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Food Protection Trends

Science and News from the International Association for Food Protection

Food Transportation Safety

Controlled Vapor Oven Cooking and Holding Procedure

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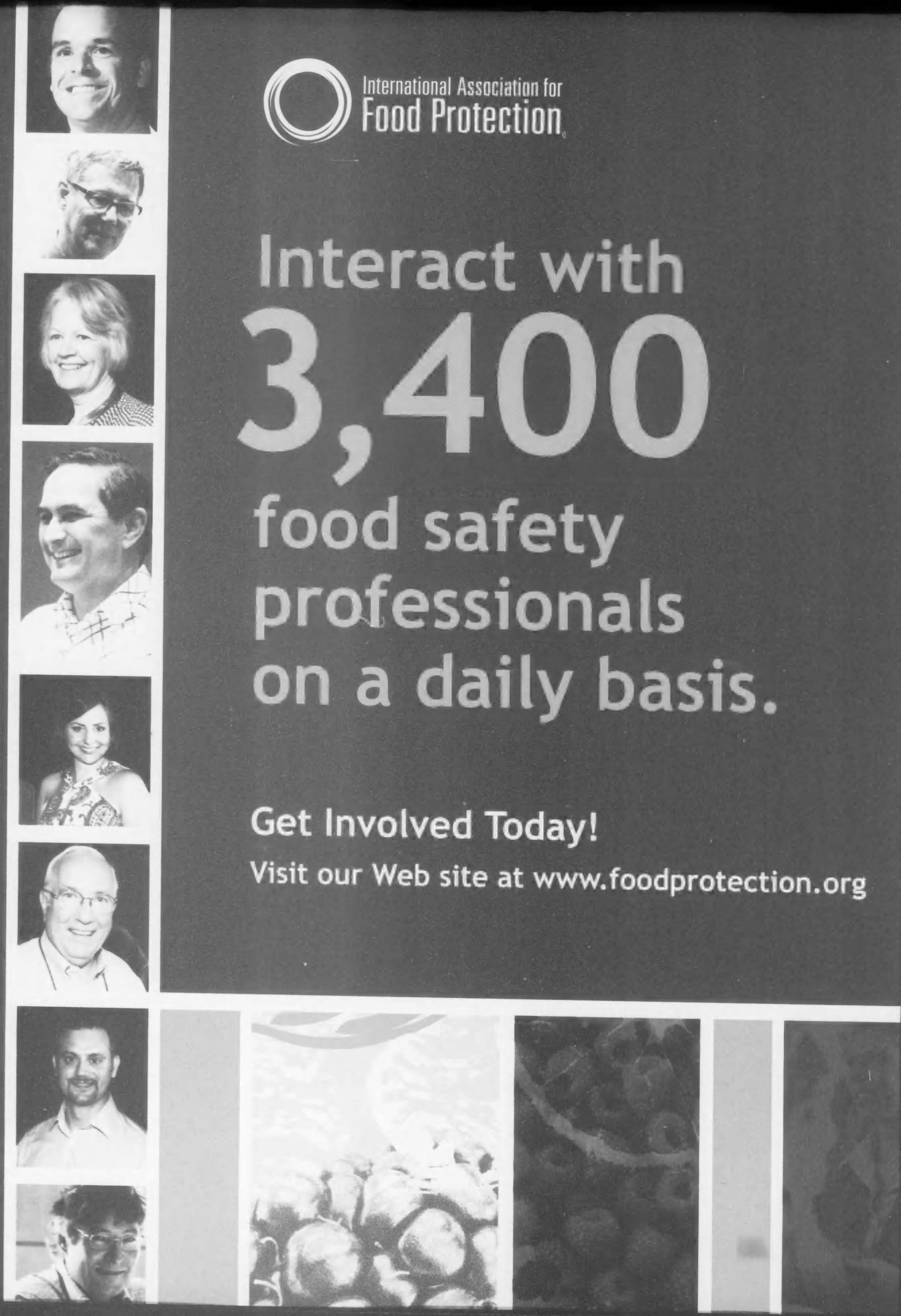
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VOLUME 30, NO. 4

