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FOOD PROTECTION TRENDS

SCIENCE AND NEWS

FROM THE
INTERNATIONAL ASSOCIATION
FOR FOOD PROTECTION

APRIL 2006



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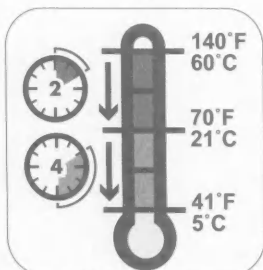
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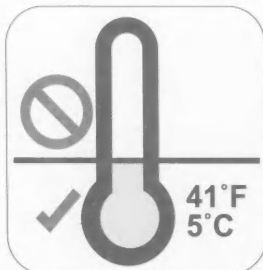
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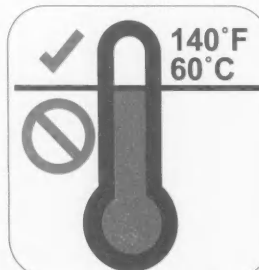
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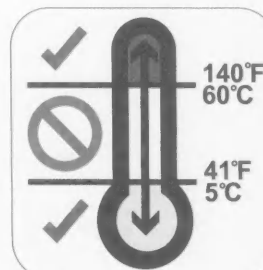
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The International Association for Food Protection (IAFP) Foundation Fund was established in the 1970s to support the mission of IAFP – "To provide food safety professionals worldwide with a forum to exchange information on protecting the food supply."



Advancing Food Safety Worldwide®

We live in a global economy and the way food is grown, processed, and handled can impact people around the world. From a public health perspective, it often provides unique challenges to food safety professionals. Combine these issues with the complexity of protecting the food supply from food security threats and the challenges seem overwhelming. However, with your support the Foundation can make an impact on these issues. Funds from the Foundation help to sponsor travel for deserving scientists from developing countries to our Annual Meeting, sponsor international workshops, and support the future of food scientists through scholarships for students or funding for students to attend IAFP Annual Meetings.

The Foundation is currently funded through contributions from corporations and individuals. A large portion of the support is provided from the Sustaining Members of IAFP. The Sustaining Membership program is a unique way for

organizations to partner with the Association. Contact the Association office if you are interested in this program.

Support from individuals is also crucial in the growth of the Foundation Fund. Contributions of any size make an impact on the programs supported by the IAFP Foundation. Programs currently supported by the Foundation include the following:

- Student Travel Scholarships
- Ivan Parkin Lecture
- John H. Silliker Lecture
(Funded through a contribution from Silliker, Inc.)
- Travel support for exceptional speakers at the Annual Meeting
- Audiovisual Library
- Developing Scientist Competition
- Shipment of *JFP* and *FPT* journals to developing countries through FAO

Donate Today!



It is the goal of the Association to grow the Foundation to a self-sustaining level of greater than \$1.0 million by 2010. This will allow the Foundation to provide additional programs in pursuit of our goal of *Advancing Food Safety Worldwide*!

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- Monthly listing of your organization in *Food Protection Trends* and *Journal of Food Protection*
- Discount on advertising
- Exhibit space discount at the Annual Meeting
- Organization name listed on the Association's Web site
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- \$750 exhibit booth discount at the IAFP Annual Meeting
- \$2,000 dedicated to speaker support for educational sessions at the Annual Meeting
- Company profile printed annually in *Food Protection Trends*

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- \$300 exhibit booth discount at the IAFP Annual Meeting



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Calgary, Alberta, Canada

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Disney's Contemporary Resort
Lake Buena Vista, Florida

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“PERSPECTIVES FROM NORTH OF THE 49TH”

I have just come back from Calgary where we held our Program Committee meeting, followed by our Executive Board meetings. First, let me tell you that Calgary is a beautiful city and I think you will be very impressed. The three hotels that we have picked for this meeting are all very close to the convention center where our scientific sessions will be held. The convention center itself has very nice décor and we have plenty of room this year for posters and all our exhibitors.

I want to tell you a little bit about the Program Committee meeting. This year's committee had a really daunting task as 557 abstracts were submitted, around 115 more than last year! Just to give you a rough idea, 5 years ago, in 2001, only 230 abstracts were submitted! Our committee this year was very ably led by Chairperson Vickie Lewandowski and Vice-chairperson Lee-Ann Jaykus. This year we had 4 new members join the committee, Linda Harris, Susan McKnight, Gloria Swick-Brown and Pascal Delaquis. It was also the first Program Committee meeting for Tamara Ford who took over as our Communications Coordinator. Tamara did an excellent job in her first meeting.

The way in which the abstracts were reviewed this year was a little different from previous years. For example, this year all authors' names were taken off the abstracts so as not to bias or influence the review of the abstracts. In addition, reviewers were arranged into four teams of three people, consisting of one



By **JEFFREY FARBER**
PRESIDENT

***“I think you will
all be pleased with
the wide selection
of symposia from
which one can
choose to attend
this year”***

industry, one government and one university representative. The abstracts that the teams had difficulty with or had rejected, were then re-reviewed by a team of 7 people. Thus, each abstract rejected was reviewed by a total of 10 people. Everyone on the committee felt that the process worked really well and that a fair and objective system of evaluation had been used to assess the submitted abstracts.

That being said, there are still a number of areas which the Board and the Program Committee will be looking to improve for next year. As one example, in a number of cases, abstract submitters did not follow the abstract guidelines. One possible way around this is to make the abstract guidelines more prescriptive in the sense that we could give headings such as title, methodology, results, main conclusions and significance of the work, then individuals would only need to populate those fields. There are other scientific societies who are prescriptive in this manner. What are your thoughts on this possible change for next year?

Another very exciting change is that two of the symposia this year will be very applied and presented in a roundtable format. A total of 90 minutes will be allocated to each roundtable. A moderator will speak for 10–15 minutes to set the stage and ground rules. Each speaker will give a brief presentation of no more than 7–8 minutes, with each ideally providing a different viewpoint. Then there will be 2 or 3 questioners who will have prepared questions to ask the speakers. The remaining time will be used for the audience to ask questions of the speakers and questioners. We hope you like this format and are looking forward to your feedback. One of the roundtables will be on issues surrounding raw milk, a very hot topic of late that we all should keep abreast of!

I think you will all be pleased with the wide selection of symposia from which one can choose to attend this year. Examples of the subject areas which we have not

discussed before in symposia at the Annual Meeting are; "Spores, Spores and More Spores—What is Spoiling My RTD Beverage?" and another on "International Food Law." In addition, we will have two symposia dealing with disasters; one on the aftermath of Hurricane Katrina and its effects on seafood safety and another on post-disaster cleaning and sanitation. We will also conduct three excellent workshops this year, the titles are shown in the ad below.

Prior to the Annual Meeting this year we will institute several

schedule changes that I think you will find very attractive. For example, we will extend the exhibit hours to 6:00 p.m. on Tuesday, and will include lunches and afternoon receptions on both Monday and Tuesday in the Exhibit Hall. Poster sessions will also be in the Exhibit Hall. This will give our Members more time to view the posters and exhibits, as well as more time to interact with colleagues. Other exciting changes will be discussed in future columns, so keep a watch in this space!

As always, I can be reached by E-mail at jeff_farber@hc-sc.gc.ca and would love to hear from you! Have a great month.

Quote of the month:

Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world. Science is the highest personification of the nation because that nation will remain the first which carries the furthest the works of thought and intelligence.

Louis Pasteur



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Subject to change

“COMMENTARY” FROM THE EXECUTIVE DIRECTOR

Membership is what drives the Association forward. We have been fortunate over the past year, to see growth in our Membership, both individuals and Sustaining. After three years (2002–2004) of remaining mostly stable, we experienced an increase of about 70 Members in 2005! We also added 10 to our Sustaining Member count. Membership levels so far in 2006 are outpacing our 2005 levels.

Our Gold and Silver Sustaining Member Program also experienced great increases over the past couple of years. At the end of 2003, we had seven Silver and two Gold Sustaining Members. Today we have ten Silver and seven Gold! Please review the listing on page 212 to find our newest Gold (BPI Technology) and Silver (Food Safety Net Services) Members. We welcome them both to our growing list of Sustaining Member supporters.

We are pleased that BPI Technology and Food Safety Net Services have chosen to join with other companies lending additional support to IAFFP and the IAFFP Foundation along with providing monies for a separate speaker travel fund. This speaks highly of those companies listed and of IAFFP. They have seen the value of information that IAFFP provides through our journals, the Annual Meeting and through networking with colleagues. If your employer is interested in supporting IAFFP in this way, please contact me to discuss further.

I mentioned the speaker travel fund and that it is supported through the Gold and Silver Sustaining



By **DAVID W. THARP, CAE**
EXECUTIVE DIRECTOR

“In your contact and communication with other food safety professionals, we encourage you to encourage them to consider IAFFP Membership”

Member Program. In just more than five years time, we built the fund to \$60,000 while supporting speaker travel in the amount of \$20,000. This program allowed us to assist nationally and internationally recognized speakers to travel to IAFFP’s Annual Meetings and deliver their research to our audiences. In most cases, these speakers would not have been able to present at our Annual Meetings without this help. For that, we thank our Gold and

Silver Sustaining Members for making the program work!

This year, for IAFFP 2006, we expect to spend more than \$15,000 on speaker travel. This is a vast improvement over the \$2,000 that we had available just six or seven years ago. Again, this is because our Sustaining Members have seen value in developing a fund to support speaker travel to the Annual Meeting!

We know there are many Members who actively promote IAFFP to their non-member colleagues. You can see what happens when this takes place – we experience Membership growth! In your contact and communication with other food safety professionals, we encourage you to encourage them to consider IAFFP Membership. We want to continue to see individual Membership increase along with our Sustaining Members.

Beginning in January of 2007, IAFFP will implement a new dues structure to allow Members a choice of what publications they want to receive. The dollar amounts need further study before announcing, but we will have a base level Membership that will be offered at a very reasonable price. This, we hope, will allow interested persons to join IAFFP without requiring a substantial dollar investment. This new “base level” Membership will include an electronic newsletter that all Members will receive. Then for those desiring *Food Protection Trends* or *Journal of Food Protection*, they may add them separately (or receive both) for additional fees. It is our hope that Membership will be more affordable for all Members! As more

details become available, we will share them with you.

We are proud of our Members and the work that they perform each and every day – to help make a safe food supply available for the world's consumers. We know the work you perform is important to the world's health and well-being. Without a food supply that can nourish the population, we cannot maintain a healthy workforce that is required to produce goods and services for the population. This is why we know our jobs here at the IAFP office are so important – for us to facilitate the transfer of

information among food safety professionals worldwide! What can be more important than the health of the population?

April begins thoughts of spring-time and warmer weather to those of us in the northern part of North America and that means that summer is just around the corner too. Spring and summer always bring a renewed look at life. Maybe it is because the trees begin to bud, leaves are popping out, and the flowers are beginning to bloom! Also, it is a time when people get out of their homes, go for walks, work in the yard and have outdoor

get-togethers. This is a fun time of the year! Get out and enjoy it!

A wonderful thing occurred while I was writing this column. Sharon Whitchurch from Microbial-Vac Systems, Inc. (located in Jerome, Idaho) called on the telephone and told me her company wanted to become a Gold Sustaining Member! Bruce Bradley, the company's president will be the main contact. In addition, Microbial-Vac Systems will exhibit their products and services with us at IAFP 2006 in Calgary. They will be included in the May Sustaining Member listing and we welcome their active participation.

OUTDOOR ADVENTURE IN KANANASKIS

Thursday, August 17 • 8:30 a.m. – 2:30 p.m.



Welcome to the REAL WEST! Transfer by exclusive coach to Kananaskis Country for a morning of activities in the beautiful Canadian Rockies.

Tucked away in the spectacular Kananaskis Valley, Boundary Ranch is the perfect setting for an Alberta Barbecue. Lunch at Boundary Ranch offers the opportunity to relax and watch the trail rides leave the corral, get involved in activities like horseshoes or roping or take a picturesque stroll through the mountains surrounding the ranch.

Consider the additional activities offered for a small fee. Optional activities:

- Biking in Kananaskis
- Voyageur Canoe Ride
- Kananaskis Hiking Tours
- Horseback Trail Ride at Boundary Ranch
- Whitewater Rafting on the Kananaskis River

Go to page 263 to register.



A Methodological Approach for Assessing the Microbial Contamination of Fresh Produce from Harvest to Retail

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SUMMARY

Fresh fruits and vegetables are vehicles for pathogens associated with foodborne illness. This paper describes a methodological framework for following specific lots of produce in order to monitor their microbial contamination as they move through the production and distribution system (under commercial operations, from field to retail display). The success of this methodology depends on: (1) proper scheduling of replicates and sampling; (2) a color-coded tagging system to track the samples; and (3) close collaboration among the participants involved (researchers, growers, wholesalers and retailers). The color-coded tagging system allows easy access to information about the grower, the field, and the time and date of harvest. The monitoring of microbial contamination throughout the food supply chain can provide better understanding of the sources of contamination and of the ecology of foodborne pathogens, which will contribute to development of methods or techniques to prevent contamination. The sampling methodology proposed is designed to assess the microbiological load of fresh produce, but it could also easily be used to track other aspects of produce quality (e.g., nutrient content) or to obtain information on biological, environmental and management factors needed by the produce industry and by food inspection or public health departments.

INTRODUCTION

Food contamination with hazardous biological agents remains a worldwide challenge in food safety and nutrition (25, 35, 39). Sewell and Farber (37) estimated that 2.2 million people contract foodborne illnesses each year in Canada, with an economic cost of more than \$2 billion in 2001. The cost in the United States is believed to approach \$10 to \$83 billion annually (45). The Economic Research Service of the US Department of Agriculture (42) has estimated that the costs associated with five foodborne pathogens (*Campylobacter*, *Salmonella* (non-typhoidal), *Escherichia coli* O157:H7 and non-O157 STEC, and *Listeria monocytogenes*) were approximately \$6.9 billion in 2002. A foodborne illness outbreak is defined by the Centers for Disease Control and Prevention (CDC) (8) as the occurrence of two or more cases of a similar illness resulting from the ingestion of a common food. Increases in foodborne illness due to consumption of contaminated fresh fruits and vegetables, including lettuce, green onions, unpasteurized apple juice or cider, carrot, cabbage, raspberry, celery, tomatoes and melons, either cultivated in or imported to North America,

A peer-reviewed article

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have been documented (2, 3, 7, 9, 10, 28, 43). Tauxe et al. (39) noted that outbreaks associated with fruits and vegetables had more than doubled between the period 1973–1987 (4.3% of total outbreaks) and 1988–1991 (9.75%). Zepp et al. (48) reported that CDC data for the period between 1988 and 1992 indicated that fruits and vegetables were the vehicle for 64 of 1,072 (6%) foodborne illness outbreaks in which specific foods were identified, and fresh produce was associated with 2,448 of 48,475 (5%) cases of illness. The Scientific Committee on Food (36) reported the frequency of produce-related outbreaks between 1992 and 1999 to be 4.3% and to be similar in Europe and the United States.

The steps involved in the movement of fresh produce through the various markets (or supply chains) are variable, diverse and numerous. The changing nature of produce supply chains may have an impact on produce safety, given the many steps and increasing distances between production and retail. Pathogens of human or animal origin may be introduced to fresh produce at any point during production, harvest, postharvest handling, processing, storage, transportation and retailing. Fecal contamination from wild or domestic animals, soil, water, air, unsanitary processing or storage facilities and human handlers are the principal sources of hazardous microorganisms in fresh fruits and vegetables (2). Subsequent proliferation can be slowed down by the maintenance of low temperatures at all steps of the distribution chain (4). Unfortunately, breaks in the cold chain between the farm and the consumer sometimes occur, particularly during postharvest handling, wholesale handling, transportation and retail handling (21). The increased recognition of the value of applying HACCP (Hazard Analysis Critical Control Points) principles to the production and distribution systems used for marketing fresh fruits and vegetables has stimulated an ongoing debate, in the past 10 years, over the role of temperature as a valid critical control point in food safety plans for fresh produce (44). The management of produce temperature has an important role in limiting microbial proliferation and therefore in reducing the potential for foodborne illness, particularly if pathogens are present on the produce at the beginning of the supply chain, e.g., at harvest, or during postharvest or wholesale storage.

Relatively little is known about the level, origin and fate of potential human pathogens in fresh fruits and vegetables

through the entire system of production and distribution (under commercial operations from field to retail), and lack of quantitative data on the risks associated with each step in the continuum limits the development and application of effective control measures. Although recommended management practices and guidelines exist for fresh produce, these tend to be qualitative and general. Furthermore, guidelines developed for the production and distribution system are often broadly applied despite inherent differences between individual commodities (43, 44).

Various experimental approaches have been used in research on the origin and fate of enteric or pathogenic microorganisms in fresh produce. Sampling of produce at a single step in the supply chain can yield data on the level, frequency or risk of contamination at this step for a given commodity. Examples of such surveys are provided in Table 1. Data from these studies indicate that produce may be contaminated with various types of microorganisms, but little can be inferred about their origin or fate. Studies that follow the microbial quality from harvest or processing to retail display have been applied to other refrigerated foods but, to our knowledge, rarely to fresh produce. Gill et al. (17, 18, 19) followed shipments of beef from the packinghouse to retail display and, on the basis of measurements taken at several stages in the distribution system, established the effect of temperature and time on the microbiological quality of the meat. Similar studies using integrated approaches are necessary to establish the behavior of microbial contaminants in produce from production to retail, which would allow for a more accurate assessment of the risks posed by microbial hazards in fresh produce (35). As far as we know, no such studies have been reported. Allende et al. (1) attempted to establish the effect of various operations (reception, shredding, washing, draining, rinsing, etc.) on the microbiological quality of commercial fresh-cut lettuce; however, the impact of agronomic practices and distribution was not examined.

Tracking and sampling of specific lots of produce from harvest to retail display is a complex undertaking. In particular, the development of integrated approaches must take into account the potential variables at all steps in the production and distribution system. The present work describes a practical framework for such studies and highlights important considerations for building effective tracking and sampling schemes for fresh produce in commercial operations.

Microbiological considerations

The microbial ecology of fresh produce is complex. At harvest, plants carry mixed microbial populations that may include species living in mutually beneficial, symbiotic relationships with the healthy plant; potential phytopathogens; or accidental biological contaminants derived from environmental sources such as manure or untreated irrigation water. Other microbial species may colonize the produce during harvest and downstream handling or processing. Any or all of these microorganisms can exploit opportunities for growth when mechanical damage or senescence provides access to nutrients contained within plant tissues. Selective pressures derived from agronomic or environmental factors (e.g., drought, field conditions, cultivation techniques), postharvest treatments, intrinsic properties (physical structure, pH, availability of growth substrates, antimicrobial factors) and processing (washing, application of antimicrobials, storage atmospheres, temperature, contact with workers) influence the success of establishment and growth of individual microbial species and the composition of microbial communities in products derived from individual plants (4, 5, 6, 9, 10, 25, 26, 41). These factors must be considered in the development of appropriate sampling schemes for horticultural and agricultural products. Furthermore, development of meaningful sampling plans must take into account variability induced by the inherent inability to re-examine the same product along the chain, due to the destructive nature of microbiological analyses.

Participant involvement

Successful field studies on the microbiology of fresh produce require effective collaboration between all participants, from grower to retailer. Effective collaboration can be facilitated when wholesalers are involved in selecting the produce, the growers and the retail stores for a particular study. One must be careful, however, not to bias the selection process, and all requirements or constraints need to be presented up front. A meeting with participating researchers, growers, wholesalers and retailers provides a forum to ensure that the objectives of the research project, experimental plan, sampling requirements and operational details are communicated clearly. This is essential to provide accuracy in subsequent sampling and the collection of relevant information at each sampling

TABLE 1. Previous microbial contamination surveys of fresh produce sampled at one or several steps in the food supply chain^a

Microorganisms analyzed	Produce sampled	Location of sampling	Ref
- Coli-aerogenes bacteria, <i>E. coli</i>	- Comestible vegetables and fruits	- Market (Greece)	31
- <i>Salmonella</i> , <i>Shigella</i> , enteropathogenic <i>E. coli</i>	- Ambarella, ash plantain, gaduguda, lavalu, lovo, mango, mangosteen, orange, plantain, passion fruit, papaw, rambuttan, veralu, wood apple, wild olive, ash pumpkin, gourd, cucumber, pumpkin, beet root, cabbage, carrot, celery, gotukola, kankun, king jam, kohila, leek, lettuce, lotus root, norkoal, nivithi, onion, potato, radish, rhubarb, sarana, spinach, sweet potato, yam, breadfruit, brinjal, green bean, capsicum chilli, drumstick, elabattu, green chilli, ladies' finger, long bean, tomato, pulses	- Market and hospital distribution center (Ceylon)	47
- Fecal coliform, <i>Klebsiella</i> sp., <i>Enterobacter</i> sp., <i>Citrobacter</i> sp.	- Beet + top, carrot + top, green onion, lettuce, radish + top, tomato, celery	Market (Canada)	11
- <i>E. coli</i> , fecal streptococci, <i>Salmonella</i>	- Local: Cabbage, endive, lettuce Imported: Artichoke, avocado, beans, broccoli, cabbage, cauliflower, celery, chicory, chilli, courgette, egg plant, endive, fennel, kangkoeng, kouseband, lettuce, mango, pear, radish, spinach, sweet pepper (paprika)	- Local: shops or markets (Netherlands) Imported into Netherlands: Directly from importers or from retail shops	38
- Aerobic colony count, <i>Salmonella</i> , <i>Shigella</i>	- Carrot, cucumber, greens, green bean, lettuce, parsley, tomato	- Hotels, restaurants, food service outlets, markets or street vendors (Egypt)	34
- Serotypes of <i>Salmonella</i>	- Carrot, chive, garlic, leek, beet, mushroom, onion, potato, sweet potato, turnip, bean, broadbean, cucumber, eggplant, marrow, pepper, pumpkin, tomato Leaves of artichoke, asparagus, beet, brussel sprout, cabbage, cardoon, cauliflower, celery, endive, escarole, lettuce, parsley, spinach	- Fields, retail stores, or distribution centers (Spain)	15
- Aerobic bacteria, coliform bacilli, <i>E. coli</i> , <i>Salmonella</i>	- Artichoke, asparagus, beet, brussel sprout, cabbage, cardoon, cauliflower, celery, endive, escarole, lettuce, parsley, spinach	- Field, wholesale market, supermarkets or small shops (Spain)	16
- <i>L. monocytogenes</i>	- Beet, broccoli, cabbage, carrot, cauliflower, corn, lettuce, mushroom, potato, spinach	- Local supermarket (United States)	33
- <i>Listeria</i> species	- Celery, lettuce, radish, tomato	- Retail stores (Canada)	12

TABLE 1. Previous microbial contamination surveys of fresh produce sampled at one or several steps in the food supply chain^a

