

Food processors with knowledge of the chemistry and mecha-

nisms of chlorine-based sanitizer compounds can maximize the sanitizing ability of these chemicals, while minimizing the quantities needed to achieve effective concentrations. Reducing chlorine usage may lower sanitation costs, reduce tainting and corrosion problems, reduce worker exposure to chlorine, ensure compliance with occupational safety regulations, and reduce the quantity of chlorine and chlorinated compounds discharged into the environment.

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# Refining Consumer Safe Handling Educational Materials Through Focus Groups

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## SUMMARY

Four focus group sessions were conducted in Northern California to gather information on consumer insight and attitudes towards two possible consumer education materials – supermarket brochure and refrigerator magnet – both focusing on safe handling and washing of fresh produce. A total of 43 people participated; all were main purchasers and preparers of fresh produce in their households. The objective of the study was to use consumer group discussions to fine-tune both of the education materials in terms of their readability, understandability, practicality, and distribution.

Consumers reacted positively to the illustrations in both the brochure and magnet. They liked the magnet's concise and easy-to-read content, but thought the brochure was too detailed. Few consumers said they would follow all recommendations. Nevertheless, participants felt that detail was needed and suggested topics not originally included in the brochure.

Findings suggest that consumer education materials should contain an abundance of illustrations, highlight key words, and be brief and easy-to-read. Education materials should also include information on the prevalence and consequences of foodborne illnesses, provide an explanation behind each guideline, and be made available in multiple languages. Education materials and safe handling recommendations should be distributed and taught to children and young adolescents, especially in the classroom.

A peer-reviewed article.

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## INTRODUCTION

Between 1988 and 1992, 6% of foodborne disease outbreaks in which a specific food was identified, and 5% of cases of foodborne illness, were associated with the consumption of fresh produce (43). Although fresh fruits and vegetables are not common vehicles for foodborne diseases compared to other types of foods, the number of reported foodborne outbreaks and cases of illness associated with the consumption of fresh produce in the United States had increased from 2% (1973 to 1987) to 5% and 8% (1988 to 1991), respectively (39). The mean number of reported fresh produce-associated foodborne outbreaks had increased from 4.3 per year between 1973 and 1987, to 9.75 per year between 1988 and 1991 (39).

In recent years, a variety of foodborne pathogenic microorganisms have been linked to cases of foodborne infection and isolated from many different varieties of fresh produce (5, 13, 39). Laboratory studies including those from Del Rosario and Beuchat (12), Ruffi et al. (35), Ruffi and Lunsford (36), and Richert et al. (37) have shown that *Escherichia coli* O157:H7, *Salmonella montevideo*, and *Shigella flexneri* can survive and/or grow on fresh produce.

Many telephone and mail surveys have been conducted to assess consumer food safety knowledge and practices (3, 8, 14, 19, 20, 40, 41). However, such surveys do not provide in-depth information and insight into consumer attitudes. Focus group interviews in contrast to telephone and mail questionnaires, allow consumers to tap into their own perceptions about a particular topic in a comfortable social environment, where personal, unexpected, and various insights can be revealed (9, 21). Unlike traditional types of interviews, in which closed-ended questions are used in a laboratory environment, the format of focus group interviews consists of open-ended questions, allowing unlimited and unrestricted responses from participants. Thus, a focus

group study offers several advantages: (1) it provides a relaxed and non-threatening environment; (2) it allows for flexibility to explore unexpected issues and encourages all types of comments; (3) it provides results with high face validity because of its believable and first-hand responses; (4) it may be relatively inexpensive compared to other types of research studies; (5) it can provide relatively fast results; and (6) it allows for increased sample sizes in qualitative studies without lengthening the time or cost (21).

Focus groups can be useful in gathering critical information about food safety from the general public. One study found that although people were aware of the safe handling guidelines labeled on the packages of raw meat and poultry, many did not pay attention to the label (15). Thus, focus groups can offer consumer insight and unexpected information that could help improve the acceptance and success of consumer educational materials such as supermarket brochures and refrigerator magnets.

Prior to this focus group study, consumer handling of fresh fruits and vegetables was assessed through a mail survey of two thousand randomly selected households in the United States in spring 2000 (23). The objective of the survey was to quantify consumer practices related to the purchase, transport, storage and preparation of fresh produce, with emphasis on practices that affect safe handling. Results indicated several practices that could increase risk for foodborne disease. Less than one-third of respondents separated fresh fruits and vegetables from meat, poultry, and fish when transporting purchases home. Over 35% of respondents indicated not washing melons before preparation and over 20% reported placing meat, poultry, and fish on a refrigerator shelf above other foods. Almost half indicated not always washing their hands before handling fresh produce. While almost all respondents reported that they always wash their

food preparation surfaces after contact with meat products, 24% washed with water only. Many expressed an interest in receiving information on safe handling and washing of fresh produce, with 54% preferring a supermarket brochure and 28% preferring a refrigerator magnet. As a result of this survey, a brochure and magnet emphasizing handling practices that affect safety were developed.

This paper reports the results of a focus group study designed to discover consumers' reactions and opinions about the content, format, and practicality of the safe produce handling guidelines. Consumers were asked to comment on readability and ease of understanding and to suggest how the guidelines could be enhanced and distributed.

## MATERIALS AND METHODS

Four focus groups were held in University of California Cooperative Extension offices in Northern California (Monterey County/Salinas, Sacramento, and two in Napa). The focus group study targeted consumers who were the principal buyers and preparers of fresh fruits and vegetables. A total of 43 consumers participated, with an average group size of eleven. Thirty-seven participants were female, and the majority were approximately 30 to 40 years old; however, the authors estimated that the participants' ages ranged from 20 to 70. Income and educational information were not obtained. Ethnic representation included non-Hispanic Caucasians (91%), Hispanics (7%), African Americans (2%), and Asian Americans (2%). All participants were recruited through the University of California Extension offices and each focus group session lasted approximately 70 to 90 minutes.

During the focus group sessions, detailed safe handling guidelines for fresh fruits and vegetables were presented in the form of a draft of a supermarket brochure, while a more condensed, generalized set of guidelines was presented

**TABLE 1. Key questions about the preliminary draft of supermarket brochure and refrigerator magnet presented in the focus groups**

1. Are the brochure's guidelines easy to understand?
2. Are the brochure's guidelines easy to follow and to do?
3. Do you think people would understand the pictures and what they mean?
4. Are the brochure's pictures clear enough? Big enough?
5. Is the brochure too long?
6. Are the guidelines practical? Is it something that consumers would do? If not, why? If not, what would make the guidelines more practical?
7. Are the magnet's guidelines easy to understand?
8. Are the magnet's guidelines easy to follow and to do?
9. Do you think people would understand the pictures on the magnet and what they mean?
10. Are the magnet's pictures clear enough? Big enough?
11. Is there enough information on the magnet so that it can stand alone?
12. Of the brochure or magnet, which would you be more inclined to use and follow? Why?
13. Can the magnet be used alone to get the message across to consumers or should it be distributed with the brochure?
14. Would consumers look at the guidelines on the brochure or magnet if offered to them? If not, how would we get consumers to look at the guidelines?
15. What other sources could we use to get the message across?
16. How would you get consumers to change their habits?
17. Do you have any comments on how we can share information on safe handling of fresh produce to consumers?

on a magnet. Both the brochure and magnet were printed with black ink on white, 8 1/2" x 11" letter paper. The brochure was printed on both sides and folded in thirds so that it could fit into a typical grocery store brochure slot/holder. Participants were told that the magnet would be printed in color before public distribution.

In the first half of the focus group sessions, each participant was asked to read a copy of the brochure. When all were finished, participants were asked to share their thoughts about the safe-handling

guidelines, the format of the brochure, the content of the material, and the illustrations (Table 1). Next, an illustration of the magnet printed on a sheet of paper was presented to each participant and participants were asked to share their insights on the magnet's content and presentation (Table 1). In particular, they were asked how they and other consumers might respond to the brochure and magnet. Finally, participants were asked to suggest the best means of distributing these materials. The participants answered these questions in a discussion for-

mat. Each participant was not required to respond to each question, although all contributed to the discussion.

## RESULTS

### Supermarket brochure

All participants commented favorably on the illustrations that accompanied the guidelines (Fig. 1a, 1b, 2a, and 2b). Participants stated that the graphics were clear, easy to understand, and appropriately sized. Many acknowledged that they would pay more attention to the illustrations than to the printed text. People mentioned that the pictures were useful for those who do not read and speak English fluently. Although participants liked the graphics, a few thought that the illustration of the grocery cart (Fig. 3), where raw meat products were placed on the bottom platform of the grocery cart and fresh produce in the basket, was unrealistic. Although the illustration was drawn to emphasize the need to separate fresh produce from meat products during shopping, a few commented that it was "strange to place meat products outside the basket." One person argued that the bottom section of the cart was used for items such as potatoes and detergent, not meat products.

Participants agreed that the guidelines in the brochure were easy to follow and appeared easy to perform, but some complained that they were too long and wordy. A few stated that they would not read or follow all of the brochure's guidelines because of their length. Many thought that the brochure was not practical and that other consumers would find the guidelines too demanding. However, other consumers stated that all the details should be provided so consumers would know about the safest food-handling practices.

When asked how they or other consumers could be encouraged to follow each of the guidelines, some participants wanted a much simpler and condensed version; they

**Figure 1a.** Preliminary draft of supermarket brochure before focus group sessions, showing the cover page and the last two sections of the brochure (page 1 of 2)

5. Dry fruits and vegetables with disposable paper towels.



6. Do not use antibacterial soaps or dish detergent to wash fresh fruits and vegetables because soap or detergent residues can remain on the produce. The FDA has not evaluated the residues which could be left from soaps and detergents.\*

7. If you choose to soak your fresh fruits and vegetables, be sure to rinse the produce well under running water afterwards and dry with disposable paper towels.

8. Remove and cut greens or the hull from fresh fruits and vegetables after washing, not before.

\* Commercial cleaning solutions designed for fresh fruits and vegetables may help remove dirt and bacteria.

### Refrigerate All Leftovers

Peel leftover melons and store the fruit in the refrigerator.



### Additional Sources of Information on Food Safety:

USDA/FDA Foodborne Illness Education Information Center  
Links to food safety and HACCP training materials  
[www.nal.gov/fruits/foodborn/foodborn.htm](http://www.nal.gov/fruits/foodborn/foodborn.htm)

U.S. FDA/Center for Food Safety and Applied Nutrition  
[www.vfn.cfsan.fda.gov/list.html](http://www.vfn.cfsan.fda.gov/list.html)

Gateway to Government Food Safety Information  
[www.foodsafety.gov/](http://www.foodsafety.gov/)

National Center for Infectious Diseases  
[www.cdc.gov/ncidod/index.htm](http://www.cdc.gov/ncidod/index.htm)



## Safe-Handling of Fruits & Vegetables



Eating fruits and vegetables is healthy, but care must be taken to be sure fruits and vegetables do not become contaminated with harmful bacteria. Bacteria are everywhere, even on hands or in kitchens that look clean.

This brochure provides guidelines for protecting fruits and vegetables from harmful bacteria.

thought that general, summarized guidelines were more practical than detailed instructions. Some thought that it was not possible to encourage consumers to practice all of the guidelines presented in the brochure unless they had experienced foodborne illness that could be traced to produce.

Several participants did share ideas about how to improve the brochure without losing its specificity. Participants suggested printing crucial key words in boldface type, such as "*always wash hands*" and "*always wash knives*," so that those terms would stand out from the rest of the text. Subsequent focus groups were presented with two versions of the brochure, one with some phrases printed in boldface type and one without. Participants were asked if the boldface words made the guidelines more effective. Many agreed that the guidelines were improved by using boldface print for key phrases. Furthermore, some suggested italicizing

boldfaced terms for greater emphasis. Participants from the fourth and last focus group agreed that the terms presented in boldface and italic type greatly improved the brochure's readability. Some also recommended boldfacing and italicizing words such as '*one*' and '*or*' so that consumers would not misinterpret the directions and assume that it is necessary to follow all the cleaning options.

Some participants recommended eliminating unnecessary words so that the guidelines would be briefer. For example, many thought that the guideline "It is best to wash fruits and vegetables just before cooking or eating" could be shortened simply to "Wash fruits and vegetables just before cooking or eating."

Many participants offered advice regarding the statement on the brochure's front cover: "Eating fruits and vegetables is healthy, but care must be taken to be sure fruits and vegetables do not become con-

taminated with harmful bacteria. Bacteria are everywhere, even on hands or in kitchens that look clean. This brochure provides guidelines for protecting fruits vegetables from harmful bacteria." Because they believed that the cover statement was not sufficiently effective to convince consumers to follow the guidelines, they recommended adding information about the severity of foodborne illness, as well as a description of various foodborne illnesses and of those at highest risk. Also, some wanted statistics showing how foodborne illness is associated with the consumption of fresh produce, and a few suggested adding names of foodborne pathogens to the brochure.

Participants from the first focus group recommended that instead of stating "This brochure provides guidelines for protecting fruits and vegetables from harmful bacteria," the brochure should emphasize that the consumers not the produce, are the ones at risk. In response, an al-



**Figure 1b.** Preliminary draft of supermarket brochure before focus group sessions, showing the second, third, and fourth sections of the brochure (page 2 of 2)

## Shopping

1. In the grocery cart, separate fruits and vegetables from meat, poultry, and fish to avoid cross-contamination.



2. When bagging fresh fruits and vegetables to take home from the supermarket, put fresh produce and meat, poultry, and fish in separate bags.