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FOOD PROTECTION TRENDS
SCIENCE AND NEWS
FROM THE INTERNATIONAL ASSOCIATION FOR FOOD PROTECTION

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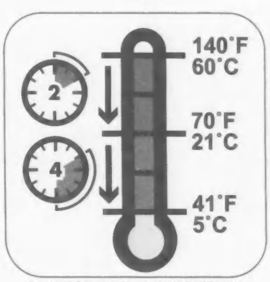

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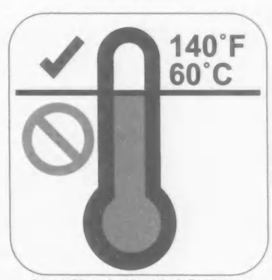

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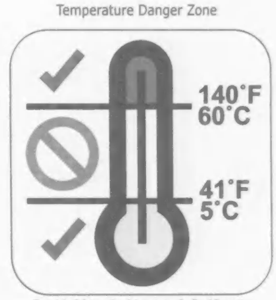

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"VICKIE'S VIEW"
FROM YOUR PRESIDENT

Greetings to all! It's hard to believe, but I have passed the halfway mark of my term as IAFP President and it seems to have passed incredibly fast. Time is marked in all sorts of ways: hours, days, months, years, decades, centuries. My son Jack recently celebrated "100 Day" at school. I guess when you are a first-grader it is a major accomplishment to make it through 100 days of school! To commemorate this milestone, each student dressed up as a 100-year-old person. It was quite amusing to see a seven-year-old's idea of what a 100-year-old man looks like! I wondered if Jack will look anything like that when he actually is 100 years old. I took pictures of him from the "100 Day" celebration, which I will share with Jack and his children. And when he is 100 years old, perhaps someone will make a collage to commemorate his life and include these pictures. The collage will be like a pictorial time capsule, giving his kids lots of amazing and humorous insight into Jack's life and successes.

IAFP will soon be commemorating its 100 years of existence and service to food protection. Our centennial anniversary will be celebrated at the IAFP 2011 Annual Meeting in Milwaukee, Wisconsin, the site of the very first meeting of our organization. Imagine if IAFP members and leaders throughout the years had created a time capsule for us to open at next year's 100-year anniversary celebration. What do you think we would find? What if we were to create one, starting at the 100-year mark, that the next generations of food safety professionals could view a century from now? What would you include in the capsule to help future members remember, recognize and celebrate where we are today and all the dedication and effort that today's members put into sustaining and driving IAFP forward each and every day?

By VICKIE LEWANDOWSKI
PRESIDENT

"How would you like to see 100 years of success celebrated?"

We have begun discussions on planning for the 100th Anniversary celebration. It certainly is not too early to begin thinking about what we will do; the event will be here sooner than we think. How would you like to see 100 years of success celebrated? If you have any ideas, time capsules included, please share them with any member of the Executive Board or IAFP staff.

Speaking of planning, while Jack was planning for his 100th day celebration, I was away for a long weekend of just that at the Program Committee and Executive Board meetings. The Program Committee met for two long days, planning the program for the 2010 Annual Meeting (August 1–4, 2010, Anaheim, CA). The process of planning the program is intense. For the 2010 meeting, the process actually started in November 2009. The call for symposia yielded a total of 77 submissions! The proposals were reviewed by each of the 12 committee members, who then came together via conference call and discussed each proposal over the course of a five-hour long call. Using the criteria defined in the Instructions to Authors, approximately 27 proposals were chosen for further development. The committee makes suggestions with respect to possible speakers, combining similar proposals, etc. in order to get a balanced program with a balance of international topics and speakers, as well as a balance from industry, academia and government. Those proposals are then resubmitted for a final review and decision at the winter meeting.

The deadline for technical session abstracts is typically in January, and like the symposia submissions, there was a record number. This year, more than 600 abstracts were submitted, up from 465 submitted for the 2009 meeting. For this review, the committee of 12 is split into four teams of three members, with one academic, one industry and one government representative per team. The abstracts are divided among the teams based on subject matter and areas of expertise of the team members. Each person reviewed roughly 150 abstracts prior to coming to the meeting. Once at the meeting, the teams spend four hours discussing each abstract and then accept or reject each one based on the stringent criteria outlined in the Instructions to Authors. The rejected abstracts are then reviewed again by a team of seven different members (two other teams and one Executive Board member). Abstracts that are ultimately rejected have been reviewed by 10 members of the Program Committee. The committee then makes edits as necessary to the accepted abstracts, groups them into subject topic, and then sorts them into program order.