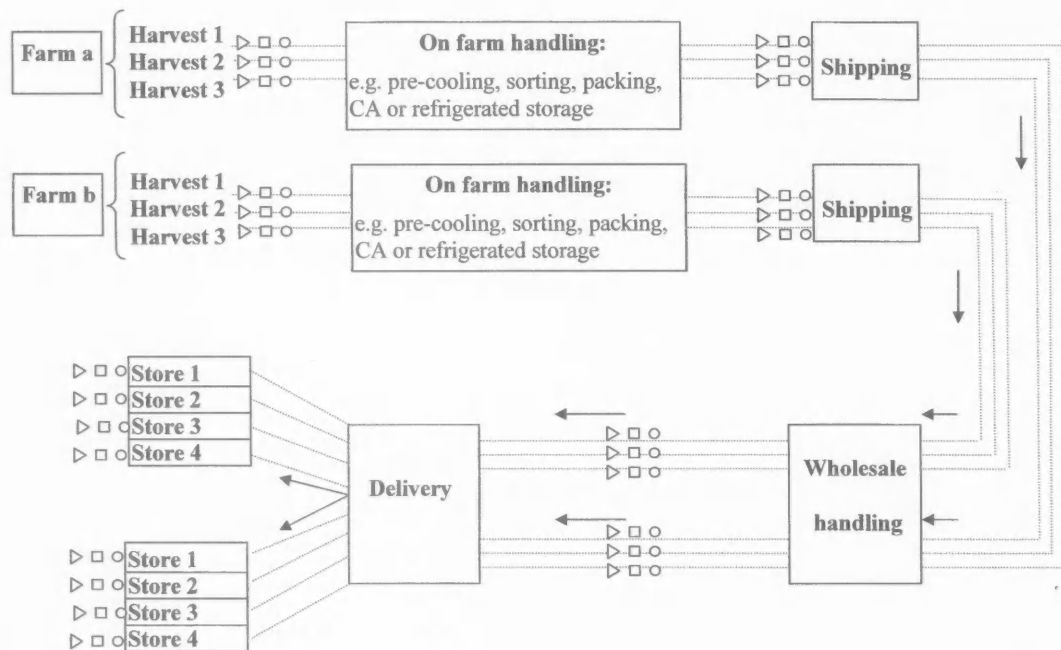
Microorganisms analyzed	Produce sampled	Location of sampling	Ref
- <i>Listeria</i> spp.	- Broccoli, cabbage, carrot, cauliflower, cucumber, lettuce, mushroom, potato, radish, tomato	- Supermarkets (United States)	22
- <i>Campylobacter</i> spp.	- Cabbage, carrot, celery, cucumber, green onion, lettuce, parsley, potato, spinach, radish	- Farmers' markets or supermarkets (Canada)	32
- <i>Listeria</i> spp.	- Bean sprout, cabbage, sweet potato, tomato	- Retail (United Arab Emirates)	20
- <i>L. monocytogenes</i>	- Iceberg lettuce, carrot	- Fields, processing plant (Canada)	13
- Aerobic plate count, <i>Bacillus cereus</i> , coliforms, <i>E. coli</i> , <i>Listeria</i> spp.	- Cabbage, carrot, celery, cucumber, green pepper, Japanese radish, lettuce, onion, spinach, Welsh onion	- Food factories (Japan)	24
- Bacteria and yeast	- Broccoli	- Markets (Australia)	30
- Coliforms, <i>E. coli</i> O157:H7, <i>Shigella</i> , <i>Salmonella</i> , aerobic plate count	- Imported (21 countries): broccoli, cantaloupe, celery, cilantro, culantro, lettuce, parsley, scallion, strawberry, tomato	- Imported: shipped refrigerated to District Servicing Laboratory (United States)	46
- <i>Yersinia enterocolitica</i>	- Lettuce	- Retail shops (Finland)	14
- Aerobic plate count, total coliform count, <i>E. coli</i> , yeast, mold	- Broccoli, cauliflower, celery, lettuce, sprouts	- Retail (United States)	40
- Thermotolerant coliform bacteria, <i>E. coli</i> O157:H7, <i>Salmonella</i> spp., <i>L. monocytogenes</i> , <i>Staphylococcus</i> spp., <i>Yersinia enterocolitica</i>	- Local: lettuce, pre-cut salad, growing herbs, parsley/dill, mushroom, strawberry Imported: lettuce, parsley/dill, mushroom, strawberry Unknown: lettuce, growing herbs, parsley/dill, mushroom, strawberry	- Distributors and retail outlets (Norway)	23
- Total coliforms, viable count, <i>Salmonella</i> , <i>Vibrio</i> spp., <i>E. coli</i>	- Amaranthus, lettuce, tomato, garden egg, cabbage, carrot	- Fields (Nigeria)	29
- Coliform count, <i>E. coli</i> , <i>Salmonella</i>	- Apple, bok choy, broccoli, cabbage, cucumber, green pepper, leafy greens, lettuce, onion, summer squash, strawberry, tomato, zucchini, and other produce	- Conventional fields Organic fields (United States)	27

^a When produce was sampled at more than one step, it was not specified whether the produce had gone through the same supply chain.

FIGURE 1. Schematic representation of a step-wise sampling scheme used to track specifically identified lots of fresh produce in a production and distribution system from harvest, to packing, to wholesale warehouse, to retail display.

In this example, at the first step on both farms (harvest), each symbol corresponds to the sampling of produce from a different lot, with each lot consisting of produce harvested at a different time of day: early morning (lot#1); mid-morning (lot#2); and late morning (lot#3)] during a visit to the farm. Both farms were visited three times. At all other steps in the supply system, each symbol corresponds to the sampling of produce from each lot. Produce from each farm is sold in the same four retail stores.

CA = Controlled atmosphere.



step. In some cases, formalized agreements (confidentiality, intellectual property, material exchange) with individual participants may be required. Pertinent information should be gathered at this stage to define operational practices and their impact on sampling. Factors to be considered at the farm level would include the history and location of the field; date of planting and planting frequency; type and quantity of pesticides and fertilizers used; origin and quality of water used for irrigation, cleaning or washing, cooling and ice making; on-farm storage conditions (e.g., temperature, type of infrastructure); handling procedures; and transportation and shipment. At the wholesale and retail level, storage conditions (duration and temperature) as well as handling and display procedures should be documented. Follow-up meetings to brief the participants on results are also useful in serving to strengthen a sense of contribution to the overall effort.

Identification of sampling steps

Previous research has frequently targeted only one or a few steps in the fresh produce supply chain. Hindrances to more extensive sampling may include lack of resources (financial, temporal or human), difficulty in monitoring appropriate parameters, and complicated, time consuming sampling design. The approach proposed herein consists of a step-wise sampling scheme in which a part of the produce lot is sampled at several steps. The flowchart in Fig. 1 summarizes the sampling approach and shows that samples are collected when produce is transferred from one step in the supply chain to the next. The first set of samples is collected in the field at harvest.

For the assessment of spatial and/or temporal variation in the level of produce contamination, the field may be separated into several sections based on the grower's harvest operations. Each section could

represent a lot harvested at a different time. Farms may be visited several times during the season, depending on the level of available resources. Sampling could also be done in the same section but over several time periods, depending on the type of produce and research objectives. Producers should be located in the same general geographical area to reduce the influence of environmental or climatic factors. Ideally, produce from two or three fields should be assessed and two or three samplings should be conducted in the same fields. Greater replication enhances the confidence level and can provide information about temporal and/or spatial variation within and between fields. The latter is of particular value, because uncertainty about spatial variation in microbial contamination in the field (and other steps of the distribution system) hinders the development of effective mitigation processes to limit such contamination (30).

Identification and tracking of experimental produce lots

Harvest and post-harvest handling operations can differ among growers. Depending on the commodity, harvested produce may be placed in plastic containers or wooden bins in the field. In addition, the freshly harvested produce may be rapidly cooled prior to storage, using one of several pre-cooling techniques: immersion in ice or ice water, evaporative cooling, force-air cooling, or vacuum cooling. Color coded tags can be used to identify wooden bins or plastic tubs employed at harvest and to ease tracking of the produce through the pre-cooling operations. If the objective is to evaluate potential points where cross-contamination may occur because of use of reusable containers, a separate tracking system for the containers would be needed.

Produce destined for immediate marketing may be placed directly in refrigerated storage for short periods of time prior to transport, while controlled atmospheres (CA) may be applied for longer storage periods. Most commodities are sorted and packed in cardboard boxes or plastic reusable containers upon removal from the storage area. For downstream tracking of produce leaving the farm, the same color coded tags may be fastened to all four sides of the boxes or containers of the same lot. Each color should correspond to well-defined codes, for example, three-digit codes in which the first digit represents the farm code and can identify the farm of origin, the second digit the date of harvest, and the last digit the lot number or time of harvest. Where individual units within the lot are sampled (e.g., a broccoli bunch or a bag of apples), additional markers (e.g., tags or rubber bands) of different colors may be affixed to the unit. Where produce from several harvest times is sampled, the different colors on the individual units can correspond to the time of day. The use of a simple color code is particularly advantageous when the experimental lots arrive at the retail level, where employees can be instructed to place lots of produce with the same color code in the display cases as required.

Environmental monitoring in the supply chain

The temperature of coded lots of produce should be monitored throughout the supply chain. Small temperature

recorders (Hobo Temp, model H08-001-02, ONSET Computer Corporation, Bourne, MA) are ideally suited to this purpose. These instruments are reasonably resilient and, in some cases, can be placed in containers at harvest and recovered at the retail outlet. Given their cost, it is recommended that only one recorder be inserted per group of boxes going through the same supply chain from harvest to retail display. Where processes such as hydrocooling and washing are performed, other traditional methods (e.g., thermocouple probes) may be used to measure temperature changes during processing; the use of electronic recorders can then be limited to post-processing handling. Tracking and retrieval of recorders may require the application of additional visual markers for prompt retrieval. For accuracy, temperatures of sampled produce are best measured with a thermocouple probe. Produce sensitive to water loss may have to be distributed under conditions of high relative humidity (RH). Automated RH recorders are available for this measurement.

Sampling

As previously described, samples from each lot are selected at each step of a production and distribution system. A sufficient number of marked or tagged boxes of produce are needed to be able to randomly select enough samples at each step of the supply chain. To avoid sampling the same box twice, boxes should be removed from distribution after sampling. One should make sure that the statistical design of the sampling scheme is robust enough so that missed samples can be tolerated. One should also maximize the number of replicates in order to ensure adequate accuracy of the measurements taken.

Microbial analyses of samples

Proper sample containment and refrigeration are essential when fresh produce samples must be transported to a remote laboratory, and microbiological analyses should be conducted within 24 h. General microbiological analyses include estimates of populations for fecal coliforms, *Escherichia coli*, viable aerobic bacteria, and yeasts and molds. Additional tests can be performed depending on the goals of the study.

It is obvious that the sampling procedure and the sampling points in the supply chain will differ, depending on the type of produce and analysis required. Importantly, all modifications from the standard sampling protocol should be

noted for further repeated analyses on similar produce. This will allow for meaningful data comparisons and therefore a better understanding of the variations in the origin of produce contamination between farm and retail.

Additional considerations

There is a pressing need to standardize procedures for sampling and analysis in studies on fresh produce microbial contamination. The present paper examines the measures required to help reduce uncertainty as to the origin of such contamination. Monitoring fresh produce from the farm to the retail store is crucial to better understand the potential level of contamination along the production and distribution chain. The methodologies to be used in assessing each step in the supply chain can be complex because of all the elements that can influence the type and level of contamination and the entry points. The sampling scheme proposed in this paper, although not exhaustive, can produce better understanding of the types of contamination and their sources. It may also help inspectors and food agencies to effectively determine the most common points of contamination in the supply chain. This methodology has been used for microbial analysis of fresh produce (Dallaire et al., in progress), but it can also be applied to other studies, such as evaluation of fresh fruit and vegetable quality, nutritional value or pesticide residues, or it can be applied to produce traceability. Many additional factors can be measured or controlled, depending on the purpose of the study. For example, participating growers could be located in the same region to reduce climatic variation, or they could be located in different regions to study variation among regions and/or climates.

To conclude, the proposed sampling methodology brings three important advantages: (1) the elaboration of proper scheduling of replicates to prevent unwanted duplication and to address timing considerations; (2) the establishment of a recognizable tagging system to efficiently track the samples throughout the production and distribution system; and (3) a close collaboration with all participants (researchers, growers, wholesalers and retailers) to reduce the likelihood that samples may be missed or misidentified. The ability to trace the source of any foodborne contamination is of great importance to any health department or food agency, especially in view of the now-global nature of our food supply. A tag-

ging system like the one presented herein may be helpful to identify grower, field, time and date of harvest for research studies or for produce traceability. Easier identification of sources and factors contributing to microbial contamination of produce with this methodology can lead to recommendations regarding prevention methods in the various steps of production and distribution systems. This could further reduce the public health risks that are associated with the consumption of fresh produce.

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Changes in Microbiological Populations on Beef Carcass Surfaces Exposed to Air- or Spray-chilling and Characterization of Hot Box Practices

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SUMMARY

This study: (i) evaluated changes in Aerobic Plate Counts (APC), Total Coliform Counts (TCC), *Escherichia coli* Biotype I Counts (ECC), and prevalence of *E. coli* O157:H7 on samples from beef carcasses subjected to spray-chilling or air-chilling, (ii) compared APC, TCC and ECC recovered from the upper region (round and flank) vs. the lower region (brisket) of carcasses before and after chilling (~ 48 h), and (iii) characterized carcass hot box practices by comparing carcass handling and chilling procedures at different plants. Carcasses at Plants A and B received both treatments (spray-chilling and air-chilling), whereas carcasses at Plant C received only the spray-chilling treatment. Overall, cold carcass APC, TCC and ECC were similar ($P > 0.05$), regardless of chilling treatment, at Plants A and B. Hot carcass APC were lower ($P < 0.05$) for upper carcass sites (3.5 log CFU/100 cm²) than for lower ones (4.2 log CFU/100 cm²); hot carcass TCC and ECC did not show this site difference ($P > 0.05$). Of the hot carcass samples in plants A and B, 0.4 and 6.3% tested positive for *E. coli* O157:H7, respectively; no carcass samples tested positive after chilling. At Plant C, 1.5% of pre-chilled samples were positive for *E. coli* O157:H7, compared to 4.9% of the samples collected from carcasses after chilling. Average time for carcass surface to reach ~ 4°C during chilling was 11.0, 9.33, and 21.7 h at Plants A, B, and C, respectively, regardless of chilling treatment.

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TABLE 1. Individual carcass sample collection at plants A, B and C. Individual sample collections were blocked by plant (A, B or C) and separated by chilling treatment (spray-chilling or dry-chilling), and sample type (pre-chill or post-chill carcass samples). A sample is defined as one sterile sponge used to swab five consecutive beef carcasses. Phase 1 of sample collection at Plant C was completed before a plant-wide suspension of operations and thorough plant sanitation, as well as adjustments to management and carcass handling. After plant operations were resumed, Phase 2 of sample collection at Plant C was conducted. No carcass sides at Plant C received the dry-chilling hot box treatment

Plant	Chilling treatment	Pre-chill N = samples (carcasses)	Post-chill N = samples (carcasses)
A	Spray	110 (550)	151 (755)
	Dry	193 (965)	200 (1000)
	Spray	157 (785)	151 (755)
	Dry	73 (375)	66 (330)
B	Spray	250 (1250)	256 (1280)
	Dry	257 (1285)	250 (1250)
C	Spray (Phase 1)	139 (695)	136 (680)
	Spray (Phase 1)	127 (635)	130 (650)
	Spray (Phase 2)	130 (650)	139 (695)
	Spray (Phase 2)	136 (680)	127 (635)
Total		1574 (7870)	1610 (8050)

INTRODUCTION

Spray-chilling involves the intermittent application of potable water to the surface of carcasses during the initial stage (usually the initial 8–12 h) of chilling following dressing (22). This process reduces evaporative water losses from carcass surfaces and thereby helps minimize weight reduction. Carcass weight loss due to evaporation of water can be reduced by 0.5 to 1.5% by water-spray application during the first 24 h of chilling (1, 14). Because carcass shrinkage is an important financial factor for the beef industry, scientific research has been conducted (8, 10, 12) to determine if increased water activity on carcass surfaces during chilling has a significant effect on microbial activity. Hippe et al. (12) found that spray-chilled sides had higher total aerobic and mesophilic facultative anaerobe counts than air-chilled carcass sides had; psychrotrophic aerobic, psychrotrophic facultative anaerobe and lactic acid bacteria counts of spray-chilled sides tended to be higher as well. Conversely, Stopforth et al. (22) found that simulated spray- and dry-chilling treatments resulted in comparable microbial reductions on beef carcass tis-

sue samples inoculated with acid adapted and non-acid adapted *Escherichia coli* O157:H7. According to Doyle and Schoeni (8), spray-chilling of carcass sides may result in fewer pathogenic organism generations, due to a more rapid rate of carcass surface temperature decline caused by the increased water evaporation. Carcass surface temperature is not the single limiting factor in proliferation of pathogenic bacteria (8). The time required for carcass surfaces to reach a temperature low enough to retard microbial proliferation is also critical, because slow cooling rates may allow bacteria to proliferate on moist carcass surfaces, producing shifts in microbial profiles (6).

Following splitting and evisceration of carcasses, sides are chilled and held for 36–50 hours until fabrication in large coolers, referred to as hot boxes. The microbiological profiles of carcasses exiting the hot box depend heavily on initial contamination of hot carcasses, application of good manufacturing practices (GMP), dedication of employees, and the upkeep of a properly constructed and operating hot box, as well as other associated factors (15). The outer surfaces of beef carcasses are often included in trimmings destined for ground product, making con-

trol of pathogenic bacterial levels on carcasses before and after chilling critical (20). The efficiency of multiple intervention hurdles applied before chilling for decontamination may be nullified by poor hot box GMP. Therefore, it is imperative that plants implement rigid, yet practical, guidelines for proper handling and storage of carcasses during chilling, as recommended by Schmidt et al. (20).

Gill and Landers (10) stated that although results of past research show little difference in the microbial profiles between dry- and spray-chilling methods, some commercial plants have implemented slower, extended spray-chilling systems to reduce the risk of cold shortening and its associated decreases in product tenderness. These changes, combined with the antimicrobial hurdles being applied at most North American beef processing facilities, could affect the microbiological status of carcasses. Because past research was conducted on carcasses not exposed to current antimicrobial intervention strategies (10), the effects of microbial decontamination methods in conjunction with combinations of current spray-chilling practices are uncertain and require further investigation (10). The objectives of this study were to examine

TABLE 2. Intervention strategies implemented at each plant before carcass chilling. Concentrations of lactic acid used in both pre- and post evisceration interventions were increased from 2% to 5% for Phase 2 of sample collection at Plant C

Intervention strategy	Plant		
	A	B	C
Pre-harvest intervention (<i>L. acidophilus</i>)	N	Y	N
Pre-evisceration steam-vacuum	N	Y	N
Pre-evisceration lactic acid spray (2–2.5%)	Y	Y	Y
Ambient temperature water wash	Y(post)	Y(pre)	Y(post)
Hot water wash	Y(both)	N	Y(post)
Post-evisceration warm water rinse	N	Y	N
Post-evisceration zero-tolerance knife trimming	Y	N	Y
Post-evisceration hot water pasteurization	N	Y	N
Lactic acid final intervention (2–2.5%)	Y	Y	Y

Y, implemented at plant. N, not implemented at plant. (pre), pre-evisceration intervention. (post), post-evisceration intervention. (both), intervention implemented at pre- and post-evisceration sites.

the effects of two chilling methods (spray-chilling vs. dry-chilling) and surface temperature declines, in conjunction with modern carcass decontamination methods, on microbial profiles of beef sides before fabrication, and to identify superior hot box practices by comparing slaughter floor and hot box techniques and subsequent outcomes at three different commercial beef packing facilities.

METHODS AND MATERIALS

Processing plants

Samples were collected at three commercial beef packing plants (A, B and C) that harvested predominately steers and heifers. Plants were located in the North-eastern and Southwestern regions of the United States, and samples were collected during September and October, 2003. At all plants, temperature recorders (SAPAC TempRecord II, Auckland, NZ) were placed just below (1 mm) the fat layer at the posterior-most part of the cut-side surface of the round (upper) or on the brisket at a point level with the elbow (lower) of carcasses (N = 28) selected to represent multiple cooler locations, and carcass surface temperature was recorded every 5 min throughout chilling (approximately 48 h).

Sample collection

Samples (Table 1) were taken by swabbing carcasses with sterile sampling

sponges (BioPro EnviroSponge Bags, International BioProducts, Redmond, WA) (7) hydrated with 25 ml of 0.1% sterile buffered peptone water (BPW, Difco, Becton Dickinson and Company, Sparks, MD). A 500 cm² area of either the brisket (on a point of the ventrum, level with the elbow), the flank (on a point of the ventrum, within 10 cm of the midline), or rump (on the posterior-most part of the cut-side surface of the round) was sampled (23). One individual sponge was utilized at one anatomical area on one side of five consecutive carcasses, representing 2,500 cm² of sampling area per sponge. Sponges from the round and flank were combined (upper region) in a single sterile bag with an additional 20 ml BPW (Difco, Becton Dickinson and Company, Sparks, MD), while sponges from the brisket (lower region) were placed in a separate sterile bag with an additional 10 ml BPW (Difco, Becton Dickinson and Company, Sparks, MD). Sampling gloves and templates were sanitized between carcass groups by submersion in 80°C water for 8–10 s. Carcass sides were alternated each day to avoid bias potentially associated with variation in bacterial loads between leading and trailing sides. At Plants A and B, samples were taken from carcass sides before chilling treatment (spray- vs. dry-chilling), and after chilling, just before carcass fabrication (Table 1). Conversely, samples at Plant C were collected from carcasses that had received the spray-chill-

ing treatment only, because only one undivided hot box existed in that plant (isolated hot boxes would have been required to enable comparisons to be made to samples collected at Plants A and B). An initial sample set was collected at Plant C, after which operations were suspended, the plant was intensively cleaned, and modifications were made to and in the hot box. One week after operations had resumed, a subsequent sample set was collected (Table 1).

At Plant C, carcass surface incisions or cuts were being created in the outer fat layer of the carcasses, directly beneath the hide, during mechanical hide removal. When the fat layer was being pulled away from the lean tissue underneath, water and lactic acid spray-washing solution filled this space during application of slaughter floor decontamination interventions, creating a fluid-filled pocket that partially solidified during carcass chilling. As an aside to this project, these pockets were excised from along the *m. longissimus dorsi* region between the 12th and 13th ribs, following chilling at Plant C. Sampling of fluid pockets (N = 40) was done aseptically by a researcher wearing sterile latex gloves (Sterile Latex Examination Gloves, Shamrock Manuf. Co., Medan, Indonesia), who applied a downward stripping motion and collected approximately 20 ml of the retained fluid into a sterile sampling bag (Whirl-Pak™ Bag, Nasco International, Fort Atkinson, WI).

All samples were immediately cooled to 4°C, packaged in insulated shipping containers, covered with cardboard to prevent direct contact of samples with the frozen ice packs, and shipped overnight to Food Safely Net Services (San Antonio, TX) for analysis.

Treatments

At plant A, samples were taken from carcasses that were either dry-chilled following the final intervention or water-sprayed (1 min) at 10 min intervals during the initial 10 h of chilling (spray-chilling). Carcass samples before chilling were collected from carcasses entering the hot box immediately following the final intervention, while chilled carcass samples were collected from the same lots of carcasses upon exiting the hot box, immediately prior to grading, following ribbing. Average carcass chill time in plant A was approximately 48 h. Harvest floor chain speeds into the hot box were 280 head/h and carcasses were transferred from the hot boxes into the sales cooler at 340 head/h. Harvest floor microbiological decontamination treatments included: (i) pre-evisceration hot water washing (90°C, 40 psi, 5 s) followed by (ii) 2.5% lactic acid spraying (37°C, 20 psi, 2–3 s); (iii) post-evisceration ambient temperature water washing (32°C, 300 psi, 6 s) following zero-tolerance inspection; (iv) hot water washing (98°C, 20 psi, 8 s); and (v) final application of 2.5% lactic acid (37°C, 20 psi, 2–3 s) directly before carcasses entered the hot boxes (Table 2).