## Home Storage

In general, store fresh fruits and vegetables in the refrigerator produce drawer or on a refrigerator shelf.

When storing meat, poultry, or fish in the refrigerator, be sure to store them in the clean meat/poultry drawer or on the bottom shelf below other refrigerated foods so that they will not drip on other foods.

## Prepare the Kitchen

1. Clean the sink with hot soapy water or cleanser before and after washing and preparing fresh fruits and vegetables.



2. If possible, use a different cutting board and preparation area for meat/poultry/fish and fresh fruits and vegetables. Always wash cutting boards and preparation areas before and after food preparation. Wash

especially well between the preparation of meat/poultry/fish and the preparation of foods that will be eaten without cooking.



3. Sanitize cutting boards and food preparation areas after cutting meat, poultry, fish or any produce item with visible dirt or that grows on the ground. Choose one of the following cleaning methods:



a. Rinse clean cutting boards with a solution of 1 teaspoon chlorine bleach in a quart (4 cups) of water.

b. Pour boiling water over the clean board for 20 seconds.

c. Place board in dishwasher and run, using the normal cleaning cycle.

4. Always wash knives after cutting meat, poultry, or fish with hot soapy water before cutting fresh fruits and vegetables or use different knives for cutting meat products and fresh produce.



## Wash Your Hands

Always wash hands with hot soapy water for at least 20 seconds before and after handling fresh fruits and vegetables.



## Wash ALL Fruits and Vegetables

1. It is best to wash fruits and vegetables just before cooking or eating.



2. Wash fresh fruits and vegetables under running water.



3. When possible, scrub fruits and vegetables with a scrub-brush or with hands.

4. For melons, scrub with a brush around the rind under running water before cutting.

Sanitize the brush by putting it in the dishwasher, placing it in boiling water for 20 seconds, or rinsing in bleach solution.



ternative last statement stating "This brochure provides guidelines for protecting YOU from harmful bacteria" was produced on a sheet of white paper. This revision of the statement was then tested in subsequent focus groups, in which all participants agreed that the alternative statement was much more effective. When asked if the alternative message would discourage or scare consumers from purchasing or consuming fresh produce, the participants unanimously replied, that it would not.

Many wanted to know why melons were emphasized and why fruit needed to be washed before being peeled or cut. Some participants revealed that they never thought to wash melons, because the rind is not consumed. After being told about the potential spread of bacteria from rind to flesh

when unwashed melons are sliced, participants suggested that an explanation was needed to encourage consumers to wash melons.

Several participants were confused as to why a discussion had been included on separating raw meat and fresh produce during shopping and transportation. A few thought that raising the topic was unnecessary, because they assumed that consumers always separate fresh produce from raw meat, poultry, and seafood products. On the other hand, others were unaware of the need to separate fresh produce from raw meat, poultry, and seafood during bagging in order to prevent cross-contamination. In addition, some stated that they have no say in how groceries are packed because supermarket bagging clerks pack their groceries.

Several thought that the advice to store raw meat, poultry, and fish on the bottom shelf of the refrigerator or below other foods was unnecessary (Fig. 4). Others recognized the potential for meat juices to drip on other foods and suggested that advising consumers to "store meat below other foods" was sufficient. People also advised that raw meat, poultry, and seafood should be stored in a container, bowl, or tray to further prevent meat juices from dripping onto other foods.

A few participants asked how often cutting boards and food preparation areas needed to be sanitized after cutting meat products and produce. They thought the brochure did not clearly indicate the need for boards and preparation areas to be sanitized after each instance of cutting meat and produce. Participants suggested printing "Al-

Figure 2a. Final form of supermarket brochure after focus group sessions (page 1 of 2)

## More on Washing

7. If you choose to soak your fresh fruits and vegetables, be sure to rinse the produce well under running water afterwards and dry with disposable paper towels.

8. Remove and cut greens or the hull from fresh fruits and vegetables *after* washing, not before.

9. *Ready-to-eat, prewashed and bagged produce* can be used without further washing if kept refrigerated and used by the "use-by" date. If desired, produce can be washed again.

Precut or prewashed produce in *open* bags or containers should always be washed before using.

\* Commercial cleaning solutions designed for fresh fruits and vegetables may help remove dirt and bacteria.

## Refrigerate All Leftovers

1. Peel leftover melons and store the fruit in the refrigerator.



2. Store all cut produce in a clean container in the refrigerator.



### Additional Sources of Information on Food Safety:

USDA/FDA Foodborne Illness Education Information Center  
<http://www.nal.usda.gov/foodborne/index.htm>

U.S. FDA/Center for Food Safety and Applied Nutrition  
<http://vm.cfsan.fda.gov/list.html>

Gateway to Government Food Safety Information  
<http://www.foodsafety.gov/>

National Center for Infectious Diseases  
<http://www.cdc.gov/ncidod/dp/index.htm>



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ways sanitize cutting boards and food preparation areas..." as opposed to just "Sanitize cutting boards and food preparation area...".

Some participants wanted the brochure to specify whether both plastic and wooden cutting boards could be sanitized in a dishwasher, with boiling water, or with a chlorine solution. The brochure was modified accordingly for final presentation to the public. Furthermore, a few wanted to know whether there was a difference between plastic and wooden cutting boards in terms of health risks and food safety.

Some inquired whether commercial cleaning solutions designed for washing produce were more effective than water in removing bacteria, pesticides, and dirt from fresh produce. They wanted a stronger statement than the footnote provided. This statement was not changed, because commercial solutions vary in effectiveness.

One person mentioned that he once got dysentery from consuming produce that grew under the ground. He commented that cutting boards and food preparation areas should be sanitized after handling produce that was grown *under* the ground, such as potatoes and carrots, and not just those that are grown *on* the ground.

Some participants expressed concerns that were not originally addressed on the brochure. Many wanted to know whether bagged, prewashed fresh produce needed additional washing before consumption, and wanted the topic addressed in the brochure. Also, some asked if the guidelines addressed in the brochure pertained to home-grown and organically grown produce. Many incorrectly thought that home-grown and organically grown produce are safer to consume and thus requires less cleaning than commercially grown produce. The brochure was modified before public distribution to respond to these issues.

# Safe-Handling of Fruits & Vegetables

**Eating a variety of fruits and vegetables is healthy**, but care must be taken to be sure fruits and vegetables do not become contaminated with harmful bacteria. One out of four people suffer from foodborne illness each year. Some of these illnesses have been traced to eating raw fruits or vegetables.

**Everyone is at risk for foodborne illness**; however people who are younger than 5, older than 50, diabetic, take antibiotics or antacids, and those whose immunity is compromised are at highest risk.

**Bacteria are everywhere.** Harmful bacteria may be on fruits and vegetables, hands, kitchen counters and sinks, even when they *look* clean.

**This brochure provides guidelines for protecting YOU from harmful bacteria.**

Some were concerned about the increased amount and variety of produce imported into the United States; many thought that increased foodborne illness in the United States was due to imported fresh produce. Since foodborne illness can be traced to both domestic and imported produce, no change was made in the brochure to reflect this perception. Consumers were advised to wash all fruits and vegetables, no matter their origin.

### Refrigerator magnet

Like the brochure, the preliminary draft of the magnet contained illustrations that the participants appreciated (Fig. 5). Many liked the magnet because of its simplicity and concise format, and thus preferred the magnet over the brochure. The magnet appeared more attractive and practical to consumers because it was less detailed.

The majority stated that magnet needed to be accompanied by the brochure when distributed. Par-

Figure 2b. Final form of supermarket brochure after focus group sessions [page 2 of 2]

### At the Supermarket

1. In the grocery cart, **separate** fruits and vegetables from meat, poultry, and fish to avoid cross-contamination.



2. When haggling fresh fruits and vegetables to take home from the supermarket, put fresh produce and meat, poultry, and fish in **separate bags**.



### Home Storage

In general, store fresh fruits and vegetables in the refrigerator produce drawer or on a refrigerator shelf.

Store meat, poultry, or fish in the clean meat drawer or on a tray on the bottom shelf **below** other refrigerated foods. This prevents meat juices from dripping on other foods.

### Prepare the Kitchen



1. Clean the sink with hot soapy water or cleanser **before** and **after** washing and preparing fresh fruits and vegetables.

2. If possible, use a **different** cutting board and preparation area for meat/poultry/fish and fresh fruits and vegetables.

Always wash cutting boards and preparation areas **before** and **after** food preparation.



Wash especially well between the preparation of meat/poultry/fish and the preparation of foods that will be eaten without cooking.

3. Washing with detergent removes soil and food, but only some bacteria. **For additional safety, always sanitize cutting boards and food preparation areas** after cutting meat, poultry, fish or any produce item with visible dirt, or that grows on or in the ground. Choose **one** of the following methods:



a. Pour boiling water over the clean wood or plastic boards for **20 seconds**.

b. Rinse clean wood and plastic cutting boards with a solution of 1 teaspoon chlorine bleach in a quart (4 cups) of water.

c. Place plastic boards in dishwasher and run, using the normal cleaning cycle.



4. **Always wash knives** after cutting meat, poultry, or fish with hot soapy water before cutting fresh fruits and vegetables or use different knives for cutting meat products and fresh produce.



### Wash Your Hands

**Always wash hands** with hot soapy water for at least 20 seconds **before** and **after** handling fresh fruits and vegetables.



### Wash ALL Fruits and Vegetables

(including organically grown, Farmer's Market and homegrown produce)



1. Wash fruits and vegetables just before cooking or eating.

2. Wash under running water.



3. When possible, scrub fruits and vegetables with a clean scrub brush or with hands.



4. For **melons**, scrub the rind with a brush under running water before cutting or peeling. This removes bacteria before it is spread by the knife when slicing.

Sanitize the brush by putting it in the dishwasher, placing it in boiling water for 20 seconds, or rinsing it in bleach solution.

(As described in points 3a, b, and c)



5. Dry fruits and vegetables with **disposable** paper towels.

6. **Do not use antibacterial soaps or dish detergents** to wash fresh fruits and vegetables because soap or detergent residues can remain on the produce. The FDA has not evaluated the residues which could be left from soaps and detergents.\*



Participants commented that the magnet could be used as a quick reminder whereas the brochure would be used as a reference. As with the brochure, many thought that key words printed in boldface, such as 'refrigerate' and 'store', should also be italicized for emphasis, and that unnecessary words should be removed. For example, "Remember to refrigerate leftover foods immediately after eating" should be condensed to "Always refrigerate leftovers immediately." Participants also agreed that the magnet needed to be printed in color to enhance its attractiveness before it was distributed. A few also recommended removing the specific item on storing raw meat, poultry, and fish on the refrigerator's bottom shelf. Some participants recommended replacing the heading 'Keeping' with the more practical term 'Leftovers.' In addition, many thought that the positioning of numbers 2 and 5 and headings 'Cleaning' and 'Preparing' in sections 3 and 4 in the preliminary

draft were awkward because they read in a circular fashion.

### Sources of distribution

Besides distribution of information in the forms of a brochure and magnet at the supermarket, participants had other ideas about how to distribute the safe handling guidelines. Several people discouraged the idea of dropping the brochure and magnet into shopping bags, claiming that most consumers would throw them away immediately without reading them. Another participant stated that distributing the brochure through supermarket brochure slots was ineffective; a more effective way would be for someone to personally hand out the brochures to shoppers.

The most common response as to how the materials could be distributed was that it should be done through children. Participants from all focus groups were adamant about teaching children about food and produce safety. Many claimed

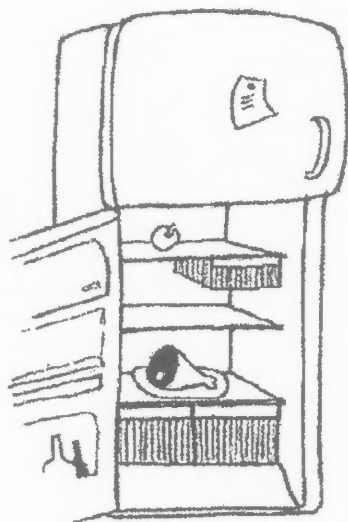
that children can have great influence on how parents and other adults in the household behave. They explained that adults are more willing to change their unsafe habits and practices if children bring home information they learn in class. Others thought that introducing safe-handling material to children or adolescents at an early age can shape the way they practice safe handling in the future. Some complained that introducing safe handling material to adults can often be ineffective because many adult consumers are unwilling to change behavior.

Although participants agreed that children, especially those in elementary school, were a good source of distribution, perception of the appropriate age that children should receive safe handling guidelines varied. Some recommended kindergartners and first graders, others recommended second and third graders, and others thought that fourth, fifth, and sixth graders should be the focus of safe food-

Figure 3. Illustration of grocery cart in supermarket brochure and on refrigerator magnet



Figure 4. Illustration of refrigerator in supermarket brochure



handling programs. One participant thought that simple good hygiene practices, such as hand-washing, could be taught to preschoolers. Others mentioned that distributing information through health and home economic classes in high schools would be appropriate. To better reach children, some participants mentioned the need for producing a children's version of the brochure in which simpler words, cartoon illustrations, and catchy phrases were incorporated.