The resubmitted symposia are then reviewed again by the entire committee and a final decision is made to accept (with or without modifications) or reject. The workshop proposals are then reviewed; accepted or rejected. Whew! But wait, there's more! The actual arranging of the symposia sessions, oral technical sessions and poster sessions needs to be done, and great care is taken to eliminate or minimize speaker and topic overlap as much as possible. This can get tricky when there are a few "popular" speakers who will present at more than one session, or when there is a particular topic of relevance that year with several sessions addressing it. For the 2010 meeting, we tried to put a little of everything on each day so that every day has something for everyone, including Wednesday. The goal is to have full attendance of the sessions right through the end of the program!

At the end of the second day of meeting planning, the entire Program Committee was exhausted but proud of the program planned for the 2010 meeting. This committee puts in a lot of time and effort to make each Annual Meeting the best food safety/food protection meeting of the year. Each year, committee members strive to move the bar higher and make the meeting better. The repeated feedback is a sure indication that the committee is exceeding expectations: "There are too many good sessions going on at once," and "I wish I could clone myself," are just a few.

I would like to acknowledge the members of the Program Committee for 2010: Faye Feldstein (chair), Randy Phebus (vice chair), Maria Teresa Destro, Paula Fedorka-Cray, Scott Hood, Vijay Juneja, Kalmia Kniel, Loralyn Ledenbach, Eric Martin, Alejandro Mazzotta, Mary L. Tortorello and Purnendu C. Vasavada. A tremendous thanks to all of you! Thank you, also, to David Tharp, Lisa Hovey and Tamara Ford for keeping everything running so smoothly!

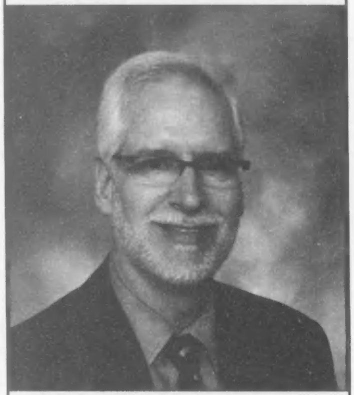
The second meeting of the weekend for me was with the Executive Board. We covered a lot of agenda items but the one I'd like to mention is the strategic planning session that will be held in April. Successful organizations don't just happen; you have to have a plan for how to achieve your mission and vision. We've had one strategic planning session since I joined the board, and for the most part, we have accomplished what we set out to do. Gaining presence internationally was one of our biggest strategic goals. With two IAFP international meetings every year and our presence, support or sponsorship of at least three other international meetings, we have made great strides! But we need to keep moving forward. Do you have thoughts on where you think IAFP should be in five or 10 years? I'd like to hear your ideas and share them with the rest of the Executive Board at the April planning session. Remember, time flies, so be sure to reach out to me with ideas for celebrating our past and thoughts for planning for the future success of IAFP! You can reach me directly by E-mail at VLewandowski@kraft.com.

"COMMENTARY"
FROM THE EXECUTIVE DIRECTOR

When writing this month's column, I have just returned from Dubai and the Dubai International Food Safety Conference (DIFSC). So, I'll concentrate on this event and the near future events that IAFP is working to coordinate.

The conference in Dubai was the fifth successful conference held and was organized by the Dubai Municipality. As was discussed at the event, IAFP works with the Dubai organizers in helping to identify topics and speakers for the program. This year, more than one-third of the fifty-plus speakers were IAFP Members. Many of those who were not directly IAFP Members have strong ties to our organization and we hope they will soon join as Members too! The program was outstanding, covering many food safety issues including: third-party certifications, food safety culture, regulations, advances in food safety and many more.