Hot box sanitation standard operating procedures (SSOPs) at Plant A included: (i) cleaning of coolers during operations as they were emptied; (ii) cleaning and sanitizing of pillars, walls and floors in a manner that did not cross-contaminate hanging carcasses, by removing dry/solid debris from floors and walls, rinsing with water, applying a cleaning agent, rinsing and sanitizing; (iii) daily cleaning of floors, under the main hot box chain that moved carcasses from the slaughter floor to the hot boxes and from the hot boxes to the sales cooler, prior to the start of each production period; and, (iv) biannual cleaning of ceilings and overhead equipment if needed. Ambient temperature of the hot box was approximately 1°C during the first 36 h of chilling and was then lowered to approximately -3°C.

At plant B, samples were taken from carcass sides that were either dry-chilled or water spray-chilled in a manner similar to that used for carcass sides at Plant

A, after the final harvest-floor intervention. Carcass samples before chilling were collected from carcasses immediately following final intervention and electrical stimulation. Post-chilled carcass samples were collected immediately before grading, following carcass ribbing, just prior to fabrication. Average carcass chill time in plant B was approximately 42 h. Harvest floor chain speeds were 210 head/h; chain speeds from the hot box into the sales cooler were 230 head/h. Harvest floor microbiological decontamination methods included: (i) pre-harvest intervention at feed yard (*Lactobacillus acidophilus* probiotic in ration); (ii) steam vacuuming (carcass location; 2 upper, 2 lower) following hide removal; (iii) pre-evisceration rinse cabinet (27°C, 50 psi) followed by a 2.5% lactic acid rinse; (iv) post-evisceration carcass washing (43°C, 20–50 psi); (v) hot water pasteurization (90°C, 60 psi); and (vi) final 2.5% lactic acid spraying (43°C, 20–50 psi) immediately prior to entering coolers (Table 1).

Hotbox SSOPs for Plant B included: (i) cleaning and sanitizing of hot boxes were every 48 h as hot boxes were emptied; (ii) condensation removal, using propane heaters and poles, throughout each shift; (iii) frequent sanitizing of tools used to handle carcasses, and sanitizing or replacement of any tools or clothing that came in contact with the floor; (iv) sanitizing of gloves and/or frocks, or changing if excessively dirty or if cross-contamination had occurred; and (v) removal from floors and hallways of standing water and condensate and large pieces of fat. To prevent condensate formation and/or the transfer of condensate onto beef carcasses entering the hot box, Plant B applied an additional hot box standard operating procedure (SOP) for loading carcasses, which included: (i) maintenance of hot box temperature at 18°C throughout cleaning, until 15 min prior to the entry of hot carcasses; (ii) maintenance of a temperature of 7°C during the loading of the hot box; (iii) reduction of temperature to 0°C once the hot box was fully loaded and throughout chilling (this procedure reduces the amount of condensate found in the hot box during the chilling process); and (iv) after cleaning and sanitation, stationing of two designated employees in the hallway that joins the slaughter floor and the hot box, to direct carcasses into cleaned hot boxes.

Microbiological outcomes of samples taken from carcasses pre- and post-chilling in Plant C were used to investigate the effects of poor hot box GMP. Two sample sets were collected; before (Phase 1) and after (Phase 2): (a) intensive plant-wide cleaning and sanitation, as well as

(b) adjustments to hot box employee and equipment management and decreased carcass handling (Table 8). All carcasses at Plant C received an intermittent (1 min every 10 min) water-spray comparable to that used in Plants A and B. No carcass sides received a dry-chilling treatment at Plant C, as this facility did not have adequate space to accommodate separate treatment groups in isolated hot boxes. Samples from pre-chilled carcasses were collected immediately following final intervention, upon entry into the hotbox. Post-chill samples were collected from the same lots of carcasses upon exiting the hotbox, just prior to grading, and before fabrication. Average carcass chill time in plant C was 54 h. Ambient temperature of the hot box during Phase 1 was approximately 3°C throughout chilling. Following collection of carcass swab samples (Plant C; Phase 1) (Table 1), plant operations were suspended and the facility underwent an intensive plant-wide sanitation. Slaughter was suspended, and cleanup was initiated on the slaughter floor, in hotboxes, in alleys and in yards. Following thorough sanitation, the slaughter facility and hot boxes were restored to working order, and the following adjustments to the facilities slaughter processes were made: (i) the concentration of lactic acid used in three intervention spray cabinets (located prior to evisceration, just before chilling, and directly before fabrication), was increased from 2% to 5%; (ii) a hot water spray cabinet, after the hot weight scale and the final lactic acid spray cabinet, were both included as a critical control point (CCP) and continuous temperature (96–105 and 43–60°C, respectively) control was initiated; (iii) alternate traffic routes were created, limiting personnel in the hot box to hot box and management employees only; (iv) carcass handling and hygiene procedures were also adjusted such that wall-mounted hand/equipment sanitizers located throughout the hot box were cleaned and maintained in proper working order (82°C); (v) carcass handling was reduced to an "as necessary only" basis; and (vi) workers were informed of the importance of regular sanitation of boots, aprons, gloves and equipment and were encouraged to sanitize at more frequent intervals.

After plant operations resumed and plant employees had been given one week to adjust to these new processes, a second set (Plant C; Phase 2) of samples was collected (Table 1). Harvest floor microbial intervention strategies at Plant C during Phases 1 and 2 included: (i) pre-evisceration lactic acid (2% during Phase 1, 5% during Phase 2; 43–60°C, 16 psi, 4 s); (ii) zero tolerance inspection following

TABLE 3. Least squares means (LSM), standard errors (SE) observed for Aerobic Plate Counts (APC), Total Coliform Counts (TCC) and *E. coli* Biotype 1 Counts (ECC) (log CFU/100 cm²) recovered from carcasses at three packing facilities where samples collected before (Pre-chilling) and after (Post-chilling) chilling, partitioned by carcass location

	Pre-chilling				Post-chilling			
	Upper ^a		Lower ^b		Upper ^a		Lower ^b	
	LSM	SE	LSM	SE	LSM	SE	LSM	SE
Plant A								
APC	3.5 ^y	0.06	4.0 ^z	0.06	3.5 ^y	0.06	4.0 ^z	0.06
TCC	2.4 ^z	0.06	2.4 ^z	0.06	2.4 ^z	0.06	2.3 ^y	0.06
ECC	2.2 ^{yz}	0.06	2.1 ^y	0.06	2.3 ^z	0.06	2.1 ^y	0.06
Plant B								
APC	3.6 ^y	0.04	4.4 ^z	0.04	3.3 ^x	0.04	3.5 ^y	0.04
TCC	2.4 ^y	0.04	2.8 ^z	0.04	2.4 ^y	0.04	2.2 ^x	0.04
ECC	2.2 ^z	0.04	2.2 ^z	0.04	2.0 ^y	0.04	2.0 ^y	0.04
Plant C								
APC	2.5 ^x	0.04	2.7 ^y	0.04	2.9 ^z	0.04	2.4 ^x	0.04
TCC	2.2 ^y	0.04	2.2 ^y	0.04	2.3 ^z	0.04	2.1 ^x	0.04
ECC	2.0 ^y	0.04	2.0 ^y	0.04	2.2 ^z	0.04	2.0 ^y	0.04

^aUpper region included samples from the round and flank.

^bLower region included samples from the brisket.

^{x,y,z}Means, within row, lacking a common superscript letter are different ($P < 0.05$).

evisceration; (iii) hot water washing (96–105°C, 17–20 psi) located directly after the hot scale, followed by (iv) ambient temperature water washing (27°C, 18–20 s); and (v) final lactic acid spraying (2% during Phase 1, 5% during Phase 2; 43–60°C, 16 psi, 4 s) (Table 2). Pre-chilled carcass samples were collected from carcasses entering the hot box, immediately following final intervention. Post-chilled carcass samples were collected from ribbed carcasses entering the retail cooler, just prior to grading.

Plant C hot box SSOPs included: (i) cleaning of floors and walls as carcasses are removed from the hot box; (ii) use of scrubbers releasing quaternary ammonia solution to scrub floors and walls of dry/solid debris, after which floors and walls are rinsed; and (iii) cleaning of walls, overhead equipment and ceiling 2 times per year in a biannual plant-wide sanitation effort. Ambient temperature of the hot box during Phase 2 of sample collection was approximately 3°C throughout chilling.

Microbiological analysis

Upon arrival of the samples at the laboratory, the temperature of each shipping container was measured and re-

corded. Any samples with a temperature exceeding 4°C were discarded as to temperature abused. One set of 127 samples (one shipment) collected from pre-chilled carcasses from Plant C were not analyzed because of extreme temperature abuse. All remaining samples were analyzed for APC, TCC, ECC and the prevalence of *E. coli* O157:H7. Samples were pummed with an IUL Masticator (Neutec Group Inc, Plainview, NY) for 1 to 2 min, and buffer from sample sponges was serially (1:10) diluted, using 0.1% sterile buffered peptone water (BPW, International BioProducts, Bothwell, WA). One ml of the extracted buffer was placed on a 3M[™] Petrifilm[™] Aerobic Count Plate (APC) and a 3M[™] Petrifilm[™] *E. coli*/Coliform Count Plate (TCC, ECC) (3M Microbiology Products, St. Paul, MN), which were incubated for 48 h at 32°C. 3M[™] Petrifilm[™] APC colonies possessing a bright red color were counted as aerobic colonies (APC). Colonies on 3M[™] Petrifilm[™] EC/CC plates closely associated with a gas bubble and possessing a bright red or bright blue color were counted as TCC, whereas colonies possessing a blue or red-blue color were counted as ECC.

Detection of *E. coli* O157:H7 was conducted according to the procedure of Barkocy-Gallagher et al. (3). A 10 ml ali-

quot of fluid was taken from each sample bag, suspended in 90 g tryptic soy broth (TSB, International BioProducts, Bothwell, WA), and incubated for 2 h at 25°C, then for 6 h at 42°C, and then overnight at 4°C. After incubation, 20µl of anti-*E. coli* O157 Dynalbeads (Dynal Laboratories, Lake Success, NY) and 100µl 0.05% protamine (Sigma, St. Louis, MO) were added to 1 ml aliquots and incubated again for 30 min on a rocker at room temperature (24 ± 2°C). Tubes were placed in a magnetic separation rack to bind beads and incubated for an additional 5 min at room temperature (24 ± 2°C) on the rocker. A 1 ml portion of supernatant was removed from each tube, and beads were washed 3 times with 1 ml of a 7.0 pH phosphate buffered saline (PBS) and 0.05% of Tween 20 solution (Tween 20 Solution, Fischer Scientific, Fair Lawn, NJ) and then re-suspended in 100µl of PBS containing 0.05% Tween 20 solution. A 50µl portion of the suspended bead solution was spread onto Sorbitol MacConkey agar supplemented with cefexime (0.05 mg/l) and 2.5 mg/l potassium tellurite (Sigma-Aldrich, St. Louis, MO) (ctSMAC) and another 50µl spread on Rainbow-plus agar (Rainbow-Agar O157, Bilog Inc., Hayward, CA) containing 0.8 mg/l potassium tellurite (Sigma) and 20 mg/l novobiocin (Sigma)

TABLE 4. Least squares means (LSM), standard error (SE) and changes during chilling (Δ) observed in Aerobic Plate Counts (APC), Total Coliform Counts (TCC) and *E. coli* Biotype I Counts (ECC) (log CFU/100 cm²) recovered from carcasses before (Pre-Chill) and after (Post-Chill) either Spray-chilling or Dry-chilling

	Spray-chilled				Δ	Dry-chilled				Δ
	Pre-chill LSM	SE	Post-chill LSM	SE		Pre-chill LSM	SE	Post-chill LSM	SE	
Plant A										
APC	3.8 ^y	0.05	4.0 ^z	0.05	0.2	3.7 ^{xy}	0.05	3.5 ^x	0.05	- 0.2
TCC	2.4 ^z	0.05	2.4 ^z	0.05	0.0	2.3 ^y	0.05	2.3 ^y	0.05	0.0
ECC	2.1 ^y	0.05	2.2 ^z	0.05	0.1	2.2 ^z	0.05	2.1 ^y	0.05	- 0.1
Plant B										
APC	3.7 ^y	0.05	3.4 ^x	0.05	- 0.3	4.3 ^z	0.05	3.4 ^x	0.05	- 0.9
TCC	2.6 ^z	0.05	2.4 ^y	0.05	0.2	2.6 ^z	0.05	2.3 ^y	0.05	- 0.3
ECC	2.2 ^z	0.05	2.0 ^y	0.05	0.2	2.2 ^z	0.05	2.0 ^y	0.05	- 0.2

^{x,y,z}Means, within row, lacking a common superscript letter, are different ($P < 0.05$).

TABLE 5. Number hot box (N) of temperature recorders (SAPAC TempRecord II, Auckland, NZ), minimum, maximum, and mean (x) temperatures ($^{\circ}$ C), average time for carcass surface to reach 4 $^{\circ}$ C (T), range of carcass surface temperature decline, and average time beef sides were chilled (H), at each plant (A, B and C)

Plant	N	Temperature History ($^{\circ}$ C)					
		Min	Max	x	T	Range of T	H
A	12	-0.08	32.0	3.5 ^x	11.0 ^y	2.9-22.7	48
B	8	-0.50	33.9	6.5 ^y	9.33 ^x	6.2-11.5	42
C	8	0.01	37.8	8.8 ^z	21.7 ^z	2.1-26.5	54

^{x,y,z}Means, within a column, lacking a common superscript letter, are different ($P < 0.05$).

and incubated for 18 h at 37 $^{\circ}$ C. Following incubation, three or more morphologically typical *E. coli* O157-like colonies found on the cTSMAC plates (colorless, with or without a dark center) or Rainbow-agar, (dark, slightly blue colonies) were removed and screened with the latex agglutination assay of the DrySpot[™] *E. coli* O157:H7 Test Kit (Oxoid; Ogdensburg, NY). Each isolate was checked with a test reagent and control reagent located on the test card. Isolates were also checked against known positive and negative strain agglutination test reactions.

Statistical analysis

Bacterial populations were transformed into log CFU/100 cm² and least squares means were calculated using the analysis of variance in the general linear model of SAS Version 8e. Data were blocked by plant (A, B or C), and the effects of treatment (spray- vs. dry-chilling), phase (pre- vs. post-chilling), and location (upper vs. lower) on populations of APC, TCC and ECC were analyzed individually and interactively.

RESULTS AND DISCUSSION

Spray-chilling versus dry-chilling

Indicator organism populations recovered during this study (Table 3) were consistent with anticipated microbial loads associated with modern beef processing facilities (2, 21). According to Bacon et al. (2), carcass sides sampled prior to chilling, after being treated with a comparable set of antimicrobial interventions (pre-evisceration carcass washing, organic acid

TABLE 6. Least squares means (LSM), and standard errors (SE) observed for Aerobic Plate Counts (APC), Total Coliform Counts (TCC) and *E. coli* Biotype 1 Counts (ECC) (log CFU/100 cm²) recovered from carcasses at three packing facilities where samples collected before (pre-chilling) and after (post-chilling) chilling were partitioned by carcass location

	Pre-chilling				Post-chilling			
	Upper ^a		Lower ^b		Upper ^a		Lower ^b	
	LSM	SE	LSM	SE	LSM	SE	LSM	SE
Plant A								
APC	3.5 ^y	0.06	4.0 ^z	0.06	3.5 ^y	0.06	4.0 ^z	0.06
TCC	2.4 ^z	0.06	2.4 ^z	0.06	2.4 ^z	0.06	2.3 ^y	0.06
ECC	2.2 ^{yz}	0.06	2.1 ^y	0.06	2.3 ^z	0.06	2.1 ^y	0.06
Plant B								
APC	3.6 ^y	0.04	4.4 ^z	0.04	3.3 ^x	0.04	3.5 ^y	0.04
TCC	2.4 ^y	0.04	2.8 ^z	0.04	2.4 ^y	0.04	2.2 ^x	0.04
ECC	2.2 ^z	0.04	2.2 ^z	0.04	2.0 ^y	0.04	2.0 ^y	0.04
Plant C								
APC	2.5 ^x	0.04	2.7 ^y	0.04	2.9 ^z	0.04	2.4 ^x	0.04
TCC	2.2 ^y	0.04	2.2 ^y	0.04	2.3 ^z	0.04	2.1 ^x	0.04
ECC	2.0 ^y	0.04	2.0 ^y	0.04	2.2 ^z	0.04	2.0 ^y	0.04

^aUpper region included samples from the round and flank.

^bLower region included samples from the brisket.

^{x,y,z} Means, within a row and across phases, lacking a common superscript letter, are different ($P < 0.05$).

rinse, hot water carcass wash, final intervention lactic-acid rinse), had APC, TCC and ECC ranging from 3.8 to 7.1, 1.5 to 3.7 and 1.0 to 3.0 log CFU/100 cm², respectively, at seven different commercial packing facilities. In the same study, corresponding populations recovered from the same lots of carcasses following a 24 to 36 h chilling period ranged from 2.3 to 5.3 log CFU/100 cm² for APC, 0.9 to 1.3 log CFU/100 cm² for TCC and 0.9 log CFU/100 cm² for ECC. The differences between Least Squares Mean (LSM) of APC populations of pre-chilled (hot) versus post-chilled (cold) carcass samples at Plants A, B and C were 0, -0.6 and 0.1 log CFU/100 cm², respectively. TCC population differences between hot and cold carcasses were 0, -0.3 and 0.1 logs CFU/100 cm² at Plants A, B and C, respectively, and ECC differences between hot and cold carcasses were 0, -0.2 and 0.1 logs CFU/100 cm² at Plants A, B and C, respectively (Table 3). The larger reductions in APC, TCC and ECC observed at Plant B are presumably attributable to the fact that initial carcass loads at Plant B were higher than those at Plants A or C, providing a greater opportunity for population reduction (Table 3).

At plants A and B, APC, TCC and ECC recovered from spray-chilled car-

cases were not ($P > 0.05$) different from those recovered from carcasses which were dry-chilled at the corresponding processing facility (Table 4). Related studies have also observed a lack of difference in bacterial populations found on beef carcass surfaces using either spray- or dry-chilling treatments (1, 13). Although one might expect an increase in bacterial populations associated with the addition of water to warm carcass surfaces, researchers have reported substantial reductions in surface contamination due to existing harvest-floor antimicrobial hurdles used to decontaminate beef carcasses and beef carcass tissue (2, 11, 16). Therefore, it is feasible that choice of chilling method, such as dry- or spray-chilling, may not have a distinct effect on remaining surface bacterial contamination.

Carcasses at Plant B experienced a much more rapid rate of surface temperature decline, reaching 4°C faster (within 9.3 h) than did carcasses chilled in Plant A (within 11.0 h) or C (within 21.7 h) (Table 5). In similar research conducted by Gill and Landers (9), variation in surface temperature decline was the main element involved in the difference in reduction of bacterial contamination with spray-chilling. These differences in micro-

bial population reduction indicate a possible relationship between differences in rate of surface temperature decline and total microbial populations of chilled carcasses. Cross (6) expressed concern that an extended temperature decline of carcass surfaces allows for the proliferation of pathogenic bacteria, increasing the likelihood of illness associated with products derived from these carcasses.

APC recovered from samples taken from the lower (brisket) region of pre-chilled carcasses were higher ($P < 0.05$) than those found on samples taken from the upper (round and flank) region of the same carcasses at plants A, B and C (Table 6). Recovered coliform populations from the upper and lower regions were similar at plant A and plant C, whereas TCC from the lower region of carcasses at Plant B were higher ($P < 0.05$) compared to TCC from the upper region (Table 6). *Escherichia coli* Biotype 1 Counts (ECC) recovered from the upper region versus lower region samples from all pre-chilled carcasses at Plants A, B and C was similar.

In contrast to results from hot carcasses, recovered coliform (TCC) populations recovered from chilled carcasses were greater ($P < 0.05$) from the upper region than from the lower region (Table

TABLE 7. Prevalence of *E. coli* O157:H7 recovered from groups of carcasses sampled before chilling, and following either spray-chilling or dry-chilling at 3 commercial packing facilities

Escherichia coli O157:H7 prevalence in carcass samples						
Plant	# Samples	Pre-chilled		# Samples	Post-chilled	
		# Positive	% Positive		# Positive	% Positive
A	533	2	0.4	532	0	0
B	507	32	6.3	506	0	0
C	532	8	1.5	405	20	4.9

TABLE 8. Least squares means (LSM), standard error (SE) and changes (Δ) observed for Aerobic Plate Counts (APC), Total Coliform Counts (TCC) and *E. coli* Biotype 1 Counts (ECC) (log CFU/100 cm²) recovered from carcasses at Plant C before (pre-chilling) and after (post-chilling) chilling. Phase 1 carcasses were sampled before a plant-wide intensive sanitation; Phase 2 samples were collected after sanitation and plant operations had resumed

	Phase 1					Phase 2				
	Pre-chill		Post-chill		Δ	Pre-chill		Post-chill		Δ
	LSM	SE	LSM	SE		LSM	SE	LSM	SE	
APC	2.5 ^y	0.04	2.7 ^z	0.04	0.2	2.7 ^z	0.04	2.6 ^y	0.04	-0.1
TCC	2.0 ^x	0.04	2.2 ^y	0.04	0.2	2.3 ^z	0.04	2.2 ^y	0.04	-0.1
ECC	2.0 ^y	0.04	2.0 ^y	0.04	0	2.0 ^y	0.04	2.1 ^z	0.04	0.1

^{x,y,z}Means, within row and across phases, lacking a common superscript letter are different ($P < 0.05$)

6). It is presumed that the rinsing effect created by interventions on the harvest floor, transported flora down, but not off of, the carcass surface.

The prevalence of *E. coli* O157:H7 on carcass samples at plants A and B was not significantly affected ($P > 0.05$) by chilling treatment (Table 7). Samples from pre-chilled carcasses were positive for *E. coli* O157:H7 in 2/533 (0.4%) and 32/507 (6.3%) of samples taken from plants A and B, respectively. Post-chilling, 0 of 532 and 0 of 506 samples collected from carcass groups at plants A and B, respectively, tested positive for *E. coli* O157:H7 (Table 7).

Some plants encounter problems with cuts in the subcutaneous fat layer when hides are mechanically removed. When these carcasses are rinsed or sprayed with antimicrobial interventions or during spray-chilling, areas where the fat has been pulled away from the lean can fill with harvest-floor fluids. This fluid, which may remain in liquid form or partially solidify as the carcass is chilled, can harbor bacteria, allowing pathogens to escape the effects of carcass washing/rins-

ing. During fabrication, these pockets are removed along with the outer fat layer and become part of carcass trimmings sent to ground product production during fabrication, potentially allowing these viable bacteria to go undetected until ground product arrives at the retail level. APC, TCC and ECC from fluid found in these pockets, collected ($N = 40$) from chilled carcasses (all from Plant C), were below detection limits (< 1.99 log CFU/100 cm²). However, 2 of the 40 samples tested positive for *E. coli* O157:H7 (5%). Previously, Berry and Cutter (4), Samelis et al. (17), and Brackett et al. (5) found that acid spray interventions are sufficient to cause major declines in natural competitive flora, while allowing for the potential survival of acid-stressed *E. coli* O157:H7 during extended cold storage. It has been shown (4, 19) that *E. coli* O157:H7 has the ability to survive for up to 13 days in $\leq 2\%$ concentration lactic acid runoff fluid. Therefore, it is possible that if contamination on carcass surfaces is subjected to sub-lethal acid treatments, the number of bacterial competitors will be reduced, while injured pathogenic microbes are

washed into pockets created during hide removal. Therefore, it is imperative that intervention strategies ensure elevated levels of microbial death, and are not merely acid stressing pathogenic bacteria (18).