Television was also identified as an effective distribution medium. One participant mentioned that a

university or public health specialist could appear on a local talk show and educate viewers on safe produce handling and offer the brochure to those sending a self-addressed stamped envelope. Others recommended distributing brochures and putting up posters about safe produce handling at farmers markets and in the produce section of grocery stores. A few recommended placing a laminated sign about the necessity of separating meat and fresh produce at the supermarket meat counter and checkout counter. A few also recommended displaying a laminated sign

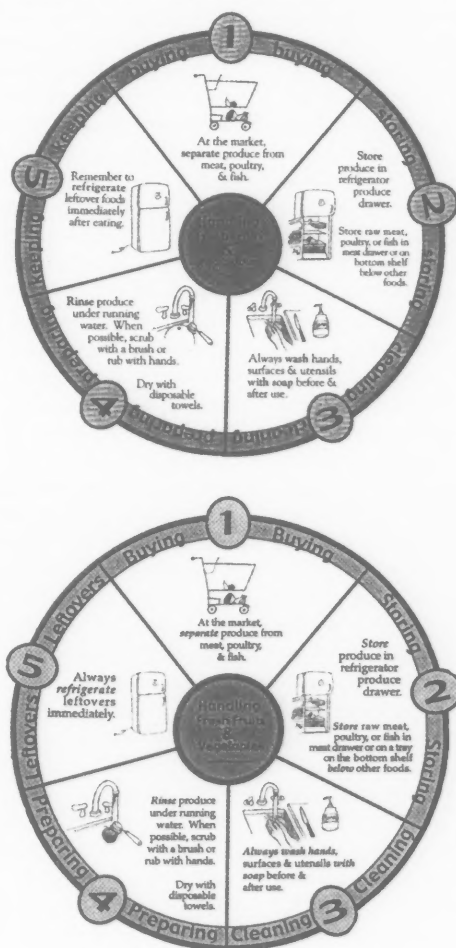
in the meat department about the importance of double bagging all raw meat packages. One person suggested that the guidelines could be printed on supermarket paper bags, an idea that many other participants endorsed.

Several suggested distributing the brochures through various recreational classes, clubs, organizations, and special events, including food banks, foster care programs, senior programs, county fairs, county health departments, hospitals, and California State Fairs. Other suggestions included distributing the brochures along with food stamps, free supermarket coupons, free supermarket-distributed recipes, and free promotional packages for college students. One participant said that the guidelines should be incorporated into the "5 a Day for Better Health" program, which advises consumers to consume at least five servings of produce per day. Several suggested that the educational materials could be distributed through the "Special Supplemental Nutrition Program" for Women, Infants, and Children (WIC). In addition, many recommended that the brochures and magnets should be printed in multiple languages, and especially Spanish.

## DISCUSSION

Successful research using focus groups requires a well-trained moderator (21). Challenges of this research method include greater difficulty in data analysis, group variations, and less interview control. Other limitations were present in the focus groups used in this study. Although mixed ethnic representation and different age groups were sought, a majority of the participants were Caucasian non-hispanic females over 30 to 40 years old. People in this age group have been targeted, however, because they are more likely to practice unsafe food handling practices, according to a national survey (23). Although varied educational backgrounds and income levels were sought, exact

**Figure 5.** Preliminary draft of the refrigerator magnet before focus group sessions (top) and final version of the magnet after focus group sessions (bottom)



demographic characteristics are unknown. Thus, it should be acknowledged that consumer attitudes revealed in the focus group do not necessarily represent all consumers.

Although focus group participants were confident that the public would not discontinue consuming fresh produce because of the brochure's material, there is still concern among health professionals that some consumers may reduce or stop their consumption of fresh produce as a result of reading a brochure of this type. For example, one survey found that over one-fifth (22%) of consumers responded that they have stopped purchasing specific fresh produce

because of food safety concerns (27). Likewise, some consumers reported reducing their fruit and vegetable intake because of concerns about pesticides (9). During the focus group study, the statement on the brochure's cover was altered to motivate consumers to pay closer attention to the guidelines. Participants of the later focus groups thought that the revised message was much more effective, since it emphasized potential food safety hazards and was more likely to motivate consumers to practice safe handling.

Not all consumer recommendations were incorporated into the brochure and magnet. The authors

incorporated the suggestions they considered most effective and appropriate. For example, because the suggestion to use a tray for raw meat storage in the refrigerator is practical and addresses an important safety issue, it was incorporated into the brochure and magnet. However, although some participants thought that the guideline to store raw meat on the bottom refrigerator shelf was unnecessary, the authors believe that this advice clarifies and reinforces the importance of storing raw meat, poultry, and seafood below *all* other foods. Therefore, this guideline was maintained.

Not all of the issues considered important by the participants were addressed in the brochure. Information on pesticide residues, waxes on produce, types of harmful bacteria, and storage conditions for meat products and fresh produce were not added because of space limitations. Furthermore, although many participants recommended a more condensed or abbreviated version of the brochure to encourage consumers to read the guidelines, the brochure's content could not be shortened without removing information that is essential to safe handling. The purpose of the brochure is to provide specific information on how to reduce the risk of foodborne illness associated with the consumption of fresh produce. If shortened, the intention of the brochure would be lost.

Many incorrectly assumed that homegrown and organic produce do not need to be handled as carefully or washed as thoroughly as commercial produce. Almost 20% of consumers believe USDA certified organic produce is safer than conventional produce. However, organically grown, just like commercially grown, produce can be contaminated by foodborne pathogens or unsafe handling practices (27). As a result, a statement about washing all fresh produce, including produce that is organically grown, homegrown, and purchased at farmers markets, was added to the brochure.

A few participants indicated that the illustration of the grocery cart, which shows meat products on the bottom platform and produce in the cart, was unrealistic and impractical. Despite consumer opinion, the illustration was not altered in either the brochure or the magnet; its purpose was to emphasize the need for consumers to separate fresh produce from raw meat products in the grocery cart. It was not designed to suggest that consumers must store raw meat specifically on the bottom platform of the cart. However, we recognize that some consumers may not appreciate the illustration because of the unfamiliarity of the idea.

Many participants were concerned about the greater availability and increased consumption of imported fresh produce; many assumed that imported produce plays a significant role in foodborne illness. Survey results indicate that as many as 70% of consumers believe that fresh produce grown in the United States is safer than imported produce (31). Nonetheless, there is no evidence that there is a difference in health risks associated with the consumption of domestically grown or imported fresh produce (43). Thus, consumers need to be informed that both domestically grown and imported fruits and vegetables are possible vehicles for foodborne illness.

In the focus group sessions, many participants indicated a concern about whether prewashed, bagged, and ready-to-eat fresh produce needed to be washed again. Many consumers purchase ready-to-eat, packaged, and pre-cut fresh produce. According to one survey, 94% of consumers have purchased some kind of packaged, prewashed, or pre-cut fresh produce item in the past six months (28). Many participants also stated that they liked the convenience of prewashed, packaged produce. Consumers reported that they would purchase fresh fruits (52%) and vegetables (61%) more frequently if they were more convenient to prepare or eat (26). Because of the popularity of these

convenience produce items, a statement emphasizing the participants' concerns needed a response. Thus, the following statement was incorporated into the brochure: "Ready-to-eat, prewashed and bagged produce can be used without further washing if kept refrigerated and used by the "used-by" date. If desired, produce can be washed again." Therefore, in general, consumers can prepare and eat prewashed, bagged produce without additional washing. In contrast, pre-cut or prewashed produce purchased from open bags or containers must be thoroughly washed again at home before preparation or consumption, because produce in open containers can easily be contaminated by consumers and supermarket employees who are ill or have poor personal hygiene.

Several participants were very interested in knowing if commercial cleaning solutions designed for fresh produce are more effective than water in cleaning and reducing harmful bacteria on fruits and vegetables. According to *The Packer's* "Fresh Trends 2001" survey, 16% of respondents indicated that they wash their fresh produce with cleaners or commercial cleaning solutions. In general, commercial washes designed for cleaning fresh produce may help remove bacteria, dirt, and chemicals (32). The effectiveness of the commercial produce cleaning solution Fit is currently being evaluated. Studies indicate that Fit can reduce harmful bacteria (6, 17, 18) and its makers claim that it is more effective in removing dirt and chemicals than water (32). The effectiveness of other solutions on the market has not been reported in the peer-reviewed literature. However, some consumers with lower household income levels may not be able to afford these commercial cleaning solutions. For instance, a survey revealed that 21% of consumers with income levels of \$75,000 and higher use commercial cleaning solutions, compared with 12% of consumers with income levels of less than \$17,500 (32). In addition,

many consumers may prefer using water because it is convenient and inexpensive. According to our mail survey conducted in spring 2000 (23) and *The Packer's* "Fresh Trends 2001" survey, most consumers wash their fresh produce with water (32). To encourage all consumers to clean fresh produce, the brochure provides guidelines based on use of readily available supplies. The intent of the brochure is not to advocate the purchase of any specific type of product, including commercial cleaning solutions.

Some participants wanted to know if there was a difference between plastic and wooden cutting boards in terms of sanitation and risks of cross-contamination. Because of the controversy over the advantages and disadvantages of using plastic or wooden cutting boards (1, 2, 24, 25), the brochure does not recommend one type of material over another. Wooden and plastic cutting boards are both popular among consumers and as a result, the brochure addresses guidelines on how to clean and sanitize cutting board surfaces regardless of composition (25).

One participant suggested that sanitizing cutting boards after cutting produce that grows *in* the ground, as well as produce that grows *on* the ground, should be emphasized in the brochure. This makes sense because foodborne pathogens from the soil can be present on the surface or in the interior of produce grown underground (4). The brochure was modified accordingly before public distribution.

Besides revealing consumer attitudes about educational materials, the focus groups also provided important insights on consumers' food safety knowledge. Many participants were unaware that whole melons needed to be washed before slicing or peeling, since the rinds are not consumed. The inside of a melon can be contaminated during slicing by bacteria present on its unwashed rind (11). Over the years, there have been several outbreaks associated with melons, with the

most recent outbreak (April 2001) associated with the consumption of *Salmonella*-infected cantaloupes (10). To reduce the risk of outbreaks of foodborne illness associated with melons, it is recommended that the outer surface of whole melons be washed thoroughly with running tap water before being cut with a sanitized knife to remove dirt and bacteria (38). Scrubbing with a brush increases bacteria removal (33). In addition, leftover cut melons, like all other leftover cut produce, should be refrigerated immediately after consumption.

Some participants were also unaware of the importance of keeping raw meat, poultry, and seafood separate from fresh produce in the grocery cart and in shopping bags. Many did not know that juices from packages of raw meat products may leak and cross-contaminate fresh produce and other ready-to-eat foods. Some also assumed that consumers routinely double bag their packages of raw meat to prevent juices from leaking out from the original wrapping; however, since the concept of double bagging was novel to others, it is apparent that all consumers double bag their raw meat packages.

In addition, many participants did not realize that bagging produce with raw meat may constitute a food safety hazard. Some mentioned that the packing of groceries is the supermarket bagging clerk's job. However, consumers must become aware of how the supermarket clerks bag their groceries and, if bagging is inappropriate, consumers should advise the clerks about safe packing practices.

Motivating consumers to change their handling behaviors is a challenge. According to one survey, fewer than 40% of consumers who had food safety concerns, indicated making some change in their behavior as a result of those concerns. Among those who had indicated changing their behavior, only 37% indicated washing their produce carefully, and only 6% indicated changing the way they

store, prepare, or cook produce (27). Because fresh produce are not commonly associated with foodborne illness, many consumers may not be willing to change their unsafe produce handling practices. Bruhn and Schutz (8) found that over 90% of California consumers were either very confident or somewhat confident in the safety of fruits and vegetables. Only 27% of Southern California consumers reported being very or somewhat concerned about bacterial contamination of fresh produce (22). Consumers appear less concerned about the safety of produce than the safety of meat, seafood, and dairy products (29). Likewise, only 10% or fewer of consumers were concerned about the safety of produce in terms of disease or getting sick (10%), bacteria (9%), and contamination (5%) (30). In addition, the mail survey conducted in spring 2000 by this paper's authors indicated that over 30% of consumers were not interested in receiving information on safe handling of fresh produce (23). Despite the relatively low level of consumer sensitivity to potential risks from microbiological contamination, concern for the safety of fresh produce is increasing. One 1998 survey found that 58% of consumers are more concerned about bacterial contamination of produce than they were a year ago (30).

Many participants thought that the safe handling instructions in the form of a supermarket brochure was impractical or too time-consuming. Although the brochure was perceived as being easy to read and follow, some consumers may believe that the task of proper cleaning and sanitation is too time-consuming or bothersome. In a related area, Harnack et al. (16) found that people who believed that consuming a more healthy diet is difficult are less likely to make dietary changes. Therefore, the perception that proper cleaning is burdensome is a serious impediment to safe handling.

However, the focus groups did provide some useful insights on how safe handling guidelines of

fresh produce could be effectively distributed to consumers. One effective distribution method is to print the guidelines in languages other than English. One survey suggested that Hispanics report greater awareness than Asians of safe food-handling labels on packages of raw meat and poultry because the labels were printed in Spanish but not in any Asian language (42). The focus groups also provided many examples of how produce safety materials might be delivered, suggesting that the safe-handling messages need to be distributed through many different convenient sources and various food safety and health education programs (8, 34, 42).