The DIFSC organizers do an excellent job of reviewing programs from past IAFP Annual Meetings and other symposia, looking for important topics and finding trusted authorities (speakers) to invite to speak at their meeting. This was the third year for IAFP's involvement, and it is rewarding to see the increased interest in IAFP each year. After separate presentations by President Vickie Lewandowski and me, there were a large number of attendees who approached us to learn more about IAFP and asked how to become involved. It is exciting to see the growth in IAFP created by this conference and the other, non-North American conferences we support each year. When looking at Membership in each of the regions IAFP has concentrated on in recent years, it is easy to see a direct result in new Members.



By DAVID W. THARP, CAE
EXECUTIVE DIRECTOR

"IAFP Members can serve as a resource to help solve problems or issues you face each day in your job"

Our next event outside of North America is the European Symposium which will be held in Dublin, Ireland over the dates of June 9-11. The Organizing Committee worked hard to establish the program and we will enjoy excellent support from a committee of local food safety professionals. Everyone has gone above and beyond expectations in working to provide the appropriate venue and environment for this, our sixth symposium in Europe. We offer an exceptional program this year and interest has been high from both Europeans and those outside of Europe. A capacity crowd is expected!

If you are interested to review the program, it is available on the IAFP Web site. Technical presentations this year will include both poster and oral formats and supporting companies will be present in the exhibit hall. We will look forward to seeing you in Dublin.

You might recall that our first International Symposium was held in Campinas, Brazil in May of 2008. We titled that Symposium as the "First Latin America Symposium on Food Safety" and now we are planning the second one in this series! With the assistance and guidance from our new Colombian Affiliate, the Second Latin America Symposium on Food Safety will be held in Bogota, Colombia this coming September. This conference is organized in conjunction with the Colombian Association of Food Science and Technology (our Colombian Affiliate) and the Latin America Association of Food Science and Technology. Between the three organizations, the synergy created will bring an audience of food safety professionals from all over Latin America to Bogota. Again, this will give IAFP great exposure to professionals who can both learn from our publications and who can contribute to the IAFP community.

Speaking of "the IAFP community," did you know that IAFP is on both Facebook and LinkedIn? From the IAFP Home page, you can link directly to either Facebook or LinkedIn and join the IAFP groups. There are discussions initiated by members of the group and other information about IAFP conferences – sometimes, including picture albums after the event takes place. Take a look; it might be another way to keep in touch with IAFP Members from around the world!

We encourage you to attend meetings organized by IAFP. Take advantage of the resources offered through meeting new people who hold common interests with you. IAFP Members can serve as a resource to help solve problems or issues you face each day in your job. After you have an opportunity to meet someone face-to-face, it is much easier to communicate with them over the telephone or via E-mail.

So, as you meet food safety professionals, let's begin asking: "Are you a Member of IAFP?" When you find that they are not, provide encouragement to your colleagues to become an IAFP Member. Not only to become a Member, but to become an "**Active**" IAFP Member. By sharing knowledge and experiences, all Members can benefit and help to "Advance Food Safety Worldwide"; therefore helping to protect the public's health through safe food.

ARTICLES

Food Protection Trends, Vol. 30, No. 4, Pages 212–222

6200 Aurora Ave., Suite 200W, Des Moines, IA 50322-2864

International Association for Food Protection.

Food Transportation Safety: Characterizing Risks and Controls by Use of Expert Opinion

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ABSTRACT

Federal regulations stipulate that food products be protected against physical, chemical and microbial contamination during transportation and holding. An expert opinion elicitation was conducted to assess food safety hazards and preventive controls associated with the transportation and holding of food commodities. Frequency and severity risk rankings suggest five food safety hazards of greatest concern across all modes of transport: (1) lack of security; (2) improper holding practices for food products awaiting shipment or inspection; (3) improper temperature control; (4) cross-contamination; and (5) improper loading practices, conditions, or equipment. Factor analysis suggests that "in-transit" and "organizational" risk factors might explain the relationships among the various food safety hazards. Raw seafood, raw meat and poultry, and refrigerated raw and ready-to-eat foods have the highest overall risk (in descending order) across all modes of transit. Our analysis also identified a range of preventive controls that may help eliminate/mitigate the risks to food during transport and storage, including: employee awareness and training, management review of records, and good communication between shipper, transporter and receiver.