Some plants have implemented management strategies to deal with cuts created during hide removal. At Plant B, plastic film was fastened over fat tears immediately following hide removal, prior to intervention application, to prevent potential accumulation of fluid and bacteria in these tears.

Plant sanitation and modifications to hot box good management

Least squares means for APC, TCC and ECC of pre-chilled carcass samples collected at Plant C prior to intensive plant-wide sanitation and modification to good management procedures (Phase 1) were 2.5, 2.0 and 2.0 logs CFU/100 cm², respectively (Table 8). Post-chilled carcass sample APC, TCC, and ECC from Phase 1 were higher ($P < 0.05$) than pre-chilled populations recovered from the same lot

of carcasses sampled 48 h earlier (2.7, 2.2 and 2.0 logs CFU/100 cm², respectively). Although populations recovered from hot carcass sides at Plant C were lower ($P < 0.05$) than populations recovered from Plants A and B (log CFU/100 cm²), similar research has reported a comparable range in APC, TCC and ECC (3.8 to 7.1, 1.5 to 3.7 and 1.0 to 3.0 logs CFU/100 cm², respectively), recovered from beef carcass at three commercial packing facilities (2, 21). After Phase 1 of sample collection, plant-wide suspension of operations, intensive sanitation, and adjustments to hot box GMPs, plant operations were resumed, and 1 week later Phase 2 of sample collection began. During Phase 1, APC, TCC and ECC did not change or increased during chilling; however, actual reductions in APC, TCC and ECC after chilling were observed during Phase 2 (Table 8). This indicates that although initial bacterial loads recovered from hot carcasses were higher in Phase 2 than the initial loads in Phase 1, improved plant SSOPs and GMPs may have positively influenced carcass bacterial population reductions. During Phase 1, 0/266 samples collected from pre-chilled carcasses and 8/139 samples (5.8%) collected from post-chilled carcasses tested positive for *E. coli* O157:H7. During Phase 2 of sample collection, 8/266 samples (3.0%) collected from pre-chilled carcasses and 12/266 samples (4.5%) collected from post-chilled carcasses tested positive for *E. coli* O157:H7 (Table 7). The rate at which temperature of carcass surfaces declined (average of 21.7 h to reach 4°C) at Plant C could influence the survival and possible growth of pathogens on chilled carcass surfaces.

Because of the effectiveness of current slaughter floor intervention technologies, chilling method (spray-chilling versus dry-chilling) may not influence, positively or negatively, indicator organism levels on carcass surfaces as indicated by this research. However, when carcasses are chilled expediently (< 4°C in roughly 12 h), survival and potential replication of *E. coli* O157:H7 may be reduced. In addition to proper chilling SOPs, modifications to hotbox GMPs and SSOPs can provide small yet beneficial reductions of carcass contamination levels. It is also apparent that there is a "rinsing" effect that occurs during carcass spray-washing/rinsing, and pockets created during mechanical hide removal should be addressed as a potential accumulation site for acid-tolerant pathogenic bacteria. With regard to this potential for accumulation of survivors, selected interventions should provide lethality rather than sub-lethal injury to bacteria. Further investigation

into surface temperature decline and "mapping" of bacteria in relation to temperature decline may lead to improvements in carcass chilling technology and contribute to greater reductions in surface bacterial loads found on beef carcass surfaces.

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Perceptions of Risk Communication Messages: Applications in a Food Processing Environment

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SUMMARY

Risk communication includes the interactive process between employees within an organization for identifying risk, projecting its relevance and potential impact, and enacting practices to eliminate or minimize the threat. Outbreaks and scares of foodborne illness beginning in the 1990s have catapulted risk communication and food safety issues into the public arena and have resulted in demands to elevate standards and improve safety in food processing plants. This research examined perceptions related to risk communication to determine to what extent mindful risk communication, as conceptualized by the *high reliability organization* (HRO) model, functions within an exemplary processing plant in the food industry. Employees at a Midwestern turkey processing plant completed a survey that measured their perceptions of mindful risk communication in practice. The results indicated that employees generally perceived the plant as a high reliability organization. One-way ANOVA results revealed that employees shared this overall perception regardless of job position. Likewise, for nine of ten HRO characteristics, employees in different job categories reported similar perceptions. The high reliability model helps to explain the plant's consistent performance and provides a solid base on which plants can implement mindful risk communication aimed at co-constructing and renegotiating workplace dialogue and interactions capable of improving safety and quality in the food processing industry.

INTRODUCTION

On January 15, 1993, the Washington State Health Department alerted Robert Nugent, president of Jack in the Box, that an *E. coli* outbreak was partly attributable to hamburgers purchased at Jack in the Box restaurants (17). This and other foodborne illness scares in the early 1990s catapulted risk communication and food safety issues into the public arena and temporarily resulted in public, government, and industry demands to elevate standards and to increase compliance enforcement in food processing plants. The purchasing public wanted to minimize food safety risks and poisoning outbreaks (2, 16, 17, 18).

The United States Department of Agriculture (USDA) responded with various initiatives targeted to ensure the safety and quality of meat and poultry products in the marketplace. Hazard Analysis Critical Control Point (HACCP), a philosophy and practical approach to food safety systems, became the flagship of new and revised standards and regulations (12, 13). HACCP stresses prevention and is a structural approach for analyzing the potential hazards in an operation by identifying the points in the operation where hazards may occur and deciding which points are critical to control to ensure

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TABLE 1. Effective risk communication strategies

Downward Strategies

- Communicating a commitment to food safety
- Communicating a willingness to maintain safe operations
- Acknowledging workers' contributions to food safety
- Demonstrating a willingness to accept and act upon worker ideas for improving safety
- Communicating clear and complete messages

Upward Strategies

- Soliciting and acting upon daily worker communication
- Soliciting and acting upon worker communication for long-term planning
- Reinforcing the importance of upward communication
- Soliciting and acting upon worker ideas for improving safety
- Encouraging horizontal communication that emphasizes safety

consumer safety. These critical points are then monitored, and remedial action, specified in advance, is taken if conditions at these points are not within safe limits. The USDA mandated HACCP for meat and poultry plants in 1996 and required full implementation by 2000 (10).

In 2002, the USDA funded a multidisciplinary research project to conduct a case study of a designated turkey slaughter and processing plant in the Midwest. According to USDA inspections and records, this plant had consistently met and surpassed quality and safety standards, unlike seemingly similar plants. This research examined the communication perceptions related to risk and food safety to determine to what extent characteristics of high reliability organizations, a composite of five distinct communicative processes, function in the exemplary plant. Identification of such characteristics may explain the plant's high reliability and could be generalizable to other food processing plants in the industry.

HIGH RELIABILITY COMMUNICATION PROCESSES

Academic texts and practitioner handbooks generally converge on the definition of risk communication. Covello (5) defined risk communication as "the exchange of information among interested parties about the nature, magnitude, significance, or control of a risk" (p. 359).

Risk communication consists of an interactive process among interested parties for identifying risk and projecting its relevance and potential impact. Seeger, Sellnow, and Ulmer (16) suggested that risk communication "in the early stages is most closely associated with crisis sensing and threat assessment" (p. 202). Risk communication also includes decision-making based on risk projections and overarching values.

Risks frequently originate in organizations (16) or, at a minimum, manifest first to organizations. Some risks then evolve to events due to system problems in addition to individual behavioral actions or inactions. Pidgeon, Hood, Turner, Jones, and Gibson (11) observed that such a progression happens "not just [because of] individual slips and lapses, but also [because of]...patterns of management and organizational failings such as failures of communication, information handling, coordination and error diagnosis" (p. 97).

Interestingly, some organizations characteristically operate in high-risk conditions (where there is high probability and occurrence of unexpected threats that can quickly escalate out of control and cause severe harm) and nevertheless experience fewer-than-anticipated problems (16, 22, 23). Researchers (9, 21, 23) highlight communication among employees as key to the identification of risks and the prevention of negative outcomes.

Notably, "employees who are active in the process of generating and acting on risk-related information are more likely to act in ways that avert or interrupt crises or potential crises" (16, p. 214).

After considerable study, Weick and Sutcliffe (23) built on Langer's (8) concepts of learning and mindfulness to describe communication processes within these "high reliability organizations" (HROs). They contend that these organizations have developed "ways of acting and styles of learning that enable them to manage the unexpected better than most other kinds of organizations" (23, p. v). HROs operate in a collective state of *mindfulness*, the result of five coexisting communication processes: (a) preoccupation with failures rather than successes, (b) reluctance to simplify interpretations, (c) sensitivity to operations, (d) commitment to resilience, and (e) deference to expertise, a fluid decision-making system (4, 19, 22, 23). Table 1 summarizes the key communication strategies for high reliability organizations. By employing these communication processes, HROs function as learning organizations; they perceive aberrations, near misses, or errors and actively respond and adapt to sustain or modify the system as needed (8, 19). HROs maintain reliable performance despite constant exposure to risk, in part by developing and maintaining their capability for mindfulness (22). A well-developed capability for mindfulness

catches the unexpected risk earlier, when it is less influential on normal operations; comprehends its potential importance, despite the small size of the disruption; and removes, contains, or rebounds from the effects. As repeatedly observed, HROs consistently perform better than non-HROs in assessing and managing risk and thereby in disproportionately preventing and minimizing crises. By managing the unexpected mindfully, HROs continue to reliably achieve the performance they were organized to deliver.

At present, most research regarding high reliability organizations has utilized case study methodology and has focused on contexts such as aircraft carriers and emergency rooms (1, 23, 24). Some preliminary research, however, has explored high reliability principles in agriculture (14, 20). In this time of heightened concern and risk of food safety problems and foodborne illnesses, the model for high reliability organizations, not previously extended to the food processing industry, may help to uncover communication processes that describe operations in the turkey slaughter and processing plant under study and subsequently explain its consistently optimal performance.

Case study context

The Midwest turkey plant under study has operated since the 1930s. Initially, the plant produced a holiday food commodity, the whole bird, which required only seasonal operations and seasonal workers. In the 1970s the plant underwent name and ownership changes and expanded the physical plant and operations (personal communication, June 26, 2003). Throughout the turkey and poultry industry, the next decade saw high inflation, increased energy costs, intense international competition, and slow economic growth. Plants restructured by relocating facilities to be near supply points, removing transport intermediaries, and vertically integrating the entire process (3, 15). Besides efficiencies gained from organizational restructuring, productivity increases were brought about through genetic poultry management and technological innovations (15). The plant under study remained a small, family-owned operation, but it did convert from a seasonal, whole turkey plant to a year-round, turkey parts and full processing plant. The plant had actually outpaced the industry in restructuring changes and therefore mirrored industry trends in all other operational aspects. The 1980s became economic boom years for the plant. Although not quite as economically profitable as previously, the plant continued to

increase production during the 1990s and maintains production in the 2000s at approximately 50 million pounds/year in a 150,000 sq ft, state-of-the-art processing facility offering raw and pre-cooked turkey deli products for the foodservice industry (personal communication, June 26, 2003).

Research question

The small (according to industry standards) Midwestern turkey plant has maintained a strong record of safe and quality performance without recalls or outbreaks throughout years of foodborne illness events, industry innovations, and governmental regulation changes. The researchers examined the food plant to assess the extent, if any, to which the plant's ongoing risk communication caused the employees to perceive high reliability characteristics functioning in the turkey slaughter and processing plant.

METHODS

The researchers administered a survey to assess, analyze, and compare the perceptions of the plant employees to those communication characteristics suggested by Weick's model for high reliability organizations (23).

Employees and sample selection

The plant operated with approximately 300 employees in the following umbrella job categories: management, supervisory, line worker, janitorial, and support service. The line workers directly handled and processed the product in one of four areas: kill, evisceration, boning and packaging, and further processing. Most line workers specialized in one area, although many had experience and sometimes rotated in more than one area. Supervisors likewise specialized in one area, although considerable cross training and lateral working occurred. The janitorial workers cleaned and sanitized the facility during daytime operations and during the night, after daily operations had ceased, for the next day.

Although administrative personnel (managers and supervisors) reflected considerable homogeneity in demographic characteristics such as local origin and work tenure, line and janitorial personnel were notably diverse, especially in ethnicity, language, and national origin. The national origin of employees included Mexico, Mongolia, the Philippines, Puerto Rico, Russia, South Africa, the United States, and Vietnam. Additionally, line

personnel varied considerably in work tenure, from days to years.

The researchers administered an on-site survey on one workday to a randomly selected sample of employees. Only those present and working at the plant on the survey day were potential participants. Although the sample selection was random, human resources retained some control over the actual selection of participants, in view of the naturalistic setting and the imperative to minimize disruptions to operations. Managers and supervisors released the selected employees for survey completion while maintaining adequate coverage; therefore, administrators informally exhibited some selection influence, because not all selected employees could be released.

Procedure

Sellnow, Venette, Seeger, and Ulmer (20) developed the High Reliability Survey (see Appendix) from the literature on high reliability organizations and Weick's proposed model. The instrument probes employees' perceptions regarding the level of risk in their workplace and industry and their perceptions of organizational structure and communication processes. Venette established expert validity for the entire instrument and reported the instrument's internal reliability for the high reliability subscale (Cronbach's alpha = .82). Although the instrument is fairly new, initial validity and reliability determinations indicate that it does consistently (reliability) measure high reliability constructs (validity) (6, 7, 20). No substantive changes were made in the survey; modifications simply changed names and vocabulary to reflect the specific plant and industry. This study confirmed the instrument's internal reliability for the high reliability subscale (Cronbach's alpha = .77) and extended the instrument application to a new organizational setting, a food processing plant.

Management and supervisory employees completed the High Reliability Survey individually. Based on recommendations by management, the researchers orally administered the survey to employees in operations. Because the survey instrument had been written for oral administration, the research team members read the survey instrument rather than a script when conducting the survey in a face-to-face interview. This provided ready opportunity for clarification of survey questions to participants, thereby decreasing possible response errors (6). The research team members began each survey with introductions and an overview of the research purpose and goals;

TABLE 2. Descriptive statistics: high reliability

Items	M	SD
1. My opinions are taken into account in the daily operations at [org].	3.18	1.32
2. My opinions are taken into account in long-term planning at [org].	2.87	1.29
3. My actions directly contribute to the prevention of food safety problems at [org].	4.37	1.00
4. My actions influence others to prevent food safety problems at [org].	4.03	1.12
5. [Org] is very concerned about the possibility of making a food safety error.	4.54	0.89
6. [Org] is committed to correcting any shortcomings in maintaining food safety.	4.64	0.82
7. [Org] emphasizes maintaining effective operations.	4.44	0.80
8. [Org] is committed to correcting any shortcomings in the food safety inspection.	4.66	0.71
9. [Org] supervisors and managers accept the advice of line workers if they think the worker has a good idea about food safety.	3.68	1.11
10. [Org] does not try to present complicated food safety issues in an overly simplistic way.	3.33	1.16

this was followed by an explanation of the voluntary and confidential nature of participation. Employees verbally consented before responding to survey questions and provided ongoing consent by their decision to complete the survey.

The survey consisted of 26 questions and generally took about 20 minutes to complete. The first five questions asked for basic demographic information. The following 21 statements probed for perceptions regarding risks and food safety at the plant and the work structures and communication processes in operation. Based on a 5-point Likert scale, which allowed participants to report their perceptions by degree along a continuum, participants indicated their level of agreement with the statements. This ordinal measurement pattern captured the extent to which the characteristics were perceived to function in the plant, unlike categorical measurements, which would measure only the perceived presence or absence of the characteristics, or numerical measurements, which simply do not apply to perceptions (6). A score of one represented a low level of agreement that the plant had the high reliability characteristic, while a score of five represented a high level of agreement.

Survey respondents

On one day during the summer of 2003, the research team administered the High Reliability Survey (20) to 102 randomly selected employees, including em-

ployees from management, supervisory, line worker, and janitorial positions. The activity was coordinated by human resources. Employees went to the plant cafeteria when relieved or when on break, to meet with the research team. All employees invited to participate consented. The survey lasted approximately 20 minutes, and each participant completed the survey via a face-to-face interview with a researcher. Participating employees represented all job categories and totaled nearly 30% of the employed workforce at the plant.

The study participants included 4 administrators, 7 managers, 63 line workers, and 28 janitorial workers. The average employment tenure with the plant was 5.9 years ($SD = 7.8$ years), with a range of 1 week to 32 years (Median = 1.8 years). Only 24 (23.5%) employees had previously worked in other food processing plants. Forty-two (40%) of 102 employees reported working in one area of the plant, while 66 (60%) reported working in two or more areas. Fifteen employees (14.7%) responded that they had helped resolve a food safety problem.

RESULTS

Participants answered questions about perceptions of food safety, risk, consequences, and communication processes. Respondents answered each question with a number corresponding to their degree of agreement (strongly agree = 5) or disagreement (strongly disagree = 1)

with the statement. Respondents reported that food safety mistakes are not acceptable ($M = 4.16$, $SD = 1.144$). They perceived that a food contamination problem would be a serious difficulty for the plant ($M = 4.29$, $SD = 1.199$), with resulting serious repercussions ($M = 4.39$, $SD = 0.977$). As to the likelihood of a food safety problem, they indicated perception of the presence of some risk by only slightly disagreeing that mistakes are inevitable ($M = 2.37$, $SD = 1.312$) and by only slightly agreeing that risk is low ($M = 3.85$, $SD = 0.948$). Overwhelmingly, the employees perceived strong organizational commitment to avoiding food safety problems ($M = 4.71$, $SD = 0.683$).

Table 2 lists the 10 items used to identify and to assess the employees' perception of the degree of communication processes inherent to HROs functioning in the plant. Employees perceived their actions and the organization's commitment to contribute highly toward the prevention of food safety problems, as indicated by ratings higher than four. They did not, however, equally perceive their opinions to be valued or accepted and contributory toward prevention, as indicated by lower ratings.

To assess the overall extent to which employees perceived the plant as a high reliability organization, a total HRO score was calculated for each employee by summing the responses to each of the ten statements. The Likert-type scale allowed for a total score ranging from 10.00 to 50.00; a midpoint score of 30.00 would

TABLE 3. Mean scores of HRO perception by job category

Job Category	M	N	SD
Administration	38.00	4	3.16
Supervisory	43.57	7	5.29
Line Worker	38.84	63	5.93
Janitorial	41.03	28	4.88
Total	39.74	102	5.66

have corresponded to a response of three to each of the 10 statements. The mean total score was 39.74 ($SD = 5.66$), with a range of 25.00 to 50.00 (Median = 40.00). The calculated total mean suggests that employees generally perceived the plant as a high reliability organization.

A one-way ANOVA tested for differences in the overall perception of the plant as a high reliability organization by job category. The mean total scores by job category are listed in Table 3. Employees in different job categories did not have different overall perceptions ($F(3, 98) = 2.302, P = 0.082$).

The USDA had classified the Midwest plant as a consistently high-quality turkey plant on the basis of the low occurrence of inspection-identified hazards, violations, and outbreaks, compared with industry statistics. This outside assessment of high reliability provided criterion-based validity for the high reliability subscale. Both the USDA and the subscale for identifying high reliability organizations affirmed that the plant operates as a high reliability organization.

In addition to testing employees' overall HRO perception by job category, one-way ANOVAs were performed to test for differences by job category on each HRO characteristic (survey statement). Of the ten characteristics, all but one were perceived similarly by employees of different job categories. The exception was with regard to perceiving their actions as directly contributing to the prevention of food safety problems at the plant ($F(3, 98) = 3.320, P = 0.023$). A post hoc analysis was conducted to determine which employee group/s perception differed on this characteristic. In this analysis, only the management group had a significantly different (lower) rating from the other three groups.

DISCUSSION

High reliability organizations maintain consistent performance despite exposure to risk (23). Employees at the tur-

key plant recognized the ongoing potential for food safety problems, projected harmful consequences from any food contamination, and affirmed commitment to food safety. As classified by the USDA, the examined plant had consistently exceeded safety and quality standards in the turkey slaughter and processing industry in spite of the hazards and potential for contamination. The results from this study indicated that employees, regardless of job category, perceive the plant as a high reliability organization, given their perceptions of extant communication processes as elaborated in Weick's model: preoccupation with failure, reluctance to simplify interpretations, sensitivity to operations, commitment to resilience, and deference to expertise (23).

The finding that respondents in direct operations believe that their actions contribute to food safety suggests that the employees believe they can and do influence the level of safety. This finding is reassuring in that it suggests a self-perceived need for compliance with key HACCP procedures. Less reassuring is the relatively low rating that respondents gave to the idea that the plant takes their opinions into account on both daily operations and long-term planning. This finding suggests that although employees recognize the importance of maintaining prescribed procedures, they believe they can have little influence in general on plant policies for maintaining food safety. Although employees perceive some characteristics to be more prevalent than others, employees report an overall high level of confidence in the plant's commitment to maintaining food safety.

CONCLUSIONS

Employees perceive strong organizational commitment to avoiding food safety problems and high reliability in practice at the plant insofar as their actions contribute to risk reduction and food safety. These perceptions indicate that the

plant management effectively sends downward risk communication messages and has made specific, tangible suggestions for reducing risk and achieving product quality. Plant management emphasizes the HACCP system with its monitoring checks and the higher standards required by the Federal School Lunch Program, the plant's primary customer. Additionally, plant management conducts regularly scheduled paid training, models and trains on the shop floor on a daily basis, posts safety and risk reduction prompts throughout the plant, and serves turkey products processed at the plant in the employee cafeteria.

In contrast to the plant's effectiveness in sending and acting upon downward messages, employees note less effectiveness in management's reception of upward risk communication. Employees perceive less influence when communicating their opinions about daily operations or long-term planning. High staff turnover and relatively low skill level, coupled with the HACCP procedures in place, could dampen receptivity to ongoing communicative input about risk and risk reduction measures. This apparent lack of responsiveness to receiving risk communication from employees may not increase the plant's vulnerability to known risks; however, it may affect the plant's vulnerability to presently unidentified and unknown risks, and it therefore warrants further study.

Table 1 summarizes effective communication strategies for upward and downward communication. This research revealed more effective employment of downward strategies than of upward strategies. Nevertheless, the preponderance of line workers and janitorial staff and the high percentage of workers (60%) reporting work activities in more than one area suggest considerable horizontal communication, strategies typically considered upward strategies. It would be foolhardy to conclude from the results that downward strategies are more important than upward ones, because, although known risks may be easily and most frequently addressed by downward communication risks, unknown risks can be identified only at the operational level. Fortunately for the turkey processing plant, the employees closest to the product perceive connectedness between their actions and the safety of the product, which may attenuate the deficiencies in the reception by management of risk communication messages, through the employees' perceived empowerment to react as needed to ensure optimal safety and quality. In other words, employees may feel empowered to act and may do so, thereby reducing risk and ensuring safety.

Appendix: **High Reliability Survey**

Demographic Information

1. Would you describe your position at [Org] as:

Management _____

Supervisory _____

Line Worker _____

Janitorial _____

Other _____

2. Have you worked in other food processing plants in the past?

Yes _____ No _____

If yes, where and for how long? _____

3. How long have you worked at [Org]?

4. In what part or parts of the [Org] do you work most often?

5. Have you ever participated in resolving a food safety problem at [Org]?

Yes _____ No _____

If yes, please describe the problem and how it was resolved _____.

Risk

6. In general, a food contamination problem would be a serious difficulty for [Org] and the people it serves.

Strongly Agree 5 4 3 2 1 Strongly Disagree

7. Realistically, most food safety mistakes would create only minor problems for [Org].

Strongly Agree 5 4 3 2 1 Strongly Disagree

8. The threat of a food safety mistake is acceptable because maintaining affordable food costs is so important.

Strongly Agree 5 4 3 2 1 Strongly Disagree

9. The more valuable the food product is to the country, the more we should be tolerant of food safety mistakes.

Strongly Agree 5 4 3 2 1 Strongly Disagree

10. Food safety mistakes are inevitable and acceptable parts of the food processing industry.

Strongly Agree 5 4 3 2 1 Strongly Disagree

11. There would be serious repercussions for me personally if a food safety problem occurred due to my action or inactions.