The media may also play an important role in the distribution of food and fresh produce safety issues and guidelines. Recent outbreaks associated with consumption of fresh produce may heighten consumers' concerns (30). Results from one survey suggest that television programs and newspaper articles may effectively communicate food safety information (34). Another way to enhance consumer awareness and motivation to change food handling practices is to include statements from reliable sources, such as *Consumer Reports*, in any materials distributed to the public (8). Consumers are more likely to trust the food handling guidelines in brochures if the web addresses of reliable food safety experts and organizations are included.

Education on fresh produce safety, as well as general food safety and good hygiene practices, should be targeted toward children and young adolescents (7). The focus group sessions suggest that adult consumers are greatly influenced by young children or by what the adults themselves had been taught at a young age. Thus, messages on safe food and produce handling should be incorporated into school curriculums. Focus groups can be used to increase the understanding of consumer safe handling principles, to identify information needs, and to verify and enhance effective consumer tools.

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# OzFoodNet: Enhancing Foodborne Disease Surveillance Across Australia: Quarterly Report, July to September 2001

The OzFoodNet Working Group Rosie Ashbolt (Tos), Meredith Coelli (Hunter PHU), Scott Crerar (ANZFA), Craig Dalton (Hunter PHU), Rod Givney (SA), Joy Gregory (Vic), Gillion Holl (NCEPH), Brigid Hardy (AFFA), Geoff Hogg (MDU), Rebecca Hundy (SA), Martyn Kirk (ANZFA), Vanessa Madden (Tas), Ian McKay (DoHA), Lynn Meuleners (WA), Geoff Millard (ACT), David Peacock (NT), Nittita Prasopa-Plaizier (Vic), Paul Roche (DoHA), Russell Stafford (Qld), Nola Tomaska (NCEPH), Leanne Unicomb (Hunter PHU), Craig Williams (ANZFA) Corresponding author: Mr. Mortyn Kirk, <http://www.health.gov.au/pubhlth/cdi/cdi2601/cdi2601e.htm>

Historical comparisons use notifications by date of onset.

All other data were reported using the date the report was received by the health agency.

## INTRODUCTION

OzFoodNet is a collaborative network of epidemiologists and microbiologists conducting applied epidemiological research into foodborne disease and improving existing surveillance mechanisms for foodborne disease. The Commonwealth Department of Health and Aging established OzFoodNet in 2000 and the network has had representation on the Communicable Diseases Network Australia (CDNA) since 2001.

This third quarterly report of OzFoodNet summarizes the incidence of foodborne disease in the six States of Australia and specific foodborne outbreaks identified between July and September 2001. During the third quarter of 2001, Australia experienced an outbreak of *Salmonella* Stanley. The CDNA requested that OzFoodNet coordinate the national investigation, which identified contaminated peanuts from China as the food vehicle. The investigation also alerted health authorities in Canada and the United Kingdom to human cases of salmonellosis associated with the same brand of peanuts. *Salmonella* Typhimurium phage type 126 also emerged as a national problem during the quarter. In September 2001, OzFoodNet began a national survey to estimate the incidence of diarrheal disease, and a pilot of the national case control study into *Campylobacter* infections. During this quarter, the Australian Capital Territory joined OzFoodNet and the Northern Territory participated as an observer. Data are only included for the Territories where specified.

## Notifications in the third quarter

During the third quarter 2001, OzFoodNet sites reported 4,014 notifications of campylobacteriosis, which represented a 25 percent increase over the mean for the same quarter for the years 1998 to 2002. The median age of cases ranged between 27 to 33 years old. All States reported that the male to female ratio of cases ranged from 1.1:1.0 to 1.4:1.0. There was one small outbreak of *Campylobacter* infection in Queensland that was associated with eating duck livers in a restaurant. OzFoodNet sites reported a total of 1,081 cases of salmonellosis during the third quarter and identified the source of four *Salmonella* outbreaks. As for previous reports, Queensland reported a lower median age of reported cases (9.0 years old) compared to other States (range of medians: 17.0–23.1 years old). OzFoodNet sites reported that *Salmonella* Typhimurium (phage types 126 and 135), and *S. Stanley* were the most commonly notified infections during the quarter.

The major feature of *Salmonella* epidemiology during this quarter was the emergence of *Salmonella* Typhimurium phage type 126 in jurisdictions across Australia. The National Enteric Pathogen Surveillance Scheme reported that *S. Typhimurium* 126 was among the five most common infections in five different jurisdictions (Joan Powling, The University of Melbourne, January 14, 2002, personal communication) (Table 1). The South Australian Department of Human Services conducted a case control study of this serovar, which

implicated chicken products. There were also concurrent epidemics of this organism in chicken flocks.

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**Table 1.** Top five *Salmonella* infections reported to OzFoodNet sites, July to September 2001, by date of receipt of notification at the Health Department OzFoodNet Site (this data can be found at: <http://www.health.gov.au/pubhlth/cdi/cdi2601/cdi2601e.htm>).

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The Tasmanian OzFoodNet site continued to report that the most common serovar was *Salmonella* Mississippi, which is endemic in that State. Queensland reported that the distribution and rates of salmonellosis changed depending on geographical location, with higher rates in the north of the State. Jurisdictions reported an increase in the incidence of *Salmonella* Stanley between July and September, which was related to the national outbreak.

State health departments received 14 notifications of listeriosis during the third quarter of 2001, five of which were from Western Australia. Median ages for cases not associated with pregnancy ranged from 43 to 83 years. Tasmania reported one maternal-fetal infection during the quarter.

OzFoodNet sites reported seven cases of shiga toxin producing *E. coli* infections during the quarter; four were from South Australia and three from Queensland. Investigators did not identify any sources and all cases appeared sporadic. The median age of cases were 22 years in South Australia and seven years in Queensland. The South Australian Health Department was notified of one case of hemolytic uremic syndrome in a 21-year-old male on holiday from the United Kingdom.

There were 11 notifications of yersiniosis for the third quarter of 2001. The Communicable Diseases Network Australia agreed to remove yersiniosis from the list of nationally notifiable disease, but most jurisdictions still receive reports. The decline in yersiniosis has occurred over several years and follows similar trends in other countries. OzFoodNet sites reported that during the quarter there were 86 cases of shigellosis, and 13 cases of typhoid.

### Foodborne disease outbreaks

During the third quarter of 2001, OzFoodNet sites reported 17 outbreaks that were potentially related to food (Table 2). These outbreaks affected approximately 244 people, of whom 7 were hospitalized. There were no reported deaths from these outbreaks. Ten outbreaks were associated with meals served at restaurants, and three with takeaway food or catered functions.

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**Table 2.** Outbreaks reported by OzFoodNet sites, July to September 2001 (can be found at: <http://www.health.gov.au/pubhlth/cdi/cdi2601/cdi2601e.htm>).

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There were three community-wide epidemics occurring during the quarter, two of which crossed State and Territory boundaries. One of these was a small outbreak of cryptosporidiosis associated with unpasteurized pets' milk that was not intended for human consumption.

The Communicable Disease Network Australia requested that OzFoodNet coordinate the national investigation into an outbreak of *Salmonella* Stanley amongst people of Asian ethnicity. OzFoodNet held national teleconferences of State and Territory investigators to generate hypotheses about the reasons for this national increase. The Victorian Department of Human Services and the Microbiological Diagnostic Unit (MDU) sampled dried peanuts originating from China after two cases gave a history of consumption during interviews. MDU identified *Salmonella* Stanley in the peanuts with a molecular pattern that was indistinguishable from patient isolates. The Australia New Zealand Food Authority coordinated a nation-wide recall of the contaminated product. OzFoodNet sites reported 27 cases of salmonellosis associated with these peanuts. The Australian investigation triggered product recalls and outbreak investigations in Canada and the United Kingdom (2).

The South Australian Department of Human Services continued investigations into a state-wide outbreak of *Salmonella* Typhimurium phage type 126. Since reporting this outbreak in the previous OzFoodNet report, other jurisdictions around Australia have identified cases of this emerging infection (1). South Australian investigators completed a case-control study that showed that illness was associated with consumption of chicken. The Department also identified corroborating evidence for this link, including descriptive epidemiology and microbiological evidence. This outbreak is one of a number in 2001 that were possibly associated with chicken (1, 3, 4). It is concerning that cases of this serovar are now occurring in other Australian States and Territories. It once again raises the difficult question about the role that contaminated chicken plays in the epidemiology of *Salmonella* and *Campylobacter* infections in humans in Australia.

### Applied research

In September 2001, the Tasmanian OzFoodNet Site piloted the national *Campylobacter* case control study. This study aims to examine the risk factors for infection with sporadic *Campylobacter* infection. *Campylobacter* is the most common enteric disease reported to health agencies, and is a cause of significant morbidity in Australia. This study will recruit approximately 1,200 cases and 1,200 controls across Australia during the next 12 months. The case control study will use the results of a comparison of eight *Campylobacter* typing methods that is being coordinated by the OzFoodNet-Hunter Site and Hunter Area Pathology.

During this quarter, the National Centre for Epidemiology and Population Health started the national OzFoodNet gastroenteritis survey. The aim of this cross-sectional survey is to measure the prevalence of gas-

trointestinal illness across all States and Territories of Australia. Interviewers use Computer Assisted Telephone Interviews (CATI) to ask respondents about demographic details and whether they have experienced an episode of gastrointestinal disease in the last month. If participants mention that they have had an episode of gastroenteritis, interviewers record symptom details and the patients' use of health services. This study includes residents of the Northern Territory where many people living in remote areas would not have telephone. Despite this, in the month of September Northern Territory residents reported the highest crude proportion of people experiencing gastroenteritis in the previous month, and South Australian residents reported the lowest (Table 3).

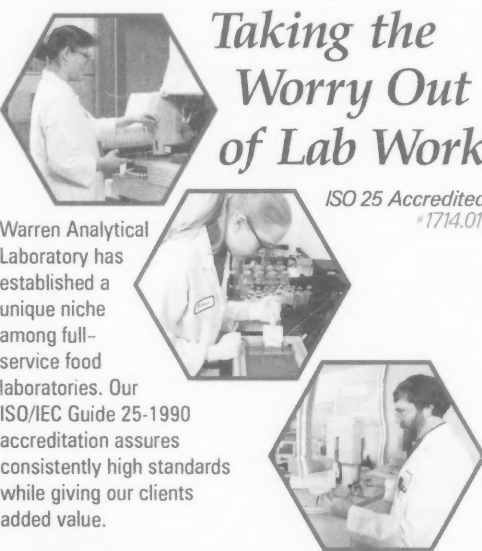
**Table 3.** Unweighted results of the national OzFoodNet gastroenteritis survey during September 2001 showing the proportion of respondents reporting an episode of gastroenteritis in the previous month, and the response rates by jurisdiction (can be found at: <http://www.health.gov.au/pubhlth/cdi/cdi2601/cdi2601e.htm>).

Includes an over sample for the Hunter region of New South Wales.

The population survey covers all States and Territories and will run for a year. It will provide important information about the burden of gastrointestinal disease and will supplement information that States and Territories collect about the causes of foodborne illness. OzFoodNet aims to combine these data to learn more about the causes and burden of foodborne illness in Australia.

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**Darci K. Svela**  
Smucker Quality Beverages  
Havre De Grace

## Michigan

**Louis Rayyan**  
Detroit

## Minnesota

**Cherree A. Bovee**  
International Multifoods  
Minnetonka

**Geunwoo Park**  
University of Minnesota, St. Paul

## Nebraska

**Adriana Velasquez**  
University of Nebraska-Lincoln  
Lincoln

## New Jersey

**Eva Rodriguez**  
Tropical Cheese Industries  
Perth Amboy

**Sarah E. Smith**  
Rutgers University  
New Brunswick

## New York

**Elizabeth A. Bihn**  
Cornell University, Ithaca

**Nadia O. Melnyk**  
Rich Products Corp., Buffalo

**David T. Randell**  
Kraft Foods NA Inc., Walton

**Helena Soedjak**  
Kraft Foods, Tarrytown

## North Carolina

**Mary Anne Hogue**  
The Steritech Group, Inc.  
Charlotte

**Anna D. Starobin**  
Kay Chemical Co., Greensboro

## Ohio

**James M. Bellew**  
Nestle Foodservice, Cleveland

## Pennsylvania

**Ching-Hsing Liao**  
ERRC-USDA-ARS  
Wyndmoor

**David H. Nash**  
American Food Safety Institute  
Hulmeville

**Donald A. Yanek**  
Wawa, Inc., Morgantown

## Tennessee

**Brendan W. Boyd**  
Eastman Chemical Co., Kingsport

**Tim Jones**  
Tennessee Dept. of Health  
Nashville

## Texas

**Donnie N. Blanding**  
US Army, Fort Sam Houston

**Everardo M. Vega**  
Texas A & M University, Bryan

**Wendy Zera**  
US Army, San Antonio

## Virginia

**Kristen E. Matak**  
Virginia Tech University  
Blacksburg

## Washington

**Jim Pressley**  
WSDA, Olympia

**Joseph A. Sasenick**  
Alcide Corporation, Redmond

**Robert V. Vu**  
Starbucks Coffee Co., Seattle

## Wisconsin

**Richard L. Katz**  
Schreiber Foods Inc., Green Bay

## Wyoming

**Somnath Bandyopadhyay**  
University of Wyoming, Laramie

## YUGOSLAVIA

**Zoran Petrovic**  
PRIMA, Belgrade, Serbia

# Updates

## **Silliker, Inc. Announces New Appointments**

Silliker, Inc. recently announced the appointment of Jocelyn Alfieri as director of Silliker Canada Co. She is responsible for managing scientific operations, quality systems, and staff to provide accurate, timely services to food processors, distributors, and retailers.