A peer-reviewed article

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INTRODUCTION

Each year, 200 billion metric tons of food are transported globally — 35 percent by land, 60 percent by sea, and 5 percent by air *(3)*. The sheer quantity and variety of foods transported, along with the multitude of container, temperature, and handling requirements for each food product, emphasizes the vulnerability of the food industry to possible contamination during transport and storage *(8)*. Risk factors for contamination include improper production practices, temperature abuse, unsanitary cargo areas, improper loading or unloading procedures, damaged packaging, shipping containers in ill repair, bad employee habits, and road conditions. There is, however, currently very little information on the state of food transportation and holding practices in the United States.

Current federal regulations stipulate that food products be protected against physical, chemical and microbial contamination during transportation and holding (21 CFR § 110.93) *(19)*. The Sanitary Food Transportation Act of 2005 (Pub. L. 109-59, 119 Stat. 1144) reallocated responsibilities for food transportation safety among the US Department of Health and Human

Services (DHHS), the US Department of Transportation (DOT), and the US Department of Agriculture (USDA) and requires the Secretary of DHHS to issue rules setting up sanitary food transport practices *(13)*. It also amends section 402 of the Federal Food, Drug, and Cosmetic Act (21 USC § 342(i)) so as to render unsanitary transport adulteration *(1)*.

Supply chains are quite similar across most products, food and non-food. A tier of suppliers serves manufacturing/production facilities. These facilities then serve distribution facilities, which eventually serve retailer outlets, which in the case of food, include restaurant retail facilities that serve the end consumer. Such supply network systems might be quite complex as there can be additional first tier and second tier suppliers. Although many companies organize the transport of their goods internally, some food manufacturers use third-party logistics providers (3PLs) to outsource transportation procurement. A 3PL is a firm that provides outsourced, or "third party," logistics services to companies for part or sometimes all of their supply chain management function. Third-party logistics providers typically specialize in integrated warehousing and transportation services that can be scaled and customized to customers' needs based on market conditions and on the demands and delivery service requirements for their products and materials.

Although certain food supply chain systems require bulk transport, such as rail, barge or inland water, truck transportation dominates most food supply chain systems, especially toward the consumer end of the chains *(6)*. Truck transporters are typically involved in moving goods among manufacturers and distributors, distributors and retailers, and even further up the chain between suppliers and production points. Particularly for perishable foods, trucking remains the cheapest and most flexible mode of food transport *(4)*. In the United States, about 80 percent of all food shipments *(12)* and 91 percent of all temperature-controlled freight shipments, including about 28.5 million tons of refrigerated fruit and vegetables *(17)*, are transported by truck *(9)*.

Railroad and intermodal transportation have received increased attention recently because of their potential cost savings and the trucking industry's current challenges with fuel surcharges, driver shortages, and Hours of Service (HOS) regulations for commercial motor vehicle drivers *(16)*. Current law regulates the number of consecutive hours that commercial motor vehicle drivers may be on-duty (49 CFR § 395) *(18)*, thereby increasing the number of drivers required by the industry. Intermodal freight transportation involves the use of multiple modes of transportation (truck, rail and ship) for the same shipment without handling the freight between modes (e.g., truck trailer transferred to flatbed railcar). Some suppliers may be taking advantage of economies of scale in boxcar shipping and utilizing intermodal transportation to develop more regionalized trucking routes in response to driver preferences for short-haul rather than long-haul trucking *(16)*.

In the complex food transportation system, the earlier an undetected problem is introduced into the system, the higher the risk (as measured by exposure likelihood and impact); that is, a problem that is introduced at an earlier stage in the supply chain can spread out to many distributors, retailers and then to consumers just because of the structure of the system. For example, "[in 1994], an estimated quarter of a million Americans got gastroenteritis after eating Schwan's ice cream — the largest outbreak of *Salmonella* poisoning in the United States ever traced to a single source. Environmental health specialists eventually tracked down the cause. Liquid eggs laced with the *Salmonella* bacteria were transported to a factory in tanker trailers. These same trucks later hauled pasteurized ice cream base to another plant, and the bacteria came too" *(7)*.