Strongly Agree 5 4 3 2 1 Strongly Disagree

12. There would be serious repercussions for [Org] if a food safety problem occurred due to my action or inactions.

Strongly Agree 5 4 3 2 1 Strongly Disagree

13. There would be serious repercussions for the food industry as a whole if food safety problem occurred due to my actions or inactions.

Strongly Agree 5 4 3 2 1 Strongly Disagree

High Reliability Perceptions

14. My opinions are taken into account in the daily operations at the [Org].

Strongly Agree 5 4 3 2 1 Strongly Disagree

Appendix: **High Reliability Survey** (continued)

15. My opinions are taken into account in long-term planning with the [Org].	Strongly Agree	5	4	3	2	1	Strongly Disagree
16. My actions directly contribute to the prevention of food safety problems at [Org].	Strongly Agree	5	4	3	2	1	Strongly Disagree
17. My actions influence others to prevent food safety problems at [Org].	Strongly Agree	5	4	3	2	1	Strongly Disagree
18. [Org] is very concerned about the possibility of making a food safety error.	Strongly Agree	5	4	3	2	1	Strongly Disagree
19. [Org] is committed to correcting any shortcomings in preventing in the food safety inspection process.	Strongly Agree	5	4	3	2	1	Strongly Disagree
20. [Org] emphasizes maintaining effective operations.	Strongly Agree	5	4	3	2	1	Strongly Disagree
21. [Org] is committed to correcting any shortcomings in the food safety inspection process.	Strongly Agree	5	4	3	2	1	Strongly Disagree
22. [Org] supervisors and managers accept the advice of line workers if they think the worker has a good idea about food safety.	Strongly Agree	5	4	3	2	1	Strongly Disagree
23. [Org] does not try to present complicated emergency response issues in an overly simplistic way.	Strongly Agree	5	4	3	2	1	Strongly Disagree
Overall Perceptions							
24. [Org] has the resources it needs to prevent any food safety problems.	Strongly Agree	5	4	3	2	1	Strongly Disagree
25. The likelihood of a food safety problem at [Org] is very low.	Strongly Agree	5	4	3	2	1	Strongly Disagree
26. [Org] is committed to avoiding food safety problems.	Strongly Agree	5	4	3	2	1	Strongly Disagree

Limitations

At the request of the USDA, the plant agreed to participate in the multi-disciplinary case study of the plant's operations. In turn, the researchers agreed to minimize disruptions that would compromise normal operating procedures. The survey sample equaled one-third of the plant's workforce, but human resources slightly influenced the selection through coordination decisions of employee rotations and task coverage. Thus, although the sample provided valuable case study information, generalizability may be risky without additional assurances that the studied sample is representative of the entire plant workforce.

Another limitation may be the use of a quantitative measurement of high reliability. For logistic and pragmatic reasons, organizational communication culture was conceptualized and operationalized by Weick as tangible phenomenon. Yet many researchers argue that culture analysis requires multiple perspectives and cannot be reduced to measurements largely devoid of interpretive analyses.

Future research

Although the identified limitations may temper practical recommendations, the research outcomes for model development and theory building have been initially accomplished. This study ex-

tended the high reliability model by applying it to a new organizational setting, a food processing plant. In this particular case study, employees perceived high reliability communication practices. Future research will provide the needed studies for ongoing validity and replicability determinations as well as continued theory development. Soliciting a greater number of respondents from several different poultry and meat processing plants may provide better insight into the relationships between plant performance and the high reliability model. In addition, a companion, qualitative study would help to identify the actual behaviors and interactions among employees that could potentially be replicated at other workplaces.

RECOMMENDATIONS

The researchers identified, through employee perception, the presence of high reliability characteristics at the turkey plant, which may explain the plant's high reliability. Weick's HRO model provides a solid base on which other plants and USDA can co-construct and renegotiate workplace dialogue and interactions to improve food safety and quality in the poultry and meat processing industry.

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NEW

IAFP Foundation Fundraisers

Murder Mystery Dinner at the Deane House

Tuesday, August 15
6:30 p.m. - 10:00 p.m.

Dinner at the Rancho

Tuesday, August 15
6:30 p.m. - 10:00 p.m.

Highlights of the Executive Board Meeting

February 19–20, 2006
Calgary, Alberta, Canada

Following is an unofficial summary of actions from the Executive Board Meeting held at the Hyatt Regency Hotel in Calgary, Alberta, Canada on February 19–20, 2006.

Approved the following:

- Minutes of November 18, 2005 Executive Board Meeting teleconference
- Minutes of November 18, 2005 Executive Board Meeting, Executive Session teleconference
- Merger of two PDGs (Food Safety Network and Outreach Education) to form a new PDG named Food Safety Education PDG
- Increasing the percentage of spending from the Speaker Support Fund
- Increasing the Award honorarium to \$1,500 for 2007 Awards
- A new investment policy for General Fund monies
- Member dues restructure plan – target date of January 1, 2007
- E-Newsletter sample
- Affiliate activity
- European Symposium for fall of 2006
- Kraft Foods support of IAFP
- Exhibit opportunities for 2006-2007
- Removal of HACCP and Foodborne Illness articles from list of publications available
- Possible Foodsafe sponsorship
- Allergy Icon development
- WHO-NGO progress
- Electronic balloting-plan for 2008 Secretary election
- Representatives to Partnership for Food Safety Education
- Proceeds of book deal to IAFP Foundation
- Guiding principals for holding international meetings
- Food Research Coalition
- Peru Workshop on risk assessment

Discussed the following:

- E-mail votes taken since the last meeting
- Committee appointments to begin at IAFP 2006
- Revision of the Procedures to Investigate Foodborne Illness
- Paper on Food Worker Hygiene
- Scheduled chat room for Student conversation with IAFP President
- Results of the Program Committee meeting held February 17–18, 2006
- Workshops for IAFP 2006
- Local Arrangements preparations
- Ivan Parkin and John Silliker Lecturers
- IAFP 2006 planning update
- Committee meeting schedule for IAFP 2006
- Revised schedule of activities for IAFP 2006
- Foundation DVD project and review
- Rapid response series
- White paper on Avian Influenza
- University Speaker Program
- Student Travel Scholarship Award Program

Reports received:

- *Food Protection Trends*
- *Journal of Food Protection*
- IAFP Web site
- Scientific Editor Terms
- Membership
- Financial–December 2005
- European Symposium results
- Board Members attending Affiliate meetings
- Affiliate Newsletter
- Future Annual Meeting schedule
- Exhibiting (IAFP on the Road)
- Future Board meeting dates

Next Executive Board meeting: April 24–25, 2006.



NEW MEMBERS

ITALY

Paola Battilani
Universita Cattolica Sacro Cuore
Piacenza

UNITED STATES

ALABAMA

Tim Roberts
Jacksonville State University
Jacksonville

CALIFORNIA

Paula Martins De Freitas
University of California-Davis
Davis

Anna K. Jesus
E & J Gallo Winery
Modesto

Misty R. Johnstone
University of California-Davis
Davis

Surinder S. Kang
The Neil Jones Food Co.
Clovis

DELAWARE

Hudaa Neetoo
University of Delaware
Newark

FLORIDA

Juan M. Cevallos
University of Florida
Gainesville

Holly T. Petty
University of Florida
Gainesville

GEORGIA

Jean Kennedy
Atlanta

KANSAS

Sarah E. Schul
Kansas State University
Manhattan

Shelby G. Scott
Orval Kent Food Co.
Baxter Springs

MASSACHUSETTS

Sylvia Gaysinsky
University of Massachusetts
Amherst

MINNESOTA

Michael O'Rourke
Target Corporation
Minneapolis

MISSOURI

John C. Mills
bioMérieux, Inc.
Hazelwood

David H. Pincus
bioMérieux, Inc.
Chesterfield

NEBRASKA

Susan L. Hefle
University of Nebraska
Lincoln

NEW JERSEY

Pauline M. Pastore
AgION Technologies
Liberty Corner

NEW YORK

Carl M. LaFrate
ProCheck Food Safety
Baldwinsville

Yesim Soyer
Cornell University
Ithaca

NORTH CAROLINA

Toni W. Becker
Family Dollar Stores
Charlotte

Jae-Woo Kim
North Carolina State University
Raleigh

SOUTH DAKOTA

Richard A. Jochum
BPI Technology, Inc.
Dakota Dunes

Eldon Roth
BPI Technology, Inc.
Dakota Dunes

TEXAS

Jim Bell
Food Safety Net Services, Ltd.
San Antonio

NEW GOLD SUSTAINING MEMBER

Mike Hesse
BPI Technology Inc.
Dakota Dunes, SD

NEW SILVER SUSTAINING MEMBER

Gina Bellinger
Food Safety Net Services, Ltd.
San Antonio, TX

UPDATES

UNL Hires New Head of Science Department, Food Processing Center

Rolando Flores, a food engineer has been named to the University of Nebraska-Lincoln's department of food science and technology and director of the food processing center. Mr. Flores assumed the two positions on March 1st.

Mr. Flores previously was a research agricultural engineer with the US Dept. of Agriculture's Crop Conversion Science and Engineering Research Unit in Wyndmoor, PA. He also conducted research at that unit as a USDA food engineer.

Mr. Flores' tenure at the Pennsylvania-based unit, which is part of the USDA-Agricultural Research Service's Eastern Regional Research Center, followed about 15 years at Kansas State and Iowa State universities.

Most recently, from 1996-2001, Mr. Flores was a faculty member at Kansas State University. There, he conducted research on simulation and optimization of the wheat milling process, dry/wet sorghum milling, waste, and residues from food industries and use of grain processing byproducts.

He also worked from 1975 to 1986 at the National Production Bureau in San Jose, Costa Rica, including three years as director of its Administration Division, which oversaw that nation's \$27 million a year wheat and corn purchase program.

Mr. Flores received his bachelor's of science degree in mechanical engineering from Universidad de

Costa Rica; his master's of science in agricultural engineering from Iowa State University, and his doctorate in grain science from Kansas State University.

Novazone Inc. Expands Team of Industry Experts

Novazone has announced the appointments of Dr. William McGrane as director of applications; Mr. Anthony Rethans as general manager, applications; and Mr. Shiva Kumar as director of field operations.

Dr. William McGrane joins Novazone with 25 years of experience in a wide variety of chemical process operations and as an expert in oxidation and water treatment. Dr. McGrane is responsible for the development of new and innovative ozone-based applications. He holds a doctorate in chemical engineering from Vanderbilt University, a master's in chemical engineering from the University of Florida, and a bachelor's in chemistry from the University of Florida.

Mr. Shiva Kumar has 20 years of operations management experience. Mr. Kumar manages field installations, service and support. Mr. Kumar has a diversified background and extensive experience in rapid growth environments. He holds a master's degree in business administration from Santa Clara University and a master's in mechanical engineering from Kansas State University.

Mr. Anthony Rethans is responsible for market development of post harvest solutions. He holds a bachelor's degree in agribusiness management from California Polytechnic

State University, San Luis, Obispo and brings over 10 years of marketing and business development experience.

Gainco Names Esch New Company President

Gainco, Inc., a manufacturer of scales, automated sorting/distribution and other yield enhancement systems for the meat, poultry and food processing industries, announces the appointment of Don Esch as company president. Mr. Esch replaces Larry Bettcher, who will continue to serve as chairman of the board for Gainco, while Gene Parets will continue as executive vice president and chief operating officer of the company, now reporting to Mr. Esch.

Prior to assuming the post at Gainco, Mr. Esch served as vice president of sales and marketing for Bettcher Industries, Inc., a position he continues to hold. In addition to his successful tenure since joining Bettcher Industries in 2001, Mr. Esch has an impressive managerial track record with other important corporations inside and outside the food processing industry. He has held executive-level positions with APV Baker, Plasti-Line and Leggett & Platt, as well as sales management positions at Hoover Universal.

Esch holds a bachelor's degree in economics from Albion College, and a master's degree from the University of Oklahoma. He has also completed coursework in international business management at Waseda University (Tokyo) and DiEU (London).

FSIS Announces Initiative to Reduce *Salmonella* in Meat and Poultry

The US Department of Agriculture's Food Safety and Inspection Service (FSIS) has announced a comprehensive initiative to reduce the presence of *Salmonella* in raw meat and poultry products. "Our goal is to work proactively to reduce the presence of *Salmonella* on raw products before plants develop a pattern of poor performance. FSIS will more quickly report testing results and target establishments needing improvement, providing timely information to both consumers and industry," said USDA Under Secretary for Food Safety Dr. Richard Raymond.

The initiative will include concentrating resources at establishments with higher levels of *Salmonella* and changes the reporting and utilization of FSIS *Salmonella* verification test results. The effort is patterned after the highly successful FSIS initiative to reduce the presence of *E. coli* O157:H7 in ground beef. The FSIS *E. coli* O157:H7 initiative led to a 40 percent reduction in human illnesses associated with the pathogen, according to the Centers for Disease Control and Prevention (CDC). Central to the *E. coli* O157:H7 model's success was a collective acknowledgment by industry that this food safety hazard needed to be addressed in all their food safety systems.

Certain serotypes of *Salmonella*, which are known to cause human illness, are commonly found in raw meat and poultry. Other food

sources, such as produce and eggs, are also known to cause salmonellosis.

Where FSIS has performed Food Safety Assessments (FSAs) in establishments that have persistently poor performance records for controlling *Salmonella*, there has been a dramatic reduction in the levels of *Salmonella*. These results have clearly demonstrated that establishments can indeed control the incidence of *Salmonella* in the raw products they produce. FSAs are comprehensive, systematic evaluations of a firm's food safety system performed by enforcement, investigation and analysis officers (EIAOs).

The Pathogen Reduction/Hazard Analysis Critical Control Point (PR/HACCP) rule, implemented July 25, 1996, established *Salmonella* performance standards for the first time in seven categories of raw meat and poultry products: broilers; market hogs; cows/bulls; steers/heifers; ground beef; ground chicken; and ground turkey. FSIS collects and analyzes *Salmonella* samples as one part of an extensive science-based food safety verification system and publishes the data annually in aggregate form.

Since 2002, FSIS has seen an increase in *Salmonella* positive samples in broilers. Although the overall percentage of positive samples in verification testing of broilers is still below national baseline prevalence figures, the recent upward trend is of concern to the Agency.

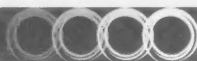
According to the strategy, which is described in a Federal Register notice (PDF Only) pub-

lished February 27, FSIS will now provide the results of its *Salmonella* performance standard testing to establishments as soon as they become available on a sample-by-sample basis. This will enable establishments to more readily identify and respond to needed process control in the slaughter-dressing operation. Receiving individual sample results soon after the samples are taken will help establishments in their assessment of whether their slaughter dressing procedures are adequate for pathogen reduction.

Currently, establishments receive results after the sample set is completed (for broilers a sample set consists of 51 consecutive days of sampling). FSIS will also begin quarterly posting on its Web site of the nationwide aggregate results of all sample results to give consumers more complete and timely information about *Salmonella* trends. The postings will provide consumers with meaningful information about overall industry performance in protecting public health.

FSIS will also plan to more quickly have the serotype of *Salmonella* found in positive samples determined in order to notify the establishment and monitor and investigate illness outbreaks in coordination with federal, state and local public health agencies. These results also could provide useful information about trends in the presence of serotypes of *Salmonella* in order to prevent outbreaks.

In August, FSIS held a public meeting to hear presentations on advances in pre-harvest reduction of *Salmonella* in poultry.



Hidden Dangers of *E. coli* in Childcare Facilities Highlighted

Due to the risks associated with the dangerous bacteria *E. coli* O157 in childcare facilities and crèches, the Food Safety Authority of Ireland (FSAI) has published the first information leaflet directly targeting childcare professionals. Infants and children show the highest incidence rates of infection with these bacteria and they are particularly vulnerable to serious and sometimes life-threatening consequences as a result. The FSAI initiative highlights the health risks associated with the potentially fatal *E. coli* O157 bacteria, and outlines the simple, but crucial, measures that should be implemented in all childcare facilities to prevent the spread of human infection.

During the five-year period from 1999 to 2004, *E. coli* O157 and related bacteria were responsible for 371 reported cases of illness in Ireland. There were two general outbreaks of *E. coli* O157 infection and one outbreak of a related bacteria, *E. coli* O26, associated with crèches. Also, in 2005, two crèches and a water scheme were associated with the largest ever Irish outbreak of illness linked with *E. coli* O157 bacteria when 18 people were infected, including nine children.

Dr. Wayne Anderson, chief specialist food science, FSAI, warned of the impact these dangerous bacteria can have on infants and children which cannot be underestimated.

"The incidence of *E. coli* O157 and the risk to public health from resulting infection is of serious concern. *E. coli* O157 can be spread

quickly and we need to ensure that infants and children, who are most at risk, are protected from the potentially fatal illnesses that can result following infection. The leaflet published by the FSAI contains some very simple and easy to follow food safety and hygiene practices that can play a major role in preventing the spread of *E. coli* O157 in childcare facilities. We are asking childcare operators to read the leaflet, distribute it to staff and to ensure that the recommendations are implemented in order to prevent the spread of *E. coli* O157 among children."

All childcare facilities that prepare or serve food are legally obliged to be registered as a food business with the local environmental health service and are legally obliged to comply with hygiene regulations. The FSAI's leaflet highlights the following crucial measures which may assist preventing the spread of *E. coli* O157 in childcare facilities:

Food Preparation and Storage – if food is being prepared in a childcare facility, it is a legal requirement that the person preparing the food is trained in basic food hygiene and the kitchen should have hygiene procedures based on the principles of HACCP. Stringent food hygiene practices are vital in preventing cross contamination of ready-to-eat foods with bacteria on raw meat.

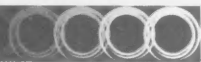
Toilet and Hygiene Practices – operators of childcare facilities are urged to ensure personal hygiene practices such as hand washing are in place and that children are supervised and encouraged to wash their hands after toilet use and before consuming food. Hygienic practices in relation to diaper changing and the disposal of soiled diapers and wipes is also essential.

Avoiding the Spread of Infection among Children – children who are suffering from sickness and/or diarrhea should be kept away from the childcare facility and if a child becomes sick during the day, the child's parents should be contacted to collect the child immediately. Special attention should be given to cleaning and disinfecting the area where a child has vomited or has suffered a bout of diarrhea.

Safe Water Supply – if the childcare facility is served by a private drinking water supply or a group water scheme, the owner should ensure that the water is safe and complies with European drinking water standards. For a private supply, the water should be tested for bacteria. If there are any doubts about the safety or suitability of the water for drinking, it should be boiled and cooled before being used to drink or prepare food.

E. coli can be found in water supplies and certain types of food. Person to person spread is an important mode of transmission in households, childcare facilities and institutions. Symptoms of *E. coli* O157 infection include bloody diarrhea and severe stomach cramps. In its mildest form, the symptoms often clear up within approximately eight days but children may continue to shed the bacterium for much longer. However, some 9% of symptomatic Irish cases went on to develop kidney disease or kidney failure (Hemolytic Uremia Syndrome – HUS). Children under 10 are most susceptible to HUS.

The information leaflet "*E. coli* O157: Protecting the Children in Your Care" is available at http://www.fsai.ie/publications/leaflets/Ecoli_children.pdf.



School of Medicine Awarded National Grant to Lead Food Safety Information Study

The University of Maryland School of Medicine, on behalf of the Food Safety Research Consortium, has been awarded a \$450,000 grant from the Robert Wood Johnson Foundation to lead a project seeking ways to facilitate the collection of and access to data that many in the public and private sector could use to improve food safety.

Michael R. Taylor, JD, a professor in the School of Medicine's Department of Epidemiology and Preventive Medicine and a former US Food and Drug Administration (FDA) and Department of Agriculture official, will manage the project, the first phase of a potentially long-term effort to address the many scientific, technical, legal, policy, and business hurdles affecting the way food safety data are collected and shared.

The project team will combine the food safety experience and expertise of the Food Safety Research Consortium (FSRC), a multidisciplinary collaboration among six universities and one nonprofit think tank, with that of the Public Health Informatics Institute, which advances public health practitioners' ability to use and manage information systems.

"We've taken on this project to test whether there is a realistic opportunity to improve the food safety information infrastructure, by which we mean all the ways that information related to food safety is collected, applied, and shared," says

Taylor. "The public health challenge is to better harness existing data and collect additional data that are needed to improve food safety."

Foodborne illness is an important public health problem in the United States. It causes an estimated 5,000 deaths and 325,000 hospitalizations annually, imposing economic costs in the billions of dollars. A dozen federal agencies, scores of state and local health departments, academic researchers, and the food industry already generate much valuable information needed to better understand how foodborne illness is caused and can be prevented. But existing information is not as widely shared as it could be due to a number of technical, legal, policy, and institutional obstacles. Moreover, some of the information needed to prevent foodborne illness is lacking, due in part to the difficulty of coordinating data collection plans and priorities among the many institutions, both public and private, that are involved in collecting and using food safety information.

"We want to explore with the food safety community the possibilities for working together toward a food safety information infrastructure that helps ensure the right data are generated, and that, as much as reasonably possible, relevant data are more widely shared and accessible to government policymakers and private sector risk managers alike," says Taylor.

Taylor notes that this 18-month project will focus on working with the food safety community to better define the need for and objectives of the food safety information infrastructure; identifying issues and obstacles that must be addressed; developing initial principles and concepts for how the system could better function; and testing interest

in collaboration among key institutions and individuals. It will include the preparation of a paper on the current state of food safety information collection and use, dialogue with public and private members of the food safety community, and a final report on the challenges and opportunities involved in improving the country's food safety information infrastructure.

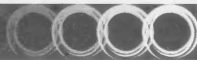
If realistic opportunities for progress are identified in this first phase, subsequent efforts could include resolving the identified issues and obstacles and developing the understandings, procedures, policy changes, and technical arrangements needed to build a better functioning information infrastructure.

The information infrastructure project is central to the FSRC's overall agenda to develop tools for more risk-based, data-driven approaches to the allocation of public and private resources and targeting of interventions to reduce foodborne risks, but, Taylor notes, a successful food safety information infrastructure must meet the diverse needs of many stakeholders across the food safety community. Taylor and his team are assembling a project advisory group to ensure that all perspectives are considered throughout the project.

Good Bacteria Reduce Pathogens in Chickens

Some commercial poultry processors have begun using a bacterial culture developed at the University of Arkansas that can sharply reduce the levels of pathogenic *Salmonella* and *Campylobacter* in live poultry.

This probiotic is helping the poultry industry increase the safety



of food products, and poultry science researcher Billy Hargis believes his research team can do more.

"We have not bothered to patent this specific culture because we don't think this is the best we can do," said Hargis, who is working on the Food Safety Consortium project in the UA Division of Agriculture. "We think we can find better cultures. This is just the best we have found so far. We think we can make it more effective." The culture is unique because unlike previous cultures that have been tested, this is a "defined culture" – entirely derived from a single defined group of bacteria. "They're known organisms, specific isolates that are well characterized," Hargis said.

The probiotic cultures are applied to the concept of competitive exclusion, in which different species compete to coexist. The plan in poultry production is to introduce the beneficial good bacteria into a live bird to drive out the harmful pathogenic bacteria. The federal Food and Drug Administration does not allow undefined cultures to be used in competitive exclusion, so the defined cultures produced by Hargis' research group fill a need for industry.