Prior to her appointment, Alfieri served as chemistry operations manager at the Markham, ONT-based lab. With 15 years experience at Silliker, she has an extensive background in analytical chemistry, pharmaceutical testing, and nutrition labeling.

Alfieri has served as a liaison with the Standards Council of Canada on laboratory accreditation and received ISO auditor training. She holds an undergraduate degree in Applied Chemistry and a master's degree of applied science in management science from the University of Waterloo.

Bradley A. Stawick was named laboratory director of Silliker, Inc.'s Chicago Heights, IL, testing facility. He is responsible for scientific operations, quality systems, and staff to provide accurate, timely services to processors, distributors, and retailers.

Since joining the Silliker organization in 1992, Stawick has served in several laboratory supervisory positions. Most recently, he served as microbiology operations manager at the Illinois laboratory.

Stawick, a graduate of the University of Illinois-Champaign with a master's degree in food science, possesses an extensive background in analytical testing methodologies, laboratory automation, environmental monitoring, and QA-QC programs. He is also a Silliker laboratory methods short course instructor.

Jim Ondyak has been appointed as vice president of sales and marketing. He will be responsible for the technical services and marketing groups headquartered in Homewood, IL, and the organization's South Holland, IL-based Research Center.

With 20 years of sales and marketing experience, Ondyak most recently served as vice president of corporate marketing & e-business and process division president of ONDEO Nalco. He has a M.S. in engineering from Illinois Institute of Technology and an MBA from Harvard's Business School.

## **International Fresh-cut Produce Association Fills Two Positions**

James R. Gorny, Ph.D. Technical Director for the International Fresh-cut Produce Association (IFPA) for the last two years, has been promoted to vice president of technical and regulatory affairs. According to IFPA president, Edith Garrett, the promotion reflects Dr. Gorny's substantial contributions to both IFPA and to the fresh-cut industry overall.

Prior to joining IFPA, Dr. Gorny was senior vice president of

technology at Davis Fresh Technologies in Davis, CA. He received his Ph.D. at UC-Davis in 1995. He worked in the fresh-cut produce industry both before and after his doctoral work.

Kelly Dietz of Grimmway Farms was named the new chairman of the board of IFPA in April 2002. She succeeds chairman Steve Gill, president of Gills Onions in Oxnard, CA.

She has served as chairman of IFPA's technical committee and a member of the board of directors, and was a contributing chapter author for the latest edition of IFPA's *Food Safety Guidelines for the Fresh-cut Produce Industry*. In addition, Dietz was editor of the latest edition of the IFPA/PMA *Fresh-cut Produce Handling Guidelines (1999)*.

## **Fibermark Board Appoints New Chairman and Names New Director**

FiberMark's Board of Directors has appointed Alex Kwader as chairman of the board, in addition to his role as chief executive officer. K. Peter Norrie who has retired as chairman of the board, will continue as a director. Duncan Middleton, president of FiberMark since January 2002, was named to the board of directors.

Kwader holds a B.S. in mechanical engineering from the University of Massachusetts and a M.S. from Carnegie Mellon University and attended the Harvard Business School Executive Program.

## Outbreak of Salmonellosis on a Ferry between Sweden and Poland

During the weekend of April 5-7, a Chinese style buffet was served to passengers booked on a cruise on the ferry M/S Polonia, which sails a regular route between Sweden and Poland. After the cruise, several of the passengers reported having fallen ill. Around 800 Swedish passengers traveled on the cruise, and to date there have been reports of 352 laboratory verified cases of salmonellosis in people who were on the ferry on April 5-7. The serotypes are *Salmonella enterica* serovar *hadar* and *Salmonella* Enteritidis phage type 21, with several patients affected by both serotypes, although numbers of each are not yet complete.

Passengers from the weekend were interviewed about their food intake during the cruise using a standard questionnaire. Samples have been taken from all 20 staff involved in food preparation and service, and eight have been found to be carriers of *Salmonella*. The serotypes have not yet been determined. Personnel with salmonellosis have not been allowed to return to work until they provide negative samples. The kitchen has been cleaned, and care was taken not to use high pressure cleaning that could cause bacteria to spread further. Food items have also been sampled and when the chicken was sampled for the second time, *S. hadar* was found. The chicken was bought in Poland, although its original source has not been identified.

The investigation has not yet been completed, but no further cases from April 5-7 have been reported, and no passengers travelling on the ferry after that date have reported infection, so the measures taken (cleaning the kitchen, suspension of buffet service, and not allowing staff



International Association for  
Food Protection



who either showed symptoms or had tested positive for *Salmonella* to return to work) seem to have stopped the outbreak. To the investigators' knowledge, no people outside Sweden, except the crew, who were Polish, have been affected. This is probably because most people travelling that weekend were on a dancing cruise departing from and returning to Sweden, and did not leave the ferry in Poland.

## Risk Assessment and the Development of Food Hygiene Standards and Guidelines

FAO and World Health Organization (WHO) convened an expert consultation on guidance for incorporating quantitative risk assessment in the development of microbiological food hygiene standards and guidelines in collaboration with the Institute for Hygiene and Food Safety of the German Federal Dairy Research Center in Kiel, Germany from March 18-22, 2002. In their deliberation, experts participating in the consultation developed guidance on how to use the outcome of microbiological risk assessments to develop food safety objectives, industry standards, guidelines, and other performance standards and food safety management

options along the entire food chain. The report of the consultation is being finalized.

## Walkerton Inquiry Part Two Report Posted on Internet

Attorney General David Young has issued the following statement: "This afternoon, I received Commissioner Dennis O'Connor's report on Part Two of the inquiry into the contamination of the Walkerton water supply and into the safety of Ontario's drinking water. To make this important document available to the public as quickly as possible, I have authorized the posting of the report on the Internet." The report may now be found on the Ministry of the Attorney General's Web site ([www.attorneygeneral.jus.gov.on.ca](http://www.attorneygeneral.jus.gov.on.ca)) as well as on the commission's Web site ([www.walkertoninquiry.com](http://www.walkertoninquiry.com)).

The government established the inquiry to get answers. We gave Commissioner O'Connor a two-fold mandate – to get to the bottom of what happened in Walkerton, and to make recommendations so this kind of tragedy never happens again. Our goal was, and remains, to ensure that no community ever has to experience what Walkerton has undergone.

The Part Two report contains recommendations for ensuring the safety of the water supply system in Ontario. With the submission of this report, the commission of inquiry has concluded its work.

"I would like to take this opportunity to thank Commissioner O'Connor for his dedicated efforts in carrying out his comprehensive mandate over the past two years. He has conducted a thorough and open process, giving the many different perspectives on drinking water issues an opportunity to be heard. The government looks forward

to considering Commissioner O'Connor's recommendations to protect the safety of Ontario's drinking water for present and future generations."

## 'Landscape Phages' Offer New Horizon of Detection Capabilities

**L**andscape phage might be considered as a new type of submicroscopic "fiber," with the potential of replacing the function of antibodies in a multitude of diagnostic applications. This could include the foundation for foodborne contaminant testing occurring in Auburn University's Detection and Food Safety Center (AUDFS) <http://audfs.eng.auburn.edu>, and even many laboratory-based tests.

Like most laboratory testing, detection systems designed by AUDFS use antibodies collected from animals and specially designed for a specific laboratory function. These antibodies are then integrated into diagnostic test kits or testing materials. Since 1999, AUDFS researchers have been designing a system to detect foodborne contaminants like *Salmonella* and *E. coli* using stamp-sized radio-frequency sensors designed around the use of antibodies. The introduction of phage technology may now offer additional detection opportunities and applications by the research center.

Bacteriophages are produced in the laboratory by using a bacterium as a host to grow them. Each phage clone is a type of fiber with unique surface properties. Billions of fibers are constructed, propagated all at once in a single vessel, and distributed in portions to multiple end-users with many different goals. Valery Petrenko <<http://audfs.eng.auburn.edu/contact.htm#vap>>, a Russia

pioneer of phage technology, joined the AU faculty in January 2001 as a member of the AUDFS research team and professor in the College of Veterinary Medicine's Department of Pathobiology. His research brings an entirely different possibility to detecting foodborne contaminants. "Current detection methods involve antibodies, which have limitations," says Petrenko. "Our phages, as selected recognition elements, give more possibilities and can function in different unfavorable environments. We believe the phage is a perfect material for fabrication of bio-selective layers in biosensors."

Petrenko's collaboration within AUDFS is the first demonstration of the use of landscape phages as bio-selective elements for biosensors, for which the center is now seeking patent-protection status. As substitutes for antibodies, phages demonstrate many features, such as high affinity for the analyte, field stability and low cost. These novel new bioselective elements allow for the development of a new generation of biosensors for food safety, as well as applications within the health care, pharmaceutical, diagnostic and law enforcement sectors.

The AU Detection and Food Safety Center is working on detection systems for *Salmonella*, *E. coli*, and a host of other foodborne pathogens that infect more than 76 million Americans every year, hospitalize more than 325,000 people and kill more than 5,200 people. In addition, AUDFS researchers are concentrating efforts on detecting animal feed contaminants that could lead to the transmission of bovine spongiform encephalopathy (BSE, or "mad cow disease"). While "mad cow disease" has not been detected in the United States, it has run rampant in Europe.

Initially detected in the United Kingdom in 1986, BSE had infected nearly 200,000 head of cattle, and has now resulted in the destruction of more than three million more, by the end of 2001 "Obviously, 'mad cow disease' represents a looming threat to the purity of the US food supply," Bryan Chin <http://audfs.eng.auburn.edu/contact.htm#bac>, AUDFS center director, says. "The spread of this disease in Europe has shown that every step must be made in preventing, not reacting to, this threat." In the AUDFS detection system, stamp-sized radio-frequency sensor tags will be placed on the surface or in the packaging of foods such as poultry, beef, vegetables, juices and milk. The sensors will communicate by radio frequency with receivers placed at critical points along the food-supply chain, including food processing plants, transportation vehicles, distribution centers and retail locations. The sensors will contain valuable food processing, storage and transportation information, as well as possess the capability to alert handlers and retailers of rising levels of foodborne contamination by *Salmonella*, *E. coli*, *Listeria* and *Campylobacter*. Contaminated food can then be removed from the food-supply chain, preventing dozens – or even thousands – of people from being infected.

AUDFS' multidisciplinary research team includes more than 20 core and affiliate faculty members from five AU colleges: Agriculture, Engineering, Human Sciences, Sciences and Mathematics, and Veterinary Medicine. It continues to work toward an antibody-based handheld detector for *Salmonella*, which it expects to complete by year's end. While its current *Salmonella* and *E. coli* detector research is still antibody-driven, the use of phage in this

same manner is being integrated into future generations of food-borne and feed-based contaminant research.

## Evaluation of Codex Alimentarius

The Food and Agriculture Organization (FAO) and the World Health Organization (WHO) have launched a joint evaluation of FAO and WHO food standards program, including the Codex Alimentarius, so that the program best serves the concerns of all (the rich and poor) regarding health, safety and trade in food. This is the first evaluation process of the international food code, Codex Alimentarius, and its standard-setting mechanisms after 40 years of operations.

The two organizations are inviting comments from the public to ensure that all those with a stake in the use of these food standards could make their views known. "In both developed and developing countries, the number and variety of food safety threats are on the increase. We need to ensure that international food standard work responds to the challenges of the new millennium in order to meet more effectively the needs of the world's people and we therefore welcome this timely review," said Dr. Gro Harlem Brundtland, WHO director-general.

Dr. Jacques Diouf, FAO's director-general, said "every day food safety and quality issues vary dramatically from country to country. National capabilities to use and apply food standards must be enhanced if global food safety is ever to be realized and I am pleased that this timely evaluation will be looking at the wider aspects of applying food standards at a practical level." The world has changed dramatically

since the Codex Alimentarius Commission was established 40 years ago. Public concern over food safety issues is now widespread, and consumers are much more aware of what they regard as threats to their health, and of their rights to full information on foods. The link between safe food, a balanced diet and the overall health and productivity of the population is increasingly recognized. In addition, the need for standards agreed through open and transparent processes has been highlighted as a result of the recognition by the World Trade Organization (WTO) of Codex standards as the reference point for trade in foodstuffs.

This evaluation of FAO's and WHO's food standards program is being carried out by an independent evaluation team and an expert panel. The evaluation process began in April 2002 and is scheduled to be completed in early 2003, with a report that will include recommendations for consideration by the governing bodies of both FAO and WHO. To produce the report, the evaluation team will conduct the widest possible consultations with the member countries of FAO and WHO and other stakeholders. In addition to a formal questionnaire on key issues to member states and stakeholders through official channels, the evaluation process will comprise a variety of methods including country visits, in-depth interviews, literature reviews, etc.