Saddle Creek Corporation, a third-party logistics provider (3PL), conducted a survey of food and beverage warehousing and transportation management executives *(12)*. The majority of respondents were grocery companies, food and beverage processors or other third-party logistics providers. The survey, intended to identify common practices, challenges, and emerging trends, found that:

- Capacity problems, driver shortages, and customer demands are the food transportation industry's top challenges.
- Food safety is the 6th highest logistics challenge (indicated by 9.6 percent of respondents).
- 58.3 percent of respondents engage in backhauling (transporting a different load in the empty truck on a return trip), although only 17.1 percent indicate achieving 81 to 100 percent of their backhauls.
- 63.5 percent of respondents outsource some or all of their transportation (34.1 percent outsource 75 to 100 percent of their transportation budget).

A number of these findings may be significant with regard to food transportation safety. Driver shortages and capacity problems may result in a lack of driver education in and adherence to proper procedures for the safe transportation of food. Backhauling increases the risk for cross-contamination if potentially hazardous foods or other items are carried in succession without proper sanitation between loads. Finally, manufacturers who outsource their transportation needs relinquish control of the safety of their product as it moves from the processing facility to the retailer. Good communication and management systems are required to maintain product integrity throughout the distribution chain.

Sources indicate that the greatest concerns for food safety during transportation are tampering and sabotage, temperature abuse, and cross-contamination *(8, 15)*. While there is limited data on food safety failures that are directly attributable to transportation and storage practices, some industry experience suggests that such incidents may be widely underreported *(8)*. An expert opinion elicitation study was conducted to characterize baseline practices in the sectors involved in food transportation (local and long distance general freight trucking, rail and deep sea freight transportation, refrigerated warehousing and storage, etc.) and identify areas where food is at risk for adulteration.

The objectives of this study were twofold: (1) To identify the main problems that pose microbiological, chemical, and/or physical safety hazards to food during transportation and storage, and (2) to determine the preventive controls that could address the problems identified. The study enables the identification of those food product types and modes of transportation where the hazards are

TABLE 1. Expert participants and affiliations

Expert	Affiliation
Jim Balestra	Safefreight Technology; Latium Fleet Management
Betsy Blair	AIB International, Inc.
Craig Cahill	Allen Lund Company, Perishable Logistics Division
Clifford M. Coles	Consulting Microbiology of California, Inc.
John Conley	National Tank Truck Carriers, Inc.
Roy Costa	Environ Health Associates
Patrick Floyd	Nordic Cold Storage
Peter Friedmann	Agriculture Transportation Coalition
Fletcher Hall	F.R. Hall & Associates, LLC
Dan Jenkins	Grapple Hook Marketing
Chris Kozak	Willis Shaw Express
Russell Laird	Agriculture and Food Transporters Conference (AFTC)
Peg Sarinyamas	Feeding America
Gary Sherlaw	Food Safety Consulting International (FSCI)
Richard F. Stier	Consulting Food Scientists
Gerald Wojtala	Association of Food and Drug Officials; Michigan Department of Agriculture

of high importance for public health. Further, information on preventive controls may help identify the most effective food transportation and storage practices.

MATERIALS AND METHODS

The study objectives required gathering current data not known or available. Moreover, they did not easily lend themselves to more precise analytical techniques, such as a statistical industry survey, given that it would entail asking food transporters to release potentially sensitive information. Thus, we used expert opinion elicitation to generate the necessary information from a panel of nationally recognized experts in food transportation safety. Expert opinion elicitation is a formal, heuristic process of obtaining subjective information or answers to specific questions about certain quantities and probabilities of future events *(2)*. The Delphi method is the first structured method for eliciting and combining expert opinion. The method requires indirect interaction among experts through a moderator *(5, 10, 11)*. Although variations of the method exist, in a typical Delphi study, experts make individual judgments. Next, these judgments are shared anonymously with the whole group. After viewing other experts' judgments, each expert is then given the opportunity to revise his own judgments, and the process is repeated. Theoretically, the goal of the Delphi is to reach a consensus after a few rounds; in reality, this rarely happens. Thus, at the end of the Delphi rounds, the experts' final judgments are typically combined mathematically.

Study design

We recruited a 16-member panel comprising experts with experience in all areas of food transportation and