"Our cultures are different because they can be truly defined and they can be reproduced from specific isolates that are stored back in the freezer," he said. "Then they can be propagated virtually forever."

At the poultry production farm level, the probiotic culture has been administered to chicks through their drinking water and by spray application. In addition to cutting down on pathogens in the live poultry, the culture has also been found in experiments to be effective in increasing the birds' weight, lowering production costs and reducing environmental contamination in poultry houses.

Emphasis on food safety is mostly concentrated at the processing plants where companies employ numerous techniques to eliminate bacterial contamination in the stages before a poultry product is packaged for sale. Processors can find their work made easier if they receive a supply of live birds at the plant that have already been exposed to pathogen-reducing exercises.

So producers of live poultry would have significant incentives to use a probiotic culture if it not only reduces pathogens but also provides financial benefits against the usual costs of doing business.

"Our premise has been that if we can do something that provides an economic advantage in addition to reducing foodborne pathogens, then we might see more rapid adoption of the technology," Hargis said. "We've had quite a bit of commercial adoption in the past year. We have several companies that are using the product at least intermittently."

In addition to seeking ways to perfect the probiotic culture, Hargis also wants to pursue more study of its ability to reduce carcass contamination. Some experiments have shown such reductions, but more data are needed.

"*Salmonella* does not occur by spontaneous generation in a processing plant. It comes in with the live animals. I think it's a pretty good bet that reducing *Salmonella* in live animals will end up reducing *Salmonella* in food because that's where it comes from. Our focus now is to make the culture better and find other isolates that are more effective," Hargis explained.

Tiny Animals Aid *Salmonella*

Salmonella, one of the planet's most problematic food-poisoning bacteria, may have an accidental ally: transparent, nearly invisible animals called protozoa.

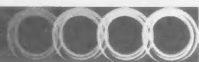
Agricultural Research Service Microbiologist Maria T. Brandl has provided new evidence of the mostly mysterious interaction between these microscopic protozoa and *Salmonella*. Brandl's discoveries from her work at the agency's Western Regional Research Center in Albany, CA may lead to new, more powerful, and more environmentally friendly ways to reduce the incidence of *Salmonella* in meat, poultry and fresh produce.

During their lives, *Salmonella* bacteria may encounter a commonplace, water-loving protozoan known as a Tetrahymena. Brandl's laboratory tests showed that the protozoan, after gulping down a species of *Salmonella* known as *S. enterica*, apparently can't digest and destroy it. So, the Tetrahymena expels the *Salmonella*, encased in miniature pouches called "food vacuoles."

The encounter may enhance *Salmonella's* later survival. Brandl found that twice as many *Salmonella* cells stayed alive in water if they were encased in expelled vacuoles than if they were not encased. What's more, Brandl found that the encased *Salmonella* cells were three times more likely than unenclosed cells to survive exposure to a 10-minute bath of two parts per million of calcium hypochlorite, the bleachlike compound often used to sanitize food and food-processing equipment.

The research is the first to show that Tetrahymena expel living *S. enterica* bacteria encased in food vacuoles and that the still-encased, expelled bacteria can better resist sanitizing.

Brandl and colleagues Sharon G. Berk of Tennessee Technological University-Cookeville and Benjamin M. Rosenthal at ARS' Henry A. Wallace Beltsville (MD) Agricultural Research Center documented their findings in a 2005 issue of *Applied and Environmental Microbiology*. Brandl now wants to pinpoint genes that *Salmonella* bacteria turn on



while inside the vacuoles. Those genes may be the ones that it activates when invading humans.

Read more about the research in the February 2006 issue of *Agricultural Research* magazine, available online at: <http://www.ars.usda.gov/is/AR/archive/feb06/protozoa0206.htm>.

Progress Made in Reducing *Campylobacter* in Poultry

Agricultural Research Service (ARS) scientists have identified and investigated two "hot spots" in poultry production where contamination with *Campylobacter* bacteria may occur.

Campylobacter are foodborne pathogens that can be present in raw or undercooked poultry. These bacteria cause mild to severe diarrhea and fever in humans, and can sometimes result in the secondary, neurological condition known as Guillian-Barre syndrome. Since these bacteria are commonly found in the digestive tracts of swine, cattle and poultry, they're readily deposited onto trucks and trailers when the animals are transported to processing plants. Getting live poultry to processing plants also involves confining the birds in transport coops for long periods.

It's possible to reduce *Campylobacter* during poultry transport and processing with simple measures. But "simple" doesn't always translate into "immediately feasible."

Microbiologist Mark Berrang, in ARS' Bacterial Epidemiology and Antimicrobial Resistance Research Unit, and Food Technologist Julie Northcutt, in the ARS Poultry Processing Research Unit — both at Athens, GA — have evaluated the role of transport coops and carcass defeathering as critical points at which *Campylobacter* contamination of broilers and broiler carcasses occurs.

The research team found that feces from *Campylobacter*-positive

birds can contaminate the feathers and skin of *Campylobacter*-negative birds later placed in the same soiled transport coop. Allowing the coops to dry for 48 hours before reuse dramatically lowered *Campylobacter* numbers.

But since this approach is economically and logistically impractical, the scientists plan to explore ways to redesign the coops to make them easier to clean. According to Berrang, washing coops with water and disinfectant can reduce the *Campylobacter* levels, but it isn't reliable and doesn't eliminate the microbes.

The second critical contamination point occurs during an early step in processing—feather removal. While, overall, processing decreases *Campylobacter* numbers on carcasses, this step increases them. To control the microbes, processors must work against this jump in numbers throughout the rest of processing. Berrang and Northcutt have shown that the *Campylobacter* increase is caused by the escape of highly contaminated fecal matter from the birds' lower gut during feather removal. They are now investigating methods to minimize this source of contamination.

Read more about this research in the February 2006 issue of *Agricultural Research* magazine, available online at: <http://www.ars.usda.gov/is/AR/archive/feb06/poultry0206.htm>.

Neogen Acquires Centrus International

Neogen Corporation has announced that it has acquired all outstanding stock of Centrus International, Inc., from Eastman Chemical Company. Centrus produces Soleris, a user-friendly, rapid optical testing system that accurately detects microbial contamination.

Centrus will continue to operate in its current facilities in Ann Arbor, MI, and its other operations

will be integrated into those facilities.

"The Soleris technology represents an excellent synergistic fit to our existing business, since Neogen did not have a product line to effectively compete in the general microbial rapid test market. The main focus of Neogen's rapid microbial testing products has been on dangerous foodborne pathogens, such as *E. coli*, *Salmonella*, and *Listeria*. The focus of the automated Soleris system is bacteria associated with poor food quality and spoilage. Soleris provides Neogen a strong entry to this important market with breakthrough technology," said James Herbert, Neogen's president.

The sales and marketing of the Soleris system will be shared worldwide by Neogen's Food Safety Division, and a proven distributor of Centrus products, Denmark-based Foss Analytical. For approximately six years, Foss has marketed the Soleris technology worldwide as its MicroFoss' system. Going forward, Foss will retain its distribution rights to the meat and dairy industries in many countries. Neogen's domestic and international sales groups will target markets, and regions of the world, not covered in the Foss agreement.

The Soleris system is a rapid optical system for the detection of microbial contamination based on an innovative application of classic microbiology. The optical assay measures microbial growth by monitoring pH and other biochemical reactions that generate a color change as microorganisms grow and metabolize. Sensitivity of the automated system enables detection in a fraction of the time needed for traditional methods with less labor and sample handling time. The Soleris system includes a wide array of tests for the food safety industry, including: total viable count, coliforms, *E. coli*, yeast and molds, lactic acid bacteria, and *Enterobacteriaceae*.

INDUSTRY PRODUCTS



Biotrace International

Biotrace Launches New Version of Uni-Lite® NG

Biotrace International has announced the availability of a new, even more flexible version of their hygiene monitoring instrument, the Uni-Lite® NG.

Using ATP Bioluminescence technology, the instrument provides a hygiene result in less than a minute, allowing decisions to be made in real time as to whether equipment or surfaces are sufficiently clean for production. Combined with state-of-the-art data trending software, Biotrack® +, this superior hygiene monitoring solution allows you to capture results for HACCP programs and produce detailed management reports. The Uni-Lite® NG now features USB connectivity in addition to RS232 giving customers more flexibility plus up to six times faster data transfer, making it more convenient to use. In addition, the instrument has a shorter overall measure time which means results are available even faster.

Used with the rapid surface hygiene and water tests, Clean-Trace®

and Aqua-Trace®, the original Uni-Lite® NG instrument was launched in 2003 and is a core part of Biotrace's hygiene monitoring offering. Colin Hunt, international product manager for the Biotrace Hygiene range says about the development, "We are confident that the improvements to the Uni-Lite® NG instrument will be well received by customers, as there is a continuing preference for faster results and enhanced data handling capability. It has always been our mission to offer our customers products that are relevant to their needs and benefit them every day. It is what we do best!"

Biotrace International offers a complete line of the products needed to check the safety and quality of food production processes; these include rapid pathogen, toxin and allergen kits, products for environmental and carcass sampling, dilution and enrichment and ATP testing that gives a "real time" assessment of plant sanitation.

Biotrace International
+44.(0)1656.641.400
Wales, United Kingdom
www.biotrace.com

New Sanitary Sample Coolers from Carltext Inc.

Carltext Inc. has introduced a new line of low cost, high quality sanitary sample coolers specifically designed for the safe taking of samples for chemistry/TOC, conductivity and microbiological studies from steam or heated water systems.

These sanitary sample coolers are specifically designed to be used in pharmaceutical plants and clean rooms. They are constructed of bright

polished 316L stainless steel and include a bracket for wall mounting.

The sample enters the top of the cooler and flows downward through the self-draining coils of electro-polished, seamless stainless steel.

Available both fixed or portable, these coolers can be steam sterilized or de-pyrogenated using a hot air process.

Carltext Inc.
631.754.2580
Greenlawn, NY
www.carltext.com

BD Diagnostic Systems BBL™ CHROMagar™ O157 Medium Receives AOAC-RI Approval

BD Diagnostic Systems, a unit of BD, announces the immediate availability of BBL™ CHROMagar™ O157, a chromogenic selective and differential medium for the presumptive identification of *E. coli* O157:H7 in foods. This unique BBL formulation allows *E. coli* O157:H7 to produce mauve (rose to purple) colonies that are easily differentiated from other bacteria, including coliforms, which may resemble *E. coli* O157:H7 on other traditional media. Laboratories will be able to perform fewer subcultures and biochemical tests as compared to conventional media.

An expert independent laboratory tested BBL CHROMagar O157 to evaluate recovery of *E. coli* O157:H7 compared to the reference USDA FSIS, FDA BAM and ISO media, as required by the AOAC™ Research Institute (AOAC-RI) Performance Tested MethodsSM program. BBL CHRO-

Be sure to mention, "I read about it in *Food Protection Trends*!"

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.

INDUSTRY PRODUCTS

Magar O157 demonstrated a sensitivity and specificity of 100%, with no false positives, with all three reference methods when testing raw ground beef and unpasteurized apple cider. The results of this study demonstrate that BBL CHROMagar O157 detected more positives than current standard reference media for the isolation and presumptive identification of *E. coli* O157:H7 in foods.

BBL CHROMagar O157 is the latest formulation in the BBL CHROMagar family of products to receive AOAC-RI approval. The BBL CHROMagar family of AOAC-RI approved products includes BBL CHROMagar *Staph aureus*, BBL CHROMagar *Salmonella*, and BBL CHROMagar *Listeria*.

BD Diagnostics
800.638.8663
Sparks, MD
www.bd.com



DuPont Qualicon

Strategic Alliance Yields New DuPont Qualicon BAX® System Q7

DuPont Qualicon is pleased to introduce the BAX® System Q7, a giant leap forward in pathogen detection designed to revolutionize food safety and quality testing. This next-generation BAX® system is the result of a strategic alliance formed earlier this year between DuPont Qualicon

and Applied Biosystems Group, an Applera Corporation business.

BAX® Q7 combines the ease-of-use and superior performance of the current BAX® System with additional technologies from Applied Biosystems that result in a highly flexible PCR instrument and new assays that exploit the technology.

While totally compatible with current BAX® System assays, the new BAX® Q7 instrument can use both real-time and end-point detection methods. It has the ability to detect up to five different dyes used for probe-based detection, as well as intercalating dyes, allowing the use of the best chemistry to match the needs of the assay. It completes 40 cycles of PCR in less than two hours, leading to faster results. And for the first time, food companies can use the same automated platform for both safety and quality testing.

"The BAX® Q7 is a major step-change in PCR detection systems," said Peter Mrozinski, business development manager for DuPont Qualicon. "Innovations in the new instrument will enable us to develop BAX® Q7 assays that provide new and meaningful information on food samples, such as presence and amount of multiple microbes in a single sample. This, in turn, will help food companies make informed business decisions at an earlier point in the process."

"The first instrument for our alliance with DuPont Qualicon incorporates Applied Biosystems' Real-Time PCR technology, already widely used in research laboratories and in other applications worldwide," said Mark P. Stevenson, president of the Applied Markets Division for Applied Biosystems. "We believe Applied Biosystems' real-time PCR technologies and scientific expertise in assay development will lead to future assays

with new levels of sensitivity and versatility ideal for food testing in the food manufacturing environment."

Beyond pathogen detection, DuPont Qualicon is developing technologies that will optimize and shorten the entire testing process. The goal is a completely integrated system of food testing modules – from sampling and enrichment to accurate detection and actionable results.

"Simply stated, our vision is to revolutionize the way food testing is done," said Ravi Ramadhar, global marketing manager for DuPont Qualicon. "Introducing the BAX® Q7 is an important first step in meeting this goal."

DuPont Qualicon
800.863.6842
Wilmington, DE
www.qualicon.com

CRYOLOG TRACEO®, the Transparent 'Smart' Label to Trace Food Quality From the Factory to the Fridge

In the last decade, food quality assurance has become increasingly imperative to grocers and consumers. With recent food scares, consumers have become increasingly vigilant about the quality of perishable food products they purchase and consume. CRYOLOG has designed the TRACEO® transparent label to trace freshness at a glance. Applied over a bar code, the label turns opaque when the product is no longer fit for consumption by using an innovative patented microorganism technology that simulates the actual degradation of the product to which it is affixed.

Significant food scares (avian flu, mad cow disease, listeriosis, dioxin,

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INDUSTRY PRODUCTS

foot-and-mouth disease) have shaken consumers' confidence and trust in their food's quality and even in the whole agribusiness sector. Traceability is becoming generalized with the aim of being able to keep track of a packaged foodstuff from the moment it is manufactured to the moment it is consumed.

The TRACEO® label provides a solution to public health problems caused by breakage in the cold chain by making it possible to optimize a product's freshness. Its general applications are tracing of fresh foodstuffs in grocery stores, and monitoring prepared meals and sandwiches in the catering market. It can also be used in the health market for applications such as monitoring vaccines, blood collection bags, etc.

A microbiological freshness indicator, this new-generation adhesive label (time-temperature integrator) is programmed according to the desired tracing criteria and is applied directly over a bar code. Made up of a gel and microorganisms, it turns opaque when the product is no longer fit for consumption, either after accumulative exposure to excess temperature or, if the product has been suitably kept, when the expiration date has passed. When the label has turned opaque, the bar code can no longer be read or scanned. Those products no longer fit for consumption can be automatically and visually detected and will not even reach the consumer's hands. Even the consumer can benefit from the technology by simply looking at the bar code before using the product, in the event that he kept it too long before consumption.

The producer activates the label when it is affixed to the end product.

It then monitors and tracks the product's freshness from the moment it leaves the factory until it enters a consumer's refrigerator, after going through distribution channels and supermarket shelves.

CRYOLOG

+33 (0) 1 41 24 25 00

Gentilly, France

www.cryolog.com



Jenco International, Inc.

Jenco International, Inc. New Series BC Upright Compound Microscopes

Jenco International has introduced their new, BC Series Upright Compound Microscopes. This new series is specifically designed for the demanding research environment.

The modern frame provides enhanced stability for high quality photomicroscopy. The ergonomic single hand focus/stage controls increase workflow while minimizing fatigue.

The true Kohler Illumination features a field diaphragm and a 20 watt, 6 volt halogen bulb with an electronic dimmer.

The BC Series offers binocular and trinocular models with bright field plan, phase plan, phase archromatic and infinity optics.

Supplies as standard are four objectives: 4X, 10X, 40X R and 100 X R (oil) and two 10X wide field eyepieces. Other objectives and eyepieces are available.

The large mechanical stage (209mm X 140mm) facilitates specimen handling. The robust all-metal gear train mechanism will endure years of usage.

The new BC Series from Jenco is one of four series of upright compound microscopes. The full line offers 23 models covering the educational, industrial, and the research markets.

Jenco International, Inc.

800.566.8502

Portland, OR

www.jencointernational.com

Eagle Introduces Quik-Set® Shelving for Heavy, Load- bearing Storage

New Quik-Set® shelving from Eagle Foodservice Equipment is designed specifically for heavy-duty load-bearing shelving and storage of goods. With each shelf able to accommodate up to 1,000 pounds of evenly distributed weight, Quik-Set® is perfect for storing canned goods and other heavy items.

Quik-Set® shelving is suitable for use in both wet and dry shelving environments. Models feature either 16- or 14-gauge type 304 stainless steel construction, or galvanized steel coated with Eagle's super-durable Valu-Master® pewter gray epoxy finish that is covered by a five-year warranty. Shelving posts are also offered in stainless steel or galvanized steel with the Valu-Master® finish, and are grooved in 2-inch increments to ensure easy leveling and quick adjusting. Shelf posts

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INDUSTRY PRODUCTS

feature adjustable feet, or optional 5-inch casters for portability.

Eagle offers Quik-Set® shelving featuring three shelf styles – flat, embossed and louvered – thereby enabling customers to select the shelf that best suits their storage needs and air circulation requirements. All shelf sides are constructed with a 2-inch downturn and marine edge, with each corner fitted with a heavy-duty aluminum casting for a snug, secure fit with the posts. Each individual shelf can hold up to 1,000 pounds of evenly distributed weight.

Assembly of Quik-Set® shelving is very easy, with no tools required.

Eagle Foodservice Equipment
800.441.8440
Clayton, DE
www.eaglegrp.com

New Ansell ChemTek® Butyl and Viton® Gloves Assure Workers Highest Levels of Protection from Hazardous Chemicals

New ChemTek® gloves from Ansell Healthcare provide the highest level of protection for handling hazardous chemicals in manufacturing and chemical processing environments. The new ChemTek product line, comprised of two different glove styles, offers superior chemical protection for first responders and others who may be faced with potentially hazardous or unknown substances.

"Ansell's ChemTek gloves not only provide outstanding and aggressive chemical protection, but they are designed for comfort with a natural, curved ergonomic shape and soft polymer feel," said Bill Bennett, business development manager for Chemical Resistant Products.

The new ChemTek glove line includes ChemTek butyl, which delivers the ketone resistance of natural rub-

ber combined with better hydrocarbon resistance; and ChemTek Viton®, a dual polymer glove providing a less costly solution compared to Viton by itself for applications where a high level of protection is needed for aggressive chemical exposure.

ChemTek butyl gloves offer excellent dexterity and the highest permeation resistance to gases and chemical vapors of any glove materials currently on the market. They are appropriate for aggressive environments in which workers require protection against esters, ketones, strong oxidizing agents and a wide range of chemicals considered particularly harsh.

For even heavier duty applications, flexible ChemTek Viton gloves feature Viton/butyl construction to assure the highest chemical-resistance against aromatic hydrocarbons such as benzene, toluene or xylene. The gloves provide superior barrier protection from most chlorinated solvents and aliphatic hydrocarbons and assure workers an added level of protection when facing exposure to hazardous chemicals and unknown contaminants.

ChemTek butyl gloves are available in 14, 20 and 28 mil versions with either a rough or smooth finish, while ChemTek Viton gloves are offered in thicknesses of 12 mil, 20 mil or 28 mil and feature a smooth finish.

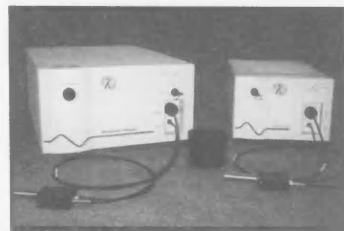
Both the ChemTek butyl and Viton gloves may be ordered in 12- and 14-inch lengths for easy donning and added wrist protection.

"The addition of highly effective ChemTek gloves completes Ansell's line of hand protection products for aggressive chemical handling," said Mr. Bennett.

ChemTek gloves protect employees working in maintenance, sampling, production and HazMat operations in

the chemical manufacturing, processing and handling industries and the refining, printing, automotive/OEM, mining and aerospace industries.

Ansell Healthcare
800.800.0444
Red Bank, NJ
www.ansellpro.com



Lambda Solutions

Lambda Solutions New Raman Systems for QC and Process Control

Lambda Solutions, Inc. has introduced New Dimension-P Raman Systems with features to provide complete solutions for quality and process control.

These Dimension-P Systems provide new functionalities for RealTime analysis along with RealTime monitoring.

Compliant with the FDA 21 CFR part 11 for complete audit, security and validation requirements.

New trigger-activated fiber probes are available for easy sample testing. Probes with working distances up to 20 mm are designed for use with liquids, powders and solids or through 10–15 mm quartz windows.

The Dimension Systems will meet your pharmaceutical or food processing quality control, quality assurance and process control needs.

Lambda Solutions, Inc.
781.478.0170
Waltham, MA
www.lambdasolutions.com

Be sure to mention, "I read about it in Food Protection Trends"!

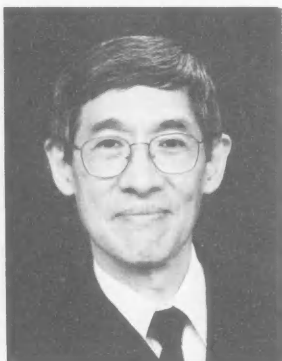


Ivan Parkin Lecture

**Sunday, August 13
6:00 p.m.**

Dr. Arthur Liang

**Director of Food Safety
Centers for Disease Control and Prevention
National Center for Infectious Diseases
Atlanta, Georgia**



Dr. Arthur Liang is director of the Food Safety Office, at the Centers for Disease Control and Prevention, National Center for Infectious Disease (CDC/NCID). He is a former CDC

Epidemic Intelligence Service officer and former chief of the Communicable Disease Division at the Hawaii Department of Health. Dr. Liang currently serves on the Executive

Committee of the National Advisory Committee on Microbiological Criteria for Foods (NACMCF) and is the CDC advisor to the Board of Directors of the Association of Food and Drug Officials (AFDO). He is also a member of the Preventive Medicine Residency Advisory Committee for the Walter Reed Army Institute of Research, a fellow and member of the Board of Regents of the American College of Preventive Medicine. He is board certified in General Preventive Medicine and Public Health. Dr. Liang earned his BA from Oberlin College, an MPH in International Health and Epidemiology from the University of Hawaii, and his MD from the University of Maryland.

***Join us at the Wine and Cheese Reception
in the Exhibit Hall following the Ivan Parkin Lecture.***

(The Wine and Cheese Reception is sponsored by Kraft Foods)



John H. Silliker Lecture

Wednesday, August 16

3:45 p.m.

"Rising From the Ocean Bottom – The Evolution of Microbiology in the Food Industry"

Dr. William H. Sperber

Senior Corporate Microbiologist

Cargill, Inc.

Wayzata, Minnesota



On a wintry Wisconsin afternoon in 1941, a future microbiologist drew his first breath and cried, "I hope you washed your hands!" Some years later, after completing undergraduate

majors in zoology and chemistry, William Sperber earned his M.S. (1967) and Ph.D. (1969) degrees in microbiology from the University of Wisconsin at Madison. In his subsequent employment with major food companies he has become one of the world's experts in designing and controlling the microbiological safety and quality of foods.