Thus, one element of the evaluation process is to invite informal comments from the global public and all potentially interested parties, in an attempt to include the broadest possible range of relevant issues. Issues for public comment could, for example, include the following aspects: The relevance and adequacy of Codex and other

standards as a basis for consumer health protection, trade and economic development; The adequacy of governance structures and decision-making processes in food standards work, including Codex; The speed and transparency of the Codex process, including the independence of Codex bodies and of scientific advice given to Codex, and avoidance of conflict of interest; Opportunities to participate in the Codex process, including for developing countries, and representation of developing country interests in Codex; Implications for future international systems of food safety and food standards developments relative to public health, food trade and economic development in a broader sense.

## USDA Announces Additional Steps to Reduce Pathogens in Raw Beef

Agriculture Under Secretary for Food Safety Dr. Elsa Murano has announced new meat safety directives to control pathogens in plants that produce ground beef. The Hazard Analysis Critical Control Point system, or HACCP, requires plants to determine those points in their process where contamination can occur and where it can be controlled. Under these new directives, Food Safety Inspection Service inspectors will determine whether plants have specifically addressed *Salmonella* and *E. coli* O157:H7 in their Pathogen Reduction/HACCP plans to have effective control measures for these pathogens.

Ground beef plants that do not employ effective decontamination strategies, or that do not

require their suppliers to do so as part of their PR/HACCP systems, will be targeted for increased verification testing by FSIS, above that which is already conducted. USDA currently tests for *Salmonella* and *E. coli* O157:H7 in grinding plants to verify that the plants' food safety systems are controlling microbial hazards. "A key part of pathogen reduction is a strong HACCP system," said Murano in a speech to the National Food Policy Conference. "These directives are an example of how we can better tap HACCP's potential."

Under the PR/HACCP rule, if a plant does not have an adequate plan, or does not have an adequate sanitation program, the US Department of Agriculture's Food Safety and Inspection Service can withhold marks of inspection or suspend inspection at a plant, which effectively shuts down the plant.

"Recent data released by the Centers for Disease Control and Prevention and USDA show that foodborne illness is declining in the United States, and that the prevalence of *Salmonella* in meat and poultry has declined since the implementation of the PR/HACCP rule," said Murano. "If we are going to continue to drive down the incidence of pathogens in raw ground beef, it is crucial that we increase our efforts and resources on those establishments where microbial control may be insufficient," said Murano. The directives will be issued within the next several weeks and will be in place while the department works through the rule-making process to include the directives in its food safety regulations.

The announcement is part of a series of actions USDA

announced Dec. 18, 2001 to further improve meat and poultry safety. USDA is expediting the placement of 75 new consumer safety officers with the primary responsibility of conducting in-depth reviews of plant HACCP and sanitation plans throughout the country. This will bring the total CSO staff to 110, supplementing the more than 7600 USDA food safety inspectors nationwide. In addition, USDA is conducting a series of public meetings to gain input from interested parties. Murano announced a public symposium on food safety, which was held May 6-7 at Georgetown University in Washington, D.C. Titled *Pathogen Reduction: A Scientific Dialogue*, the symposium will bring together leading experts from government and academia to discuss scientific data and issues associated with pathogen reduction and HACCP.

The above initiatives are part of the USDA's overall strategy to improve food safety, which is supported through the Bush Administration's FY 2003 budget request for the department. It provides for \$905 million, the second straight year of record level spending, to strengthen FSIS in order to ensure safe and wholesome meat, poultry and egg products for consumers.

### Waterborne Pathogen not Always What It Appears to Be

The waterborne parasite *Cryptosporidium parvum* was thought to be a single species that infects humans and more than 150 animal species. Now Agricultural Research Service zoologist Ronald Fayer

and his colleagues have described a unique species of this pathogen, *C. canis*, originally found in dogs.

*C. canis* can be transmitted by – and infect – dogs, humans and cattle. Scientists originally thought the new species was *C. parvum*. Identifying this and other *Cryptosporidium* species can help pinpoint potential sources of infection. *Cryptosporidium* is a single-celled parasite that lives in the intestines of animals and people. This microscopic pathogen causes a disease called cryptosporidiosis, which is characterized by mild to life-threatening diarrhea. Disease is spread by a form of *Cryptosporidium* called an oocyst, which is excreted in the feces of infected humans and animals. The tough-walled oocysts survive under a wide range of environmental conditions.

Studies by Fayer and cooperators at the Animal Waste Pathogen Laboratory in Beltsville, MD, found that *C. canis* oocysts differ markedly at the molecular level from those in known species of *Cryptosporidium*. Based on this and other research, scientists now believe *C. parvum* is not one woven cloth, but something of a quilt made of different blocks. Each block represents a biologically distinct and unique organism. Using powerful, new genetic tools, it is becoming clear that there are numerous *Cryptosporidium* species previously thought to be *C. parvum*. The slight genetic differences that distinguish one species from another have great implications for predicting which host species may become infected by the pathogen.

Other scientists have found, within the *C. parvum* classification, several unique genotypes

associated with specific hosts such as humans, mice, pigs, marsupials, dogs and ferrets, based on genetic data.

## National Food Processors Association (NFPA) Supports Reinstating President's Food Safety Council

Counsel to the National Food Processors Association John Bode provided testimony before the Senate Government Affairs Subcommittee for Oversight of Government Management, Restructuring and the District of Columbia, and the House Government Reform Subcommittee on Government Efficiency, Financial Management and Intergovernmental Relations at its hearing, "Kids and Cafeterias: How Safe Are Federal School Lunches." In its testimony, the National Food Processors Association addressed the following: Supported reconstitution of President's Food Safety Council—"The NFPA recommends that consideration be given to reinstating the President's Food Safety Council to ensure coordination at the highest levels. This Council would consist of the Secretaries of Health and Human Services, Agriculture and Treasury, the Administrator of the Environmental Protection Agency, the Director of Homeland Security, a representative from the States, and other officials the President wished to designate."

"The President's Food Safety Council could identify specific problems that require legislative action involving existing food safety statutes that impede coordination and cooperation among existing agencies, the efficient allocation of resources,

and hinder movement to a science based, risk-based food safety system," Bode said.

Voiced support for better communication and coordination, not a single food agency "NFPA respectfully submits that the proposal to establish a single food safety agency offers no meaningful benefit to food safety," Bode said.

There is absolutely no evidence that a change in organizational structure would enhance food safety. In his testimony, "In 2000, USDA dictated, without public comment or traditional contractor consultation, that ground beef must be free of *Salmonella* and that meat products may not be treated by irradiation, an approved pathogen-reducing technology that is approved by both FDA and USDA for raw meat and poultry, and for other food products. He noted that in denying the use of irradiation, processors were prevented from using the one tool that can guarantee the absence of *Salmonella* in raw ground beef," Bode stated.

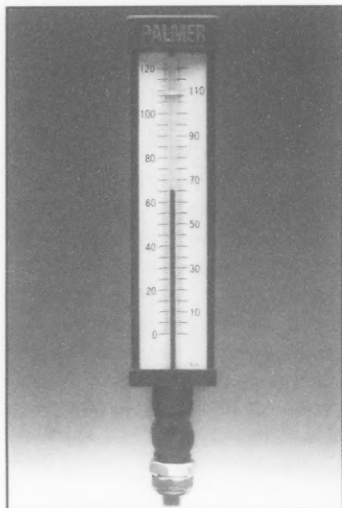
"It is inappropriate for USDA to prohibit the use of any approved food safety technology in foods provided for school foodservice," Bode said. Highlighted role of sound science and processed foods in positive food safety trends. "As food processors, NFPA members are proud of their participation in the School Lunch Program and the contributions of the National School Lunch Program to the nutritional health of our school children. Processed foods play an important role in ensuring the safety of school feeding programs, and are as nutritious as fresh foods. Many of these products are also instrumental in helping children reach the Administration's '5-A Day for

Better Health' goals, of which we are strong supporters," NFPA Counsel John Bode said.

"We also need science-based methods to quantify the progress being made. Many of these mechanisms are already in place or in the pilot stage, such as FoodNet, PulseNet, and the Food and Drug Administration (FDA) and US Department of Agriculture's (USDA) Foodborne Illness Education Information Center. Clearly, proper funding levels should be maintained for these important programs. As we know from recent Centers for Disease Control and Prevention (CDC) figures, incidences of foodborne illness in the United States have improved dramatically—food poisoning from a variety of harmful microbes declined by 21 percent between 1996 to 2001, according to the CDC. USDA reports continuing declines in food poisoning and bacteria found on meat and poultry as well. A recent US General Accounting Office (GAO) report indicates there were only 20 foodborne disease outbreaks in schools in 1997, and only 8 were associated with foods served in the school meal programs, while the other 12 were foods brought from home or obtained from other sources," Bode said.

"There is good reason to believe that streamlined foodservice systems that rely heavily upon processed foods are part of the reason for improvements in food safety. These systems permit foodservice professionals to achieve greater control of food preparation and handling responsibilities and thereby minimize potential for problems in sanitation, cooking and handling practices," Bode said.

# Industry Products



Palmer Instruments, Inc.

## Palmer Instruments Inc. Introduces the Environmentally Safe Sky Blue Economy Industrial Thermometer

This easy-to-read thermometer is filled with a non-toxic, mercury-free, blue liquid. Perfect for applications which require affordability and safety, like heating and air conditioning, process piping, tanks, air ducts, and all types of building construction. Due to its flex angle adjustment, the Sky Blue Industrial Thermometer case can be rotated 180° and its stems simultaneously rotated in 10° increments. This allows for virtually any required viewing angle. In addition, it is calibrated to NIST standards and

is guaranteed accurate to  $\pm 1$  scale division.

Users may select from a 9 inch plastic case or 9 inch aluminum case. Glass crystal, machined brass swivel nut, and cast aluminum stem and seat are standard on 3-1/2 inch stems and brass stem and seat are standard on the 6 inch stem. Tapered bulb chamber or air-duct style stem are also available. A full selection of Fahrenheit or Dual (Fahrenheit/Celsius) temperature ranges are available from -40°F (-40°C) to 300°F (149°C).

Palmer Instruments, Inc.  
Asheville, NC

Reader Service No. 247

## Thermo Orion Unveils Two New Water Quality Testing Products

Thermo Orion, a Thermo Electron business in the development and manufacturing of chemical measurement products, introduces two new water quality testing products, the Chemical Oxygen Demand (COD) products and Environmental Test Kits for water analysis. These products are ideal for laboratory and portable applications and are available through Thermo Orion's distribution network.

Chemical Oxygen Demand – COD – Thermo Orion is pleased to introduce a complete line of COD

testing products. The COD line of products includes prepared reagents offered in three ranges (0–150ppm, 0–1,500ppm and 0–15,000 ppm), a dedicated AQUAfast II colorimeter for the measurement of COD and an advanced thermoreactor. The reagents can be used with Thermo Orion's Advanced Colorimeter, Model AQ4000.

The COD reagents comply with EPA guidelines for COD testing and offer a convenient, safe and cost effective method of testing your water samples. COD testing could not be easier. Simple-to-follow instructions guide the user through measurement using either the AQ4000 Advanced Colorimeter or the dedicated AQUAfast II, AQ2040. COD standards are offered to ensure correct readings.

The AQUAfast II AQ2040 offers a simple three-button interface for measurement of COD. Sample concentration is easily read from the large liquid crystal display (LCD), and the product features long-life battery operation. The instrument incorporates a standard calibration for the species of interest, however, a customer-initiated calibration can also be performed at any time. The AQ2040 comes complete in a carrying case; reagents must be ordered separately. The compact AQUAfast II, AQ2040 is an ideal choice for even the smallest laboratory.

*The publishers do not warrant, either expressly or by implication, the factual accuracy of the products or descriptions herein, nor do they so warrant any views or opinions offered by the manufacturer of said articles and products.*



Environmental Test Kits for Water Analysis – The Environmental Kits provide the user with a portable laboratory and feature the new AQUAfast IV Advanced Colorimeter and reagents, Thermo Orion portable meters and electrodes. These products are ideal for laboratory and portable applications and are available through Thermo Orion's distribution network.

The AQ4000's Auto-ID™ feature automatically identifies the species to be measured, selects the program and initiates the measurement without the user's intervention. The AQUAfast IV reagents are simple-to-use chemistries for colorimetric measurement. The AQ4000, with its advanced features and pre-programmed methods, ensures error-free readings. The AQ4000 is IP67 waterproof and can store up to 100 points to be later downloaded to a printer or a computer.

Thermo Electron, Waltham, MA

Reader Service No. 248

#### Air Liquide America Corporation Benchmarks Ozone as Surface Sanitizer

Air Liquide America Corporation has conducted the first study benchmarking ozone against Environmental Protection Agency standards for surface sanitation. The study was conducted in response to the food industry's need for an effective, environmentally friendly alternative for disinfecting surfaces in food processing plants. Results from the study validate ozone's efficacy as a sanitizer for surfaces, including processing equipment, which come in contact with food.

"Ozone is well suited to the multiple intervention approach that is being taken today by the

food industry to improve sanitation and food safety," said Joanne Burrows, marketing manager, food and beverage, Air Liquide America.