Several of Dr. Sperber's innovations in graduate school were the development of M-Broth and the Enrichment-Serology procedure for *Salmonella* detection, which became a forerunner of ELISA-based technologies. At Best Foods in 1970, twelve years before the Tylenol[®] incident, he led the

development of the first tamper-evident packaging feature for a consumer food product. Hired in 1972 to conduct the first hazard analyses for consumer food products in Pillsbury's novel HACCP system, Dr. Sperber led Pillsbury's microbiology and food safety programs until 1995. At that time he joined Cargill, where he remains employed today on a post-retirement basis as Senior Corporate Microbiologist and "Global Ambassador for Food Safety," promoting principles of food safety and public health, beginning with the most important principle, "Wash Your Hands!"

A former chair of the IFT Division of Food Microbiology and the Food Microbiology Research Conference, Dr. Sperber was appointed five times by the US Secretary of Agriculture to the National Advisory Committee on Microbiological Criteria for Foods. The author of numerous publications and presentations, he is currently developing several book chapters and co-editing a new Compendium on the Microbiological Spoilage of Foods and Beverages, still "trying to make the world safer for people who eat." Bill and his wife, Renate, enjoy gardening, bicycling, books, music, and travel.



IAFP 2006 Preliminary Program

SUNDAY, AUGUST 13

Opening Session – 6:00 p.m.–7:00 p.m.

- Ivan Parkin Lecturer – Arthur Liang, Ph.D., CDC, Atlanta, GA, USA

MONDAY, AUGUST 14

Morning – 8:30 a.m. – 12:00 p.m.

Symposium Topics

- Making Foods Safer: How Outbreaks Can Influence Change
- Surrogate Microorganisms: Selection, Use and Validation
- The Canadian Approach to Food Safety
- Verification of Sanitary Design of Food Equipment
- Practical Application of Risk Assessment Tools in the Food Industry

Technical Session

- Applied Laboratory Methods and Meat and Poultry

Poster Session (9:30 a.m. – 1:30 p.m.)

- Food Toxicology, Education and General Microbiology

Afternoon – 1:30 p.m. – 5:00 p.m.

Symposium Topics

- Foodborne Viruses and Foodborne Viral Infections: Disease Burden, Epidemiology, Detection and Transmission
- Spores, Spores, and More Spores...What is Spoiling My Ready-to-Drink (RTD) Beverage? Is It *Alicyclobacillus* or Heat Resistant Mold?
- Biosecurity at Retail

Round-Table Topics

- Issues Regarding Raw Milk Sales and Consumption
- Refrigerated Ready-to-Eat (RTE) Foods: Microbiological Concerns and Control Measures

Technical Session

- Education and Dairy

Poster Session (2:00 p.m. – 6:00 p.m.)

- Dairy, Meat and Poultry

TUESDAY, AUGUST 15

Morning – 8:30 a.m. – 12:00 p.m.

Symposium Topics

- Disaster Preparedness and Response
- Symposium on *Enterobacter sakazakii*
- *Campylobacter* – From Gate to Plate
- Hygiene and Sanitation Solutions to Manage Evolving Risks
- International Food Law – A Global Overview

Technical Session

- Pathogens and Antimicrobials

Poster Session (9:30 a.m. – 1:30 p.m.)

- Seafood and Applied Laboratory Methods

Afternoon – 12:15 p.m. – 1:00 p.m.

- IAFP Business Meeting

Afternoon – 1:30 p.m. – 5:00 p.m.

Symposium Topics

- Foodborne Disease Update
- Contamination of Ready-to-Eat (RTE) Foods: Transfer and Risk – *Listeria monocytogenes* and Other Microorganisms
- Role and Application of International Standards in Supporting Food Safety Management and Testing
- A New Crack at Egg Safety: From the Hen House to Your House
- Cleaning and Sanitation for Retail Food Safety – Identifying the Issues

Technical Session

- Risk Assessment and Epidemiology

Poster Session (2:00 p.m. – 6:00 p.m.)

- Pathogens and Produce

WEDNESDAY, AUGUST 16

Morning – 8:30 a.m. – 12:00 p.m.

Symposium Topics

- Aftermath of Hurricane Katrina and Rita on Seafood Safety
- Assuring Microbiological Safety of Organic Products
- Symposium on *Salmonella*: The Saga Continues

Technical Sessions

- Education
- Pathogens and Antimicrobials – *Listeria*

Poster Session (9:30 a.m. – 1:30 p.m.)

- Risk Assessment and Antimicrobials

Afternoon – 1:30 p.m. – 3:30 p.m.

Symposium Topics

- How Risk Managers Decide on Risk from Different National Perspectives
- Symposium on Food Allergen Control at Retail and Foodservice
- Quality Control in Research Labs

Round-Table Topic

- Water Safety and Quality: Global Water – HACCP Issues

Technical Session

- Produce

Afternoon – 3:45 p.m. – 4:30 p.m.

- John H. Silliker Lecturer – William Sperber, Ph.D., Cargill, Minnetonka, MN, USA

Subject to change



IAFP 2006 Networking Opportunities

IAFP FUNCTIONS

WELCOME RECEPTION—Hyatt Regency Calgary

Saturday, August 12 • 4:30 p.m. – 5:30 p.m.

Sponsored by Orkin Commercial Services

Welcome to IAFP 2006 and to the beautiful city of Calgary. Reunite with colleagues from around the world as you socialize and prepare for the leading food safety conference. Everyone is invited!

AFFILIATE RECEPTION—Hyatt Regency Calgary

Saturday, August 12 • 5:30 p.m. – 7:00 p.m.

Affiliate Officers and Delegates plan to arrive in time to participate in this educational reception. Watch for additional details.

COMMITTEE MEETINGS—Hyatt Regency Calgary

Saturday, August 12 • 1:00 p.m. – 5:00 p.m.

Sunday, August 13 • 7:00 a.m. – 5:00 p.m.

Refreshments Sponsored by Springer New York LLC

Committees and Professional Development Groups (PDGs) plan, develop and institute many of the Association's projects, including workshops, publications, and educational sessions. Share your expertise by volunteering to serve on any number of committees or PDGs. Everyone is invited to attend.

STUDENT LUNCHEON—Hyatt Regency Calgary

Sunday, August 13 • 12:00 p.m. – 1:30 p.m.

Sponsored by Texas A&M Agriculture, Department of Animal Science, Food Safety

The mission of the Student PDG is to provide students of food safety with a platform to enrich their experience as Members of IAFP. Sign up for the luncheon to help start building your professional network.

EDITORIAL BOARD RECEPTION—Hyatt Regency Calgary

Sunday, August 13 • 4:30 p.m. – 5:30 p.m.

Editorial Board Members are invited to this reception to be recognized for their service during the year.

OPENING SESSION

AND IVAN PARKIN LECTURE—Hyatt Regency Calgary

Sponsored by The IAFP Foundation

Sunday, August 13 • 6:00 p.m. – 7:00 p.m.

Join us to kick off IAFP 2006 at the Opening Session. Listen to the prestigious Ivan Parkin Lecture delivered by Dr. Arthur Liang.

CHEESE AND WINE RECEPTION—Telus Convention Centre

Sunday, August 13 • 7:00 p.m. – 9:00 p.m.

Sponsored by Kraft Foods

An IAFP tradition for attendees and guests. The reception begins in the Exhibit Hall immediately following the Ivan Parkin Lecture on Sunday evening.

IAFP JOB FAIR—Telus Convention Centre

Sunday, August 13 through Wednesday, August 16

Employers, take advantage of recruiting the top food scientists in the world! Post your job announcements and interview candidates.

COMMITTEE AND PDG CHAIRPERSON BREAKFAST

(By invitation)—Hyatt Regency Calgary

Monday, August 14 • 7:00 a.m. – 9:00 a.m.

Chairpersons and Vice Chairpersons are invited to attend this breakfast to report on the activities of your committee.

EXHIBIT HALL LUNCH – NEW!—Telus Convention Centre

Monday, August 14 • 12:00 p.m. – 1:00 p.m.

Tuesday, August 15 • 12:00 p.m. – 1:00 p.m.

Stop in the Exhibit Hall for lunch and business on Monday and Tuesday.

EXHIBIT HALL RECEPTIONS—Telus Convention Centre

Monday, August 14 • 5:00 p.m. – 6:30 p.m.

Sponsored by DuPont Qualicon

Tuesday, August 15 • 5:00 p.m. – 6:00 p.m. – **NEW!**

Join your colleagues in the Exhibit Hall to see the most up-to-date trends in food safety techniques and equipment. Take advantage of these great networking receptions.

PRESIDENT'S RECEPTION (By invitation)—Hyatt Regency Calgary

Monday, August 14 • 6:30 p.m. – 7:30 p.m.

Sponsored by Fisher Scientific

This by invitation event is held each year to honor those who have contributed to the Association during the year.

PAST PRESIDENTS' DINNER (By invitation)—Hyatt Regency Calgary

Monday, August 14 • 7:30 p.m. – 10:00 p.m.

Past Presidents and their guests are invited to this dinner to socialize and reminisce.

BUSINESS MEETING—Telus Convention Centre

Tuesday, August 15 • 12:15 p.m. – 1:00 p.m.

You are encouraged to attend the Business Meeting to keep informed of the actions of YOUR Association.

JOHN H. SILLIKER LECTURE—Telus Convention Centre

Wednesday, August 16 • 3:45 p.m. – 4:30 p.m.

Sponsored by The IAFP Foundation (Funded through a contribution from Silliker, Inc.)

The John H. Silliker Lecture will be delivered by Dr. William H. Sperber.

AWARDS BANQUET—Hyatt Regency Calgary

Wednesday, August 16 • 7:00 p.m. – 9:30 p.m.

Bring IAFP 2006 to a close at the Awards Banquet. Award recipients will be recognized for their outstanding achievements and the gavel will be passed from Dr. Jeffrey Farber to Incoming President Frank Yiannas, M.P.H.



IAFP 2006 Event Information

EVENING EVENTS

NEW – IAFP Foundation Fundraisers

Murder Mystery Dinner at the Deane House

Tuesday, August 15 • 6:30 p.m. – 10:00 p.m.



A short ride from downtown Calgary leads to The Deane House located in the Fort Calgary interpretive site. Nestled on the banks of the Elbow River, the house has maintained its historical authenticity and is a perfect setting for relaxed, casual dining.

The Deane House Mystery from History is a unique, interactive dinner theatre. Characters from the past play out a mystery, loosely based on local history while guests play detective, trying to figure out “who dunnit.” During Act I, enjoy a leisurely cocktail in the Captain’s Room while the characters mingle with the crowd. The Narrator explains the rules of the game, how the evening will proceed and makes formal introductions. Guests then move to the main dining room where Act II unfolds during soup and salad service... and concludes with a murder. After a sumptuous entrée, explore the house, eaves-dropping and listening for further clues. As the curtain comes down on Act III, return to the dining room where dessert is served. At this point “guesses” are revealed and the murder is solved.

Dinner at The Ranche

Tuesday, August 15 • 6:30 p.m. – 10:00 p.m.



The flavors and traditions of Alberta’s ranching heritage live on at The Ranche Restaurant. Originally built in 1886 by William Roper Hull as the headquarters of The Bow Valley Ranche, it was sold in 1902 to Patrick Burns, one of the founding members of the Calgary Stampede. This intriguing historic house was once one of Southern Alberta’s grandest private residences and today it is home to one of Calgary’s finest and most creative restaurants – a unique setting within the city.

Located in Fish Creek Provincial Park, the Ranche is acclaimed for its commitment to exceptional dining experiences. Executive Chef Alistair Barnes and his team offer discriminating dinners, fresh baked bread, the finest meat, poultry and fish, naturally raised game (from their own game ranch!), fresh vegetables and mouth-watering desserts.

A portion of your registration fee from the two IAFP Foundation Fundraising activities will be donated to the Foundation.

GOLF TOURNAMENT



Golf Tournament at The Links of GlenEagles

Saturday, August 12 • 7:30 a.m. – 4:00 p.m.

Join your friends and colleagues for a relaxing round of golf, Canadian Rocky style, before IAFP 2006. From the very first tee at The Links of GlenEagles, you know you’ve made the right choice for your day of golf. On every hole there are panoramic Rocky Mountain views as a backdrop to one of Canada’s most superb golf courses. At The Links of GlenEagles you will find a pristine course – lush green fairways, the brilliant white sand bunkers and exciting changes in elevation.

Designer Les Furber, one of Canada’s greatest golf designers, carved this course into the rugged foothills just as they run up to the Rocky Mountains. Portions of the course run along a cliff some 200 feet above the Bow River Valley. The course offers a grand visual experience as well as a golfing adventure. It’s a round you will talk about for months afterward.

Price includes transportation, greens fees with cart, range balls, lunch and prizes.

DAYTIME TOURS

The Best of Lake Louise and Banff

Saturday, August 12 • 8:00 a.m. – 5:00 p.m.



For over a century, explorers have been making the trip to the incredible towering mountain peaks and icy blue glaciers, which are the highlights of Banff National Park. As you depart the urban city of Calgary, you will pass through the rolling wheat fields and into the foothills before entering the majestic beauty of the Canadian Rockies. Once in Banff National Park, the journey continues along the winding Bow Valley Parkway passing Hole-in-the-Wall, Johnston Canyon and magnificent Castle Mountain. At Lake Louise, enjoy free time to discover this special place with outdoor pursuits: hike, rent a canoe, or try horseback riding. If you prefer, the Fairmont Chateau Lake Louise has various shops, lounges, restaurants, and fabulous architecture that will impress for hours. The rich history and beauty of Lake Louise will last in memory for years to come! Rejoin the group to enjoy a delicious lunch before departing the Chateau for the second half of the tour.

The next part of the adventure in the Rockies leads to beautiful Banff! This tour features the spray of cool waterfalls, an optional ascent up a mountain, a taste of local history and a chance to spy on wildlife – complete in one afternoon! To start, feel the power of the Bow Falls and the beauty that surrounds it just below the Fairmont Banff Springs Hotel. Continue exploring some of the best views in town – Surprise Corner on Tunnel Mountain Drive, the Hoodoos (oddly shaped pillars of glacial rock) and Mount Norquay's winding road. Next stop at the Cave and Basin Centennial Center – the birthplace of Canada's national parks where the guide will provide interesting tidbits on Banff's rich natural and human history. Before returning to Calgary, enjoy some free time to explore the many unique cafes, boutiques, and shops in downtown Banff or take a relaxing stroll through the tranquil Cascade gardens.

Optional: For those not wanting to stop downtown, the coach will continue on to Sulphur Mountain where guests can take the gondola up to the 7,500 foot summit of the mountain and enjoy a panoramic view of the entire Bow Valley as well as explore the interpretive trail that winds atop the mountain. Gondola admission is not included in the tour price.

The Complete Calgary Tour

Sunday, August 13 • 10:00 a.m. – 4:00 p.m.



Spend today exploring the exciting attractions of Calgary. This thriving business center combines the friendly atmosphere of the old west with the aggressive style of a modern cosmopolitan center. The day will be highlighted by stops at historical locations, unique neighborhoods and scenic viewpoints. Start at the Calgary Tower that features spectacular views of Calgary and the Canadian Rockies as well as a new glass floor attraction. Visit Heritage Park where the sights and sounds of Canada's exciting pioneer west has been recreated; enjoy a tour onboard an authentic steam train followed by lunch in one of the historical buildings. Last, make a stop at Canada Olympic Park, an internationally-renowned winter training facility and home to the world's largest Olympic Hall of Fame!

Drumheller and the Badlands

Monday, August 14 • 8:00 a.m. – 4:00 p.m.



Wind whines through the stubble of brush over a dry valley, its whispers joined only by the incessant creaking of crickets and the occasional clacking of grasshoppers' wings. This is the Badlands of Alberta! As the landscape changes, you will feel as though you've stepped back in time – way back to prehistoric time! The highlight of this tour will be at the Royal Tyrrell Museum of Paleontology in Drumheller. This museum is a major exhibition and research center, and one of the largest paleontological museums in the world. It displays more than 200 dinosaur specimens, the largest number under one roof anywhere. Most of the dinos on display were found in Alberta; the majority just outside in Dinosaur Provincial Park and Drumheller. Following a tour of the museum, enjoy the unique landscape of some of the many self-guided trails and a leisurely lunch.

Art Walk

Tuesday, August 15 • 10:00 a.m. – 1:30 p.m. (Lunch not included)

Downtown Calgary isn't all concrete and glass – it's also home to some of Calgary's best-known art galleries. These gems will be explored on a walking tour of downtown. Stops will include the Stephen Lowe Art Gallery featuring Western and Asian fine art paintings and sculptures by more than 65 artists; Diana Paul Galleries, where some of Canada's most renowned contemporary impressionists are featured; Gainsborough Galleries, opened in 1923, the longest-running art gallery in the city; and Wallace Galleries, representing accomplished Canadian and international contemporary visual artists.

The tour will end at Art Central – Calgary's newest addition to the art scene, with three floors of bright open space housing art galleries and artists studios. A short tour highlighting the main attractions on each floor will be followed by a demonstration in one of the artist's studios.

Following the tour, explore Art Central, enjoy a delicious lunch (not included) in one of the trendy downtown restaurants, or continue exploring Calgary's artistic offerings.

Yoga and Cooking Class

Wednesday, August 16 • 9:45 a.m. – 2:00 p.m.

Today is dedicated to the issues of health and vitality that are so prevalent in the Western Canada lifestyle. Start the day with a private session at one of the trendy downtown yoga studios. The local instructor will lead an hour-long vinyasa yoga class. This popular form of yoga focuses on integrating breath and movement, awareness and alignment, and strength and flexibility in daily life. The result is improved circulation, a light and strong body, and a calm mind.

After class, depart for the Cookbook Company, Calgary's culinary hub. The culinary classroom plays host to over 200 cooking classes, wine classes, specialty dinners and workshops each year. The body and mind theme will be carried forward into this culinary adventure with the cooking of a delicious and healthy vegetarian lunch with the local yoga and cooking guru.

POST MEETING ACTIVITY

Outdoor Adventure in Kananaskis

Thursday, August 17 • 8:30 a.m. – 2:30 p.m.

Welcome to the REAL WEST! Transfer by exclusive coach to Kananaskis Country for a morning of activities in the beautiful Canadian Rockies.

Tucked away in the spectacular Kananaskis Valley, Boundary Ranch is the perfect setting for an Alberta Barbecue. Lunch at Boundary Ranch offers the opportunity to relax and watch the trail rides leave the corral, get involved in activities like horseshoes or roping or take a picturesque stroll through the mountains surrounding the ranch. There is always a lot to see and do! Wander through the unique log and cedar facilities and enjoy western hospitality at its finest! Consider the additional activities offered for a small fee. Optional activities:

- Biking in Kananaskis
- Voyageur Canoe Ride
- Kananaskis Hiking Tours
- Horseback Trail Ride at Boundary Ranch
- Whitewater Rafting on the Kananaskis River





IMPORTANT! Please read this information before completing your registration form.

MEETING INFORMATION

Register to attend the world's leading food safety conference.

Full Registration includes:

- Technical Sessions
- Symposia
- Poster Presentations
- Ivan Parkin Lecture
- John H. Silliker Lecture
- Exhibit Hall Lunch (Mon.-Tues.)
- Awards Banquet
- Exhibit Hall Admittance
- Cheese and Wine Reception
- Exhibit Hall Reception (Mon.-Tues.)
- Program and Abstract Book

4 EASY WAYS TO REGISTER

Complete the Attendee Registration Form and submit it to the International Association for Food Protection by:



Online: www.foodprotection.org



Fax: 515.276.8655



Mail: 6200 Aurora Avenue, Suite 200W
Des Moines, IA 50322-2864, USA



Phone: 800.369.6337; 515.276.3344

The early registration deadline is July 12, 2006. After this date, late registration fees are in effect.

REFUND/CANCELLATION POLICY

Registration fees, less a \$50 administration fee and any applicable bank charges, will be refunded for written cancellations received by July 28, 2006. No refunds will be made after July 28, 2006; however, the registration may be transferred to a colleague with written notification. Refunds will be processed after August 23, 2006. Event and tour tickets purchased are nonrefundable.



International Association for
Food Protection®

EXHIBIT HOURS

Sunday, August 13, 2006	7:00 p.m. – 9:00 p.m.
Monday, August 14, 2006	9:30 a.m. – 6:30 p.m.
Tuesday, August 15, 2006	9:30 a.m. – 6:00 p.m.

DAYTIME EVENTS – Lunch included

Saturday, August 12, 2006	8:00 a.m. – 5:00 p.m.
The Best of Lake Louise and Banff	
Sunday, August 13, 2006	10:00 a.m. – 4:00 p.m.
The Complete Calgary Tour	
Monday, August 14, 2006	8:00 a.m. – 4:00 p.m.
Drumheller and the Badlands	
Tuesday, August 15, 2006	10:00 a.m. – 1:30 p.m.
Art Walk (Lunch not included)	
Wednesday, August 16, 2006	9:45 a.m. – 2:00 p.m.
Yoga and Cooking Class	

EVENING EVENTS

Sunday, August 13, 2006	
Opening Session	6:00 p.m. – 7:00 p.m.
Cheese and Wine Reception	7:00 p.m. – 9:00 p.m.
<i>Sponsored by Kraft Foods</i>	
Monday, August 14, 2006	
Exhibit Hall Reception	5:00 p.m. – 6:30 p.m.
<i>Sponsored by DuPont Qualicon</i>	
Tuesday, August 15, 2006	
Exhibit Hall Reception	5:00 p.m. – 6:00 p.m.
NEW – IAFP Foundation Fundraisers	
Murder Mystery Dinner at the Deane House	6:30 p.m. – 10:00 p.m.
Dinner at The Ranche	6:30 p.m. – 10:00 p.m.
Wednesday, August 16, 2006	
Awards Banquet Reception	6:00 p.m. – 7:00 p.m.
Awards Banquet	7:00 p.m. – 9:30 p.m.

POST MEETING ACTIVITY

Thursday, August 17, 2006	
Outdoor Adventure in Kananaskis	8:30 a.m. – 2:30 p.m.

GOLF TOURNAMENT

Saturday, August 12, 2006	
Golf Tournament at The Links of GlenEagles	7:30 a.m. – 4:00 p.m.

HOTEL INFORMATION

Hotel reservations can be made online at www.foodprotection.org. See page 264 for additional hotel information.



IAFP 2006 Registration Form



6200 Aurora Avenue, Suite 200W
Des Moines, IA 50322-2864, USA
Phone: 800-369-6337 • 515-276-3344
Fax: 515-276-8555
E-mail: info@foodprotection.org
Web site: www.foodprotection.org

Member Number: _____

First name (as it will appear on your badge) _____ Last name _____

Employer _____ Title _____

Mailing Address (Please specify: Home Work) _____

City _____ State/Province _____ Country _____ Postal/Zip Code _____

Telephone _____ Fax _____ E-mail _____

Regarding the ADA, please attach a brief description of special requirements you may have.

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

PAYMENT MUST BE RECEIVED BY JULY 12, 2006 TO AVOID LATE REGISTRATION FEES

REGISTRATION FEES:

Registration _____
 Association Student Member _____
 Retired Association Member _____
 One Day Registration* Mon. Tues. Wed. _____
 Spouse/Companion* (Name): _____
 Children 15 & Over* (Names): _____
 Children 14 & Under* (Names): _____
 *Awards Banquet not included
 Additional Awards Banquet Ticket (Wednesday, 8/16) _____
 Student Luncheon (Sunday, 8/13) _____

MEMBERS

\$ 395 (\$ 445 late)
 \$ 80 (\$ 90 late)
 \$ 80 (\$ 90 late)
 \$ 215 (\$ 240 late)
 \$ 55 (\$ 55 late)
 \$ 25 (\$ 25 late)
 FREE
 \$ 50 (\$ 60 late)
 \$ 5 (\$ 15 late)

NONMEMBERS

\$ 597 (\$647 late)
 Not Available
 Not Available
 \$ 330 (\$355 late)
 \$ 55 (\$ 55 late)
 \$ 25 (\$ 25 late)
 FREE
 \$ 50 (\$ 60 late)

TOTAL

NEW IAFP FOUNDATION FUNDRAISERS:

Tuesday, 8/15
 Murder Mystery Dinner at the Deane House _____
 Dinner at The Rancho _____

\$ 130 (\$140 late)
 \$ 145 (\$155 late)

OF TICKETS

DAYTIME EVENTS – Lunch included

Golf Tournament (Saturday, 8/12) _____
 The Best of Lake Louise and Banff (Saturday, 8/12) _____
 The Complete Calgary Tour (Sunday, 8/13) _____
 Drumheller and the Badlands (Monday, 8/14) _____
 Art Walk – Lunch not included (Tuesday, 8/15) _____
 Yoga and Cooking Class (Wednesday, 8/16) _____
 Outdoor Adventure in Kananaskis (Thursday, 8/17) _____

\$ 135 (\$145 late)
 \$ 130 (\$140 late)
 \$ 105 (\$115 late)
 \$ 115 (\$125 late)
 \$ 42 (\$ 52 late)
 \$ 90 (\$100 late)
 \$ 82 (\$ 92 late)

Optional: Select one activity per person Qty. _____

Biking \$ 93 (\$103 late) _____
 Canoe Ride \$ 56 (\$ 66 late) _____
 Hiking \$ 51 (\$ 61 late) _____
 Horseback Riding \$ 57 (\$ 67 late) _____
 Rafting \$ 61 (\$ 71 late) _____

PAYMENT OPTIONS:



Check Enclosed

Credit Card # _____
 Expiration Date _____
 Name on Card _____
 Signature _____

TOTAL AMOUNT ENCLOSED \$ _____
US FUNDS on US BANK

JOIN TODAY AND SAVE!!!
 (Attach a completed Membership application)

EXHIBITORS DO NOT USE THIS FORM

Check box if you are a technical poster, or symposium speaker.



REQUEST FOR ACCOMMODATIONS

INTERNATIONAL ASSOCIATION FOR FOOD PROTECTION

93rd ANNUAL MEETING

August 13 - 16, 2006
Calgary, Alberta, Canada

INSTRUCTIONS

Online housing will open on **December 1, 2005**.

INTERNET:

Visit the International Association for Food Protection website at www.foodprotection.org to make your reservation.

FAX:

Only fully completed forms will be accepted by fax at **403-262-3809**. Use one form per individual request.

MAIL:

Housing forms can be mailed to: Tourism Calgary IAFP Housing #200, 238-11 Ave. SE Calgary, Alberta, Canada T2G 0X8

IMPORTANT

Requests for reservations must be received prior to **July 20, 2006** in order to guarantee convention room prices. You must cancel your room prior to July 20, 2006. Cancellations after July 20th will result in a \$25.00 USD cancellation fee.

1. Rooms will be assigned in a first-come, first-served basis. Reservations can be made online or by mail or fax.

2. An acknowledgement of your reservation will be sent to you. Please review all information for accuracy. If you have booked online you will be sent an acknowledgement automatically. For all faxed reservations, a confirmation will be sent within 72 hours of reservations being processed; mailed confirmations will take 10-14 days. You may also check your reservation, regardless of how you have booked, by logging onto www.foodprotection.org and selecting the Passkey housing link. You will not receive a separate confirmation from the hotel.

3. Reservations not secured with a credit card, will require a deposit in Canadian funds to be sent directly to the assigned hotel. You will be advised what hotel to make the money order payable to.

4. Reservation modifications & changes can be made online until **August 7, 2006** or be sent in writing to Tourism Calgary prior to the date above. After August 7, 2006, please contact the hotel directly regarding changes or cancellations.

5. All hotel accommodations will be subject to a 4% Alberta Tourism Levy and a 7% Federal Goods and Services Tax (GST). A 1% Destination Marketing Fee may also apply.

6. All room rates are quoted in Canadian funds.

GUEST INFORMATION

For best availability, make your reservation via internet (www.foodprotection.org) or by fax (403) 262-3809.

Arrival Date _____ Departure Date _____

Attention Exhibitors:

NOTE: Change of exhibit hours. Exhibit hall will close at 6:00 PM on Tuesday with teardown immediately following.

Mr. Ms. Mrs.

First Name: _____

Last Name: _____

Address: _____

City/State/Province: _____

Zip/Postal Code: _____ Country: _____

Email address: _____

Daytime Ph: () _____ Fax: () _____

HOTEL SELECTION

Please select hotel from list below in order of preference (ie. 1st, 2nd, 3rd choice etc.).

CHOICE	HOTEL	RATES
_____	Calgary Marriott	\$174.00 CAD
_____	Fairmont Palliser	\$195.00 CAD
_____	Hyatt Regency	\$175.00 CAD

All rooms are standard rooms with one or two beds.

of Occupants in room _____ List Occupants Names: _____

of Beds Requested _____

(Note: extra charges will apply for more than two people in a room)

Special Room Requirements:

Disability requiring special services Non-smoking Smoking

DEPOSIT INFORMATION

A first night's deposit is mandatory to guarantee rooms. (See instructions & information for other payment options.)

VISA American Express Diner's Club Mastercard

Card Number: _____ Expiry Date: _____

Name on Credit Card: _____

Cardholder's Signature*: _____

*Necessary to process reservations

Complete and return this form by fax or mail to:

Tourism Calgary - Calgary Convention & Visitors Bureau
200, 238 11 Ave. S.E., Calgary, AB Canada T2G 0X8

Tel: (403) 263-8510 • Fax: (403)262-3809

For more information on Calgary visit:

www.tourismcalgary.com

Tourism CALGARY
CALGARY CONVENTION & VISITORS BUREAU



Contribute to the Ninth Annual IAFP Foundation Silent Auction Today!

The Foundation of the International Association for Food Protection will hold its Annual Silent Auction during IAFP 2006, the Association's 93rd Annual Meeting in Calgary, Alberta, Canada, August 13-16, 2006. The Foundation supports:

- ◆ Student Travel Scholarships
- ◆ Ivan Parkin Lecture
- ◆ John H. Silliker Lecture (Funded through a contribution from Silliker, Inc.)
- ◆ Travel support for exceptional speakers at the Annual Meeting
- ◆ Audiovisual Library
- ◆ Developing Scientist Competition
- ◆ Shipment of *JFP* and *FPT* journals to developing countries through FAO

Support the Foundation by donating an item today. A sample of items donated last year included:

- ◆ 3-Month Membership
 "Cheese of the Month Club"
- ◆ Mickey Mouse Statue
- ◆ PepsiCo Gift Bag
- ◆ Assorted Wines
- ◆ Cow Parade Figurines
- ◆ *Food Microbiology Fundamentals and Frontiers*
- ◆ Godiva Chocolate Gift Basket
- ◆ Pearl Necklace
- ◆ McCormick Spice Rack
- ◆ Train Set

Complete the form and send it in today.



Description of Auction Items _____

Estimated Value _____

Name of Donor _____

Company (if relevant) _____

Mailing Address _____
(Please specify: Home Work)

City _____ State or Province _____

Postal Code/Zip + 4 _____ Country _____

Telephone # _____ Fax # _____

E-mail _____

Return to:

Donna Gronstal
International Association for Food Protection
6200 Aurora Avenue, Suite 200W
Des Moines, IA 50322-2864, USA
800.369.6337; 515.276.3344
Fax: 515.276.8655
E-mail: dgronstal@foodprotection.org



International Association for
Food Protection®

STUDENT FUNDRAISER!



Purchase an IAFP 2006 T-shirt or Polo Shirt from the Student PDG to help raise money in support of our Students. Pre-ordered T-shirts are \$20.00 and Polo shirts are \$30.00. Shirts will be available for pick-up from the SPDG booth throughout IAFP 2006. All order forms are due by July 1, 2006.

If you choose to pay by credit card, make sure you include the amount to be charged. If you are paying by check, make checks payable to IAFP and enclose the check with your order form. Please mail order forms for receipt by July 1, 2006 for pre-orders.

Please return order form to:



International Association for Food Protection

6200 Aurora Avenue, Suite 200W
Des Moines, IA 50322-2864, USA
Phone: 800.369.6337 • 515.276.3344
Fax: 515.276.8655
E-mail: info@foodprotection.org
Web site: www.foodprotection.org

IAFP SPDG Shirt Order Form

Name _____

Title _____

Mailing Address _____

City _____

State/Province _____

Country _____

Postal/Zip _____

Telephone _____

Fax _____

E-mail _____

Quantity _____	T-shirts	S <input type="checkbox"/>	M <input type="checkbox"/>	L <input type="checkbox"/>	XL <input type="checkbox"/>	\$20.00
	Polo shirts	S <input type="checkbox"/>	M <input type="checkbox"/>	L <input type="checkbox"/>	XL <input type="checkbox"/>	\$30.00

PAYMENT OPTIONS:



Check or Money Order Enclosed

TOTAL AMOUNT ENCLOSED \$ _____

US FUNDS on US BANK

Credit Card # _____

Name on Card _____

Signature _____ Expiration Date _____

COMING EVENTS

MAY

- **1-4, Dairy Technology Workshop**, Birmingham, AL. For more information, call 205.595.6455; E-mail: us@randolphconsulting.com.
- **6-9, 2006 Power of 5 Food Industry Convention**, McCormick Place Convention Center, Chicago, IL. For more information, go to www.media@fmi.org.
- **8-11, Better Process Control Schools**, Cornell University, Geneva, NY. For more information, call Nancy Long at 315.787.2288; Fax: 315.787.2443.
- **9-12, ABB Automation World Users Conference**, Hilton Americas, Houston, TX. For more information, contact Marcia Zemanek at 440.585.6830; E-mail: marcia.zemnek@us.abb.com.
- **12-14, Interbake China 2006**, Guangzhou International Convention & Exhibition Center, Guangzhou, China. For more information, go to www.faircanton.com.
- **16-17, Associated Illinois Milk, Food and Environmental Sanitarians (AIMFES) Spring Conference**, Eastland Suites, Bloomington, IL. For more information, call Jayne Nosari at 217.785.2439; E-mail: jnosari@idph.state.il.us.
- **16-18, Florida Association for Food Protection Meeting**, World Golf Village, St. Augustine, FL. For more information, call Rick Barney at 813.620.1139; E-mail: rabarney@kashnkarry.com.
- **22-25, 3-A Sanitary Standards, Inc. 2006 Annual Meeting**, Milwaukee, WI. For more information, go to www.3-a.org.
- **29-June 2, IDF/ISO Analytical Week**, Vilnius, Lithuania. For more information, call 32.2.733.98.88; E-mail: AFos@fil-idf.org.

JUNE

- **5-6, Brazil Association for Food Protection Meeting**, Anfiteatro do Conselho Regional de Quimica. For more information, call Maria Teresa Destro at 55.113.091.2199; E-mail: mtdestro.usp.br.

- **6-8, Penn State Food Microbiology Short Course**, Penn State Berks Campus, Reading, PA. For more information, contact Hassan Gourama at 610.396.6121; E-mail: hxg7@psu.edu.
- **13, Ontario Food Protection Association Meeting**, Springfield Golf Course, Guelph, Ontario, Canada. For more information, contact Gail Seed at 519.463.5674; E-mail: seed@golden.net.
- **24-28, IFT Annual Meeting**, Orange County Convention Center, Orlando, FL. For more information, contact James Klaphor at 312.782.8424 ext. 231; E-mail: jnklaphor@ift.org.
- **26-28, New Zealand Association for Food Protection Meeting**, Sky City Convention Centre, Auckland, New Zealand. For more information, contact Roger Cook at 64.4.463.2523; E-mail: roger.cook@nzfsa.govt.nz.

JULY

- **3-6, SFAM Summer Conference —“Living Together” Polymicrobial Communities**, Apex International Hotel, Edinburgh, United Kingdom. For more information, E-mail: meetings@sfam.org.uk; or go to www.sfam.org.uk.
- **10-13, Better Process Control Schools**, Louisiana State University, Baton Rouge, LA. For more information, call Dr. Michael Moody at 225.578.5207; Fax: 225.578.5300.
- **14-21, XXVI International Workshop/Symposium on Rapid Methods and Automation in Microbiology**, Manhattan, KS. For more information, contact Daniel Y.C. Fung at 785.532.1208; E-mail: dfung@ksu.edu.
- **16-19, 43rd Annual Florida Pesticide Residue Workshop**, Hilton Walt Disney World, Orlando, FL. Submission for oral presentations is May 15 and posters is June 1. For more information, contact Gail Parker at 850.410.3057; E-mail: parkerg@doacs.state.fl.us.
- **16-19, 8th Annual Foodborne Pathogen Analysis Conference**, Hilton Walt Disney World, Orlando, FL. Submission deadline is June 8th. For

more information, contact Yvonne Hale at 850.414.0408; E-mail: haley@doacs.state.fl.us.

- **18, United Kingdom Association for Food Protection Second Annual Meeting**, J Sainsbury Place, London. For more information, contact Gordon Hayburn at 02920.416456; E-mail: ghayburn@uwic.ac.uk.
- **24-26, Microbiology and Engineering of Sterilization Processes**, University of Minnesota, St. Paul, MN. For more information, contact Ann Rath at 612.626.1278.

AUGUST

- **11-12, IAFP 2006 Workshops**, Calgary, Alberta, Canada. See page 215 of this issue.
- **13-16, IAFP 2006 Annual Meeting**, Calgary, Alberta, Canada. For more information, contact Julie Cattanaach at 800.369.6337 or E-mail: jcattanach@foodprotection.org.

SEPTEMBER

- **5-9, China Brew & Beverage 2006**, China International Exhibition Centre, Beijing, China. For more information, call 852.2865.2633; E-mail: elaine@bitf.com.hk.

IAFP UPCOMING MEETINGS

AUGUST 13-16, 2006
Calgary, Alberta, Canada

JULY 8-11, 2007
Lake Buena Vista, Florida

AUGUST 3-6, 2008
Columbus, Ohio

JULY 12-15, 2009
Grapevine, Texas

COMING EVENTS

- **17-20, World Grains Summit: Foods and Beverages**, The Moscone Convention Center, San Francisco, CA. For more information, contact Amy Hope or Betty Ford at 651.454.7250 or go to <http://meeting.aaccnet.org>.
- **19-21, New York Association for Food Protection Annual Meeting**,

Wyndham Hotel, Syracuse, NY. For more information, contact Steve Murphy at 607.255.2893; E-mail: scm4@cornell.edu.

OCTOBER

- **14-17, 26th Food Microbiology Symposium**, University of Wisconsin-

sin-River Falls, River Falls, WI. For more information, call 715.425.3704 or go to www.uwrf.edu/food-science.

- **18-19, Iowa Association for Food Protection Annual Meeting**, Quality Inn, Ames, IA. For more information, contact Phyllis Borer at 712.754.2511 ext. 33; E-mail: borerp@ampi.com.



Come Early for These Special Events!

Golf Tournament

The Links of GlenEagles
Saturday, August 12
7:30 a.m. – 4:00 p.m.

The Best of Lake Louise and Banff

Saturday, August 12
8:30 a.m. – 5:00 p.m.

Visit the Web site at www.foodprotection.org to sign up.

CAREER SERVICES SECTION

Associate Professor / Professor

The Animal Science Department at Texas A&M University is seeking to appoint an Associate Professor / Professor in food microbiology to develop and teach graduate level courses designed to instruct students in advanced microbiology of foods and conduct an extramurally funded and nationally/internationally recognized research program in food microbiology. Requires Ph.D. in food science and technology with specialization in food microbiology. A record of publications in peer-reviewed scientific literature is required. Demonstrated record of extramural grant support and teaching effectiveness, or the ability to develop same, is also required.

Individuals are encouraged to visit the department's website (<http://animalscience.tamu.edu>; click on Employment) for more information.



Advance Food Company is a dynamic organization that has accomplished double-digit growth every year over the past 10 years. We have accomplished this by hiring the highest quality management team to fulfill our vision. We are currently constructing a new state-of-the-art RTE facility in Enid, Oklahoma. With this in mind, we are accepting resumes for the following positions:

Food Safety Director
Food Safety Managers (RTE & Raw)
Food Safety Supervisor

All applicants require college degree in related field and/or experience in the meat processing industry.

To learn more about these and other opportunities and/or apply, please visit our web site <http://www.advf.com> or contact Nancy Correa at ncorrea@advancefoodcompany.com

CAREER HOTLINE 580-213-4777

* coe m/E/v/d *

IAFP Members

Did you know that you are eligible to place an advertisement if you are unemployed and looking for a new position? As a Member benefit, you may assist your search by running an advertisement touting your qualifications.

Chemistry Branch Chief

FT Federal job opportunity with the USDA Food Safety and Inspection Service in the Food Defense and Emergency Branch in Athens, GA. The Branch Chief directs and provides extensive testing and analytical services for the purpose of food defense, anti-terrorism, and food emergency response. B.S. chemistry & professional work as a lead or supervisory chemist in a residue or food analyses laboratory required. Salary \$87,533. Please view announcement at www.usajobs.opm.gov job control # 597887 or contact Wendy at 1-800-370-3747 x2554 for information on how to apply.

CAREER SERVICES SECTION

EXECUTIVE DIRECTOR BEEF SAFETY RESEARCH

Reports to: Vice President, Research & Knowledge Management (R&KM) (based in the Denver office).

General responsibilities:

The planning, developing and implementing of beef safety research programs of the National Cattlemen's Beef Association (NCBA) that are designed to increase consumer's confidence in the safety of beef and beef products. This will require direct interaction with producers and producer leaders, government agencies, professional staff from all centers, academia and industry partners.

Specific responsibilities:

- Work with the industry expert advisory group as well as industry committees in developing beef safety research program objectives and priorities which support the strategic implementation of the Beef Industry Long Range Plan.
- Develop, coordinate and implement the beef industry's research plan. This will require working closely with the Vice President for R&KM, director of beef safety and other members of the NCBA Beef Safety Team.
- Assume the responsibility of leading the NCBA Beef Safety Team.
- Provide leadership in developing and managing beef safety research projects. This will include establishing task forces for targeted research areas, monitoring the progress of projects, site visits and the preparation of updates and interim reports.
- Responsible for the development and management of the R&KM beef safety research budget.
- Provide timely updates to the vice president of R&KM on the status of the beef safety program which will include reports on beef safety projects and the budget. Also provide strategic/business guidance on the program as well as long range strategic thinking to assist in maintaining the current pro-active mode of the program.
- Responsible for the day-to-day management associated with producer committees and subcommittees.
- Interpret research results to all segments of the beef industry and identify opportunities for the application of technologies/information resulting from industry funded research. This will include an active participation in the transfer and implementation of technology.
- Establish and maintain communications with industry and government thought leaders and scientists involved in the beef safety arena.
- Provide guidance and leadership in the development of an aggressive program to seek outside/non-check off funding sources for the beef safety program.
- Develop and maintain a strong working partnership with state beef councils to ensure a coordinated/unified state/national program.

Qualifications:

Applicants must have a doctorate degree in meat science/microbiology or a closely related field with a minimum of eight years experience. The individual must have demonstrated knowledge/leadership in the areas of beef safety, basic science, experimental design and the development of applied industry research initiatives. The individual must possess a strong background in working in a multi-tasking research group. Excellent communication (written and oral), organization and time management skills; and the ability to work with a variety of people and personalities are a necessity.

Send resume, cover letter and salary history to mpeakman@beef.org.

of large growers. On-farm food safety efforts should be tailored to specific products, buyers' needs and consumer expectations. And microbial sampling is part of it.

Fresh fruits and vegetables are the cornerstone of a healthy diet. This was reinforced last year by the US Department of Agriculture's newly updated food pyramid (www.mypyramid.gov). Even Sesame Street's Cookie Monster is getting into the act promoting fruits and vegetables as

'anytime' snacks, and explaining that his cookies are 'sometimes' food. To capture the nutritional benefit of fresh produce — and we should be eating more — while minimizing the risk, programs have been, or need to be, created to reduce risk beginning on the farm and extending through to retail (as has been recently done in the melon industry). A good produce food safety strategy needs a variety of components that alone are meaningless but together provide a picture that shows a producer is proactive about reducing risks.

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IT'S A FACT

**The IAFP
Membership
Directory is
Available Online.**

www.foodprotection.org

All you need is your Member
number and password
(your last name).

If you have questions,
E-mail Julie Cattanaach
at jcattanach@foodprotection.org

The Table of Contents from the *Journal of Food Protection* is being provided as a Member benefit. If you do not receive *JFP*, but would like to add it to your Membership contact the Association office.

Journal of Food Protection®



Vol. 69

March 2006

No. 3

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On November 4, 2005, Dr. Robert Brackett, Director of the US Food and Drug Administration's Center for Food Safety and Applied Nutrition, wrote California lettuce producers, packers and shippers, urging them to re-examine and modify operations from the farm through to distributors to ensure that consumers were provided with a safe product.

The letter followed a nationwide warning to consumers in early October 2005 against eating certain pre-packaged Dole salad products because the lettuce had been associated with an outbreak of *E. coli* O157:H7 in Minnesota in which at least 18 people fell ill. Dr. Brackett's November letter noted that FDA was aware of 18 outbreaks of foodborne illness since 1995 caused by *E. coli* O157:H7 for which fresh or fresh-cut lettuce was implicated as the outbreak vehicle. In one additional case, fresh-cut spinach was implicated. These 19 outbreaks accounted for approximately 409 reported cases of illness and two deaths. The problem with fresh produce is that the very characteristic that affords dietary benefit — fresh — also affords microbiological risk.

Because they are not cooked, anything that comes into contact with fresh fruits and vegetables is a possible source of contamination. Is the water used for irrigation or rinsing clean or is it loaded with pathogens? Do the workers who collect the produce follow strict hygienic practices such as thorough handwashing? Are the vehicles

used to transport fresh produce also used to transport live animals that could be sources of microbial contamination? The possibilities are almost endless.

Even more challenging is that many of these problems must be controlled on the farm. There are situations where the most ardent washing of produce by consumers will accomplish... nothing; in some cases, the dangerous bugs can actually reside within the fresh produce.

As Dallaire et al. report in this issue, new methods to trace produce through the supply chain can provide a better understanding of the sources of contamination and of the ecology of foodborne pathogens. That's important when trying to get the best bang per intervention dollar.

For the past decade, numerous on-farm programs have been created and touted, yet outbreaks associated with produce continue unabated. Perhaps program is the wrong word; it implies manuals, checklists and bureaucratic oversight. What's needed is the data and people to provide on-going interaction with farmers, retailers and food service, to compel each individual in the farm-to-fork food safety system to do whatever is possible to further enhance the safety of fresh produce. In the United States, government and industry have identified five products that are particularly problematic: tomatoes, melons (especially cantaloupes), lettuce, sprouts and green onions. And farms are being actively targeted.

Implementing a proactive strategy which includes skilled people, excellent surveillance and vigilance, can aid in reacting to the unknown. Regulators should assist producers in identifying the parameters of evidence-based risks and guidelines as many of the on-farm issues have common factors such as soil, water contamination and manure use.

The components of any produce-related program must be flexible enough to include the smallest of growers while catering to the needs

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