"It is an effective, scientifically proven, broad-spectrum antimicrobial agent that was not previously confirmed as a sanitizing rinse for food contact surfaces such as cutting tables or non-food contact surfaces such as floors," Burrows continued. "It is generated on-site and eliminates the need for handling harsh chemicals. It also readily reverts to oxygen, an end product that leaves no residue on contact surfaces."

This pioneering study by Air Liquide America Corporation, an innovator in ozone-based food safety solutions, benchmarked ozone against a standard recommended by the EPA's Office of Pesticides Programs. Air Liquide America contracted with a recognized third party organization, the Toxicology Group, LLC, a division of NSF International, to validate ozone's efficacy as a sanitizer. The Toxicology Group carried out witness testing on the performance of ozone as measured by the AOAC Official Method 960.09, Germicidal and Detergent Sanitizing Action of Disinfectants.

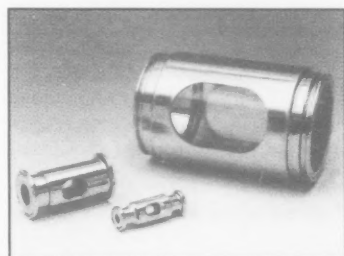
"Based on the findings of this study, ozone meets all acceptance criteria for a 99.999% reduction in viable organisms within 30 seconds," said Chris Steele, Toxicology Group manager. "The role of the Toxicology Group was to provide third-party validation of company testing data," he continued. "Ozone has long been understood as an antimicrobial agent, but these tests hold it up to stringent industry standards."

Air Liquide America Corporation offers NSF-registered mobile surface sanitation systems, which supply ozonated water used to

disinfect surfaces such as floors, processing equipment and tanks, as well as for CIP. These sanitation systems are being used across a variety of food industry sectors, including the beverage, dairy, seafood, and fruit and vegetable industries.

Air Liquide America Corporation, Houston, TX

Reader Service No. 249



L. J. Star, Inc.

#### Sterile Visual Flow Indicators Meet FDA and 3-A Specifications

Designed to be mounted in-line for high purity applications, these sterile-design visual flow indicators provide operators with a clear view of flow of virtually any process pipeline fluid or powder. They feature an internal-flush style that meets FDA and 3-A specifications, based on a unique O-ring seal design that minimizes traps where bacteria can buildup. Polished stainless steel connections include sanitary clamp as standard, with butt weld and flange as special order items.

Other premium standard features include the use of borosilicate glass, a product contact surface of 220 Grit Electropolish and an armored housing to help protect the glass from external objects and pipe stress. Units can be used during SIP/CIP and sterilizing/autoclaving.

Units are available in tube OD sizes from 1/2 to 4 inches with

standard lengths from 2-3/4 to 6 inches, depending on OD and ratings up to 150 PSIG. Custom designs and lengths are also available.

Standard material of construction is 316L Stainless Steel with full material traceability. For corrosive service, Hastelloy® is also available. EPDM is the standard O-ring material with Silicone, Viton®, and FEP jacketed Silicone as options.

L. J. Star Incorporated,  
Twinsburg, OH

Reader Service No. 250

### Apprise Technologies' New UV Clean Radiometer Delivers Reproducible Results

Apprise Technologies, Inc. introduces the UV Clean™ Radiometer. This rugged, low cost handheld UVC radiometer is designed to monitor UV light sources used in a wide range of UVC applications from deactivating bacteria, viruses and other primitive organisms in air and water; to the cleaning of sensitive surfaces in the semiconductor industry. Critical to these applications is the need to monitor the instantaneous irradiance of UVC lamps inexpensively, quickly and with reproducible results.

The UV Clean, the latest UV radiometer product released to the market by Apprise, was designed to be an inexpensive measurement device, which delivers precise instantaneous irradiance readings. The Apprise UV Clean uses a solid-state photodiode detector, which is extremely stable with a low temperature coefficient to isolate the UVC radiation and does not allow any out-of-band signal to contaminate the reading.

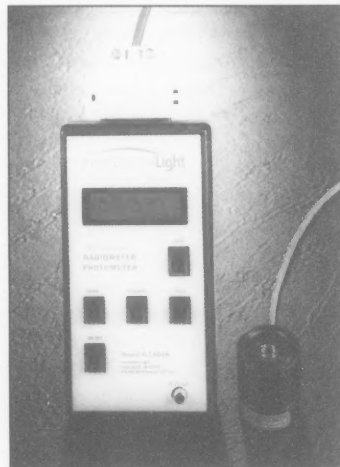
The UVC probe comes standard with a 10 ft. cable and is hermetically enclosed for submersion to 6 ft. The compact, size of the UV Clean is ideal for bench-

top and field use; the simple and reliable operation is well suited for even novice users.

The UV Clean calibration is directly traceable to a National Institute of Standards and Technology (NIST). NIST calibrated photodiode serves as the primary standard for UV Clean calibration. The accuracy of the UV Clean is ±5% typical, ±10% maximum. Apprise Technologies offers calibration services at their facility.

Apprise Technologies, Inc.,  
Duluth, MN

Reader Service No. 251



International Light, Inc.

### Portable Radiometers Test Germicidal and Bacterial UV Lamps from International Light

A line of hand-held radiometers for measuring the output of various types of germicidal lamps in a wide range of applications, to certify that their performance hasn't degraded over time, is available from International Light, Inc. of Newburyport, MA.

The IL1470 Germicidal Radiometer is designed for testing the intensity of germicidal and bacterial UV lamps to make sure they are performing within specification. Designed for ease-of-use, this portable instrument

features simple pushbutton operation and provides direct readouts in effective germicidal radiation.

Spectrally weighted to match the IES Luckiesh and DIN standard germicidal effective irradiance curves from 250 to 310 nm, the IL1470 Germicidal Radiometer is available with several detector/filter combinations for measuring low- and medium-pressure lamps. This hand-held instrument permits in-situ measurements and is NIST traceable.

International Light, Inc.,  
Newburyport, MA

Reader Service No. 252

### Shear Enhanced Anaerobic Digestion (SEAD) from Biothane Corp.

Biothane Corporation is pleased to introduce the SEAD (Shear Enhanced Anaerobic Digestion) Process.

The SEAD process is a high rate, short HRT, completely mixed anaerobic digestion process that is particularly suited for the digestion of sludge and other biodegradable solid wastes and slurries.

The SEAD reactor typically operates in a once through mode when treating sludge or slurry with total solids content of 4 percent weight or greater.

The substrate is mixed by circulating a large flow of mixed liquor from the bottom of the reactor via one or more high-shear nozzles in the top of the reactor downward into one or more draft tubes.

The process is operated at solids retention times between 4 to 12 days and reduces reactor volume as much as 50% thereby minimizing real estate and capital cost requirements.

Biothane Corporation,  
Camden, NJ

Reader Service No. 253

### **Heinkel Introduces the New Beaker Centrifuge for Testing Product on a Small Scale Prior to Production**

**H**einkel Filtering Systems has created the new beaker centrifuge to facilitate the testing of product using research quantities of formulations prior to scaling up to manufacturing quantities. The centrifuge contains two beakers with a maximum volume of 1.18 L each to filter and separate. Testing with these small volumes saves material, as little as five gallons of material can produce many trial runs from which to acquire data.

The centrifuge allows for testing at the same G-forces using various filter cloths and wash ratios as well as simulation of pressurization and drying. The unit has many of the same features as the Heinkel HF-Inverting Filter Centrifuge, is gas tight and totally enclosed, the variable frequency drive allows for high G-forces to be attained. Small cakes and pressure added centrifugation are possible.

Heinkel, Swedesboro, NJ

**Reader Service No. 254**

### **New BTE Pump/Mixer for Viscous Materials from seepex**

**S**eepex, Inc. has developed and introduced a new open hopper progressive cavity pump which incorporates a high volume auger and induction chamber into the pump design. The pump can handle viscosities to 700,000 cps, vegetable wastes and ground meat.

A ribbon mixer type auger can be substituted for the solid auger at an extra charge for high shear mixing and blending.

The pump can be constructed in special hopper lengths up to 10 feet.

seepex, Inc., Enon, OH

**Reader Service No. 255**

### **Temperature Indicating Labels and Monitoring Devices Meet Packaging & QC Needs, Ship Quickly from Dry Pak Industries**

**A** wide range of temperature indicating labels and monitoring devices available from Dry Pak Industries provide quick visual assurance that quality control standards have been monitored during storage and transit of temperature-sensitive food, nutraceutical, pharmaceutical, diagnostic, and electronic products.

Two types of temperature-indicating labels, reversible and irreversible, tell the current temperature of a product at a glance or indicate whether a critical temperature threshold has been violated. A low-cost reversible label applied to the shipping carton or pail of confectionery and other temperature-sensitive foods allows QC managers to verify cold storage conditions. These reversible labels use a liquid crystal thermometer that indicates current temperature on the "green bar" section of the label. Reversible labels are also

used in the medical diagnostic's industry to indicate temperature of specimens en route for laboratory analysis.

Dry Pak Industries offers irreversible labels that monitor conditions from -30°C to +300°C, as well as labels and tags that indicate how long a product has been exposed above critical temperatures. WarmMark™ and ColdMark™ Time Temp tags, used to monitor temperature during shipping and storage, are designed with three windows on the tag. Windows turn a tell-tale red as a product is exposed over or under critical temperatures for a brief time (30 minutes), a moderate time (2 hours) or a prolonged time (2 days). Typically placed on the outside of a pallet, irreversible tags and labels monitor temperature conditions as a product moves through the distribution system; up to 40,000 pounds of product can be monitored for less than \$20 US.

A full line of strip-chart temperature recorders from Dry Pak Industries provides inexpensive yet reliable continuous monitoring of temperatures while products are in transit. Placed inside a cargo container at the beginning of shipment, these disposable recorders produce a printed chart of temperature variation once the shipment reaches its destination. In-transit strip-chart temperature recorders are available in several run times from 5 to 60 days.

Dry Pak Industries Inc., Studio City, CA

**Reader Service No. 256**

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[www.foodprotection.org](http://www.foodprotection.org)**

# Coming Events

## AUGUST

• **12-16, Introduction to Food Science**, Rutgers College, New Brunswick, NJ. For further information, contact Keith Wilson at 732.932.9271; E-mail: kwilson@aesop.rutgers.edu.

• **17-22, 21st International Congress of Refrigeration**, Washington, D.C. For further information, contact Nadine George at 301.984.9450 ext. 11; E-mail: nadineg@conferencemanagers.com.

• **18-23, Food Micro 2002**, Lillehammer, Norway. For additional information, contact MATFORSK, Norwegian Food Research Institute, at 47.64.97.01.00; E-mail: foodmicro@matforsk.no.

## SEPTEMBER

• **9-10, HACCP I: Documenting Your HACCP Prerequisite Program**, Guelph Food Technology Centre, Guelph, Ontario, Canada. For more information, call Marlene Inglis at 519.821.1246; E-mail: gftc@gftc.ca.

• **10-11, Upper Midwest Dairy Industry Association Annual Meeting**, Holiday Inn, St. Cloud, MN. For more information, contact Paul Nierman at 763.785.0484.

• **10-14, National Society for Healthcare Foodservice Management (HFM) Training Conference**, Boca Raton Resort, FL. For additional information, call HFM at 202.546.7236.

• **11-13, HACCP II: Development of Your HACCP Plan**, Guelph Food Technology Centre, Guelph, Ontario, Canada. For additional information, contact Guelph Food Technology Centre at 519.821.1246; E-mail: gftc@gftc.ca.

• **17-19, New York Association for Food Protection Annual Meeting**, Holiday Inn, Syracuse/

Liverpool, NY. For more information, contact Janene Lucia at 607.255.2892.

• **18-19, Wisconsin Association of Milk and Food Sanitarians, Inc. Joint Conference**, Ramada Inn, Eau Claire, WI. For more information, contact Randy Daggs at 608.837.2087.

• **18-20, "Thinking Globally — Working Locally: A Conference for Food Safety Education,"** Radisson Hotel Orlando, Orlando, FL. For more information, call 202.314.3459; E-mail: fsis.outreach@usda.gov.

• **18-21, AWT Convention and Exposition**, Disney's Coronado Springs Resort, Orlando, FL. For further information, contact Carrie Harley at 800.858.6683; E-mail: charley@awt.org.

• **23-25, Indiana Environmental Health Association Fall Educational Conference**, University Inn, West Lafayette. For more information, contact Helene Uhlman at 219.853.6358.

• **24-26, Wyoming Environmental Health Association Annual Educational Conference**, Complex Center, Gillette. For more information, contact Sherry Maston at 307.322.9671.

• **24-27, Congrilait 2002, 26th IDF World Dairy Congress**, rue de Châteaudun, France. For additional information, call 330.1.49.70.71.71; E-mail: info@congrilait2002.com.

• **24-27, Techno Fidta 2002**, 6th International Food Technology, Additives and Ingredients Exhibition and Conference, Buenos Aires, Argentina. For further information, contact Julie Bernier at 207.842.5583.

• **25-26, ServSafe® for the Food Industry and Food Service**, Guelph Food Technology Centre, Guelph, Ontario, Canada. For

additional information, contact Guelph Food Technology Centre at 519.821.1246; E-mail: gftc@gftc.ca.

• **25-27, Washington Association for Food Protection Annual Meeting**, Campbells' Resort, Chelan, WA. For more information, contact Bill Brewer at 206.363.5411.

• **25-29, The 27th World Veterinary Congress, WORLDVET Tunisia 2002**, Tunis, Tunisia. For further information, contact www.worldvetunisia2002.com.

• **30-Oct. 4, Basic Dairy Technology Workshop**, Birmingham, AL. For further information, contact Kristy Morris at 205.595.6455 ext. 224; E-mail: us@randolphconsulting.com.

## 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.

• **21-23, Thermal Process Development Workshop**, Monarch Hotel, Dublin, CA. For addi-

tional 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.

• **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.

• **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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# Career Services Section

## POSITION ANNOUNCEMENT

DEPARTMENT OF PATHOLOGY AND MICROBIOLOGY  
COLLEGE OF VETERINARY MEDICINE  
UNIVERSITÉ DE MONTRÉAL

### TENURE TRACK POSITION IN VETERINARY HYGIENE

#### Requirements:

- Candidates should have a DVM degree and a Ph.D. degree in a pertinent field, e.g. food science.
- Candidates must demonstrate essential aptitudes for teaching and research and possess working experience in the field of meat safety.
- Candidates must possess excellent interpersonal and communication skills and a demonstrated ability to work with others in a collegial team atmosphere.
- Candidates must be able to communicate in French or be willing to learn French.

#### Duties:

- Active participation in teaching undergraduate (DVM) and graduate students (M.Sc., Ph.D. etc.).
- The selected person is expected to develop an independent research program.
- The selected person is expected to develop an expertise in different aspects of slaughterhouse and meat hygiene; furthermore, he/she should be familiar with HACCP and ISO concepts as they apply to "the gate and to plate" process.

In joining the Faculté de médecine vétérinaire de Université de Montréal, the new professor will find an institution where public health is important and where the multidisciplinary approach is valued.

**Salary:** Commensurate with candidate's qualifications and experience; within the bonds of the collective agreement between Université de Montréal and the faculty union.

**Starting date:** Jan. 1<sup>st</sup> 2003 or when selected candidate is available.

**Applications:** Applications will be accepted until **July 1st, 2002**. The search will continue after this date if a suitable candidate has not been found.

Candidates are invited to send a letter of interest and a curriculum vitae including names, addresses, telephone/fax numbers/email of 3 referees to: Dr. Roger Ruppanner, Chairman, Department of Pathology and Microbiology, Faculté de médecine vétérinaire, Université de Montréal P.O. Box 5000, Saint-Hyacinthe (Qc), Canada J2S 7C6 Telephone: (450) 773-8521, ext. 8146; Fax: (450) 778-8113; E-mail: [roger.ruppanner@umontreal.ca](mailto:roger.ruppanner@umontreal.ca) Web site: <http://www.medvet.umontreal.ca/>

In accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents of Canada. The University is committed to equal employment opportunity for women.



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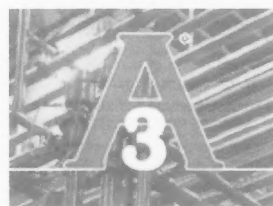
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 Postal Code/Zip + 4 \_\_\_\_\_ Country \_\_\_\_\_  
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## For Association Members Only

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DAIRY		FOOD		OTHER	
<input type="checkbox"/>	D1180 10 Points to Dairy Quality	<input type="checkbox"/>	E3220 The New Superfund: What It Is & How It Works - (5) Underground Storage Tank Trust Fund & Response Program	<input type="checkbox"/>	F2136 GMP Basics: Safety in the Food Micro Lab
<input type="checkbox"/>	D1010 The Bulk Milk Hauler: Protocol & Procedures	<input type="checkbox"/>	E3240 The New Superfund: What It Is & How It Works - (6) Research & Development: Closing Remarks	<input type="checkbox"/>	F2137 GMP Basics: Avoiding Microbial Cross-Contamination
<input type="checkbox"/>	D1050 Cold Hard Facts	<input type="checkbox"/>	E3245 Wash Your Hands	<input type="checkbox"/>	F2140 GMP Basics: Employee Hygiene Practices
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<input type="checkbox"/>	D1060 Frozen Dairy Products			<input type="checkbox"/>	F2150 GMP: Personal Hygiene and Practices in Food Manufacturing
<input type="checkbox"/>	D1070 The Gerber Butterfat Test			<input type="checkbox"/>	F2147 GMP Basics: Process Control Practices
<input type="checkbox"/>	D1080 High Temperature, Short-Time Pasteurizer			<input type="checkbox"/>	F2160 GMP: Sources & Control of Contamination during Processing
<input type="checkbox"/>	D1090 Managing Milking Quality			<input type="checkbox"/>	F2180 HACCP: Safe Food Handling Techniques
<input type="checkbox"/>	D1100 Mastitis: Prevention and Control			<input type="checkbox"/>	F2169 HACCP: Training for Employees - SIDA Awareness
<input type="checkbox"/>	D1110 Milk Plant Sanitation: Chemical Solution			<input type="checkbox"/>	F2172 HACCP: Training for Managers
<input type="checkbox"/>	D1120 Milk Processing Plant Inspection Procedures			<input type="checkbox"/>	F2171 The Heart of HACCP
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		<input type="checkbox"/>	E2010 Close Encounters of the Bird Kind	<input type="checkbox"/>	F2190 Is What You Order What You Get? Seafood Integrity
		<input type="checkbox"/>	E2015 Controlling <i>Listeria</i> : A Team Approach	<input type="checkbox"/>	F2210 Northern Delight - From Canada to the World
<input type="checkbox"/>	E5010 The ABCs of Clean - A Handwashing & Cleanliness Program for Early Childhood Programs	<input type="checkbox"/>	E2057 Cooking and Cooling of Meat and Poultry Products (2 Videos)	<input type="checkbox"/>	F2240 On the Front Line
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<input type="checkbox"/>	E5030 Air Pollution: Indoor	<input type="checkbox"/>	E2020 Egg Handling & Safety	<input type="checkbox"/>	F2270 Pest Control in Seafood Processing Plants
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<input type="checkbox"/>	E5055 Effective Handwashing-Preventing Cross-Contamination in the Food Service Industry	<input type="checkbox"/>	E2055 Fabrication and Curing of Meat and Poultry Products (2 Videos)	<input type="checkbox"/>	F2290 Product Safety & Shelf Life
<input type="checkbox"/>	E5060 EPA Test Methods for Freshwater Effluent Toxicity Tests (1 Using <i>Ceriodaphnia</i> )	<input type="checkbox"/>	E2059 Food for Thought - The GMP Quiz Show	<input type="checkbox"/>	F2220 Proper Handling of Peracetic Acid
<input type="checkbox"/>	E3070 EPA Test Methods for Freshwater Effluent Toxicity Tests (1 Using Fathead Minnow Larva)	<input type="checkbox"/>	E2040 Food Irradiation	<input type="checkbox"/>	F2230 Purely Coincidental
<input type="checkbox"/>	E3075 EPA: This is Super Fund	<input type="checkbox"/>	E2045 Food Microbiological Control (6 Videos)	<input type="checkbox"/>	F2310 Safe Food: You Can Make a Difference
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<input type="checkbox"/>	E3140 Putting Aside Pesticides	<input type="checkbox"/>	E2090 Food Safety: An Educational Video for Institutional Food Service Workers	<input type="checkbox"/>	F2450 SERVSAFE! Steps to Food Safety (6 Videos)
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<input type="checkbox"/>	E3170 The New Superfund: What It Is & How It Works-(1) Changes in the Remedial Process, Clean-up Standards & State Involvement Requirements	<input type="checkbox"/>	E2102 Tape 3-Personal Hygiene	<input type="checkbox"/>	F2580 Supermarket Sanitation Program - "Food Safety"
<input type="checkbox"/>	E3180 The New Superfund: What It Is & How It Works-(2) Changes in the Removal Process, Removal & Additional Program Requirements	<input type="checkbox"/>	E2103 Tape 4-Time and Temperature Controls	<input type="checkbox"/>	F2590 Take Aim at Sanitation
<input type="checkbox"/>	E3190 The New Superfund: What It Is & How It Works - (3) Enforcement and Federal Facilities	<input type="checkbox"/>	E2104 Tape 1-Basic Microbiology and Foodborne Illness	<input type="checkbox"/>	F2410 Wide World of Food Service Brushes
<input type="checkbox"/>	E3210 The New Superfund: What It Is & How It Works - (4) Emergency Preparedness & Community Right-to-Know	<input type="checkbox"/>	E2105 Tape 2- Handling Knives, Cuts and Burns	<input type="checkbox"/>	F2420 Your Health in Our Hands - Our Health in Yours
		<input type="checkbox"/>	E2106 Tape 3-Working Safely to Prevent Injury		
		<input type="checkbox"/>	E2107 Tape 4-Sanitization		
		<input type="checkbox"/>	E2120 Food Safety: For Goodness Sake, Keep Food Safe		
		<input type="checkbox"/>	E2110 Food Safety is No Mystery	<input type="checkbox"/>	M1010 Diet, Nutrition & Cancer
		<input type="checkbox"/>	E2130 Food Safety: You Make the Difference	<input type="checkbox"/>	M1020 Eating Defensively: Food Safety Advice for Persons with AIDS
		<input type="checkbox"/>	E2125 Food Safety Zone: Basic Microbiology	<input type="checkbox"/>	M1030 Ice: The Forgotten Food
		<input type="checkbox"/>	E2126 Food Safety Zone: Cross Contamination	<input type="checkbox"/>	M1050 Personal Hygiene & Sanitation for Food Processing Employees
		<input type="checkbox"/>	E2127 Food Safety Zone: Personal Hygiene	<input type="checkbox"/>	M1060 Psychiatric Aspects of Product Tampering
		<input type="checkbox"/>	E2128 Food Safety Zone: Sanitation	<input type="checkbox"/>	M1070 Tampering: The Issue Examined
		<input type="checkbox"/>	E2135 Get with a Safe Food Attitude		

Visit our Web site at [www.foodprotection.org](http://www.foodprotection.org) for detailed tape descriptions



# International Association for Food Protection®

6200 Aurora Avenue, Suite 200W  
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Quantity	Description	Member or Gov't. Price	Non-Member Price	TOTAL
	Procedures to Investigate Waterborne Illness—2nd Edition	\$10.00	\$20.00	
	Procedures to Investigate Foodborne Illness—5th Edition	10.00	20.00	
<b>SHIPPING AND HANDLING</b> — \$3.00 (US) \$5.00 (Outside US) Each additional booklet \$1.50		Multiple copies available at reduced prices. Phone our office for pricing information on quantities of 25 or more.		Shipping/Handling Booklets Total

## OTHER PUBLICATIONS

Quantity	Description	Member or Gov't. Price	Non-Member Price	TOTAL
	Pocket Guide to Dairy Sanitation (minimum order of 10)	\$ .60	\$ 1.20	
	Before Disaster Strikes...A Guide to Food Safety in the Home (minimum order of 10)	.60	1.20	
	*Developing HACCP Plans – A Five-Part Series (as published in <i>DFES</i> )	15.00	15.00	
	*Surveillance of Foodborne Disease – A Four-Part Series (as published in <i>JFP</i> )	18.75	18.75	
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Company \_\_\_\_\_ Job Title \_\_\_\_\_

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(Please specify:  Home  Work)

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IAFP occasionally provides Members' addresses (excluding phone and E-mail) to vendors supplying products and services for the food safety industry. If you prefer NOT to be included in these lists, please check the box.

## MEMBERSHIP CATEGORIES:

**Membership with JFP & DFES**  
12 issues of the *Journal of Food Protection*  
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**Membership with DFES**  
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# Invite a Colleague to Join

**The International Association for Food Protection**, founded in 1911, is a non-profit educational association of over 3,000 food safety professionals with a mission *"to provide food safety professionals worldwide with a forum to exchange information on protecting the food supply."* Members belong to all facets of the food protection arena, including Industry, Government and Academia.

## Benefits of Membership

- ◆ **Dairy, Food and Environmental Sanitation** — Published as the general Membership publication, each issue contains refereed articles on applied research, applications of current technology and general interest subjects for food safety professionals. Regular features include industry and association news, an industry-related products section and a calendar of meetings, seminars and workshops.
- ◆ **Journal of Food Protection** — First published in 1937, the Journal is a refereed monthly publication. Each issue contains scientific research and authoritative review articles reporting on a variety of topics in food science pertaining to food safety and quality.
- ◆ **Journal of Food Protection Online** — Internet access to abstracts and full text articles. Full text searching, active reference links, multiple delivery options, and table of contents alerting at your fingertips.
- ◆ **The Audiovisual Library** — As a free service to Members, the Library offers a wide variety of quality training videos dealing with various food safety issues.
- ◆ **The Annual Meeting** — With a reputation as the premier food safety conference, each meeting is attended by over 1,400 of the top industry, academic and government food safety professionals. Educational sessions are dedicated to timely coverage of key issues and cater to multiple experience levels.

## Promote YOUR Association to Colleagues

If you know someone who would prosper from being a Member, share with them the benefits of Membership, send them to our Web site, or provide us with their mailing address and we will send them information as well as sample journals. Together we are *Advancing Food Safety Worldwide!*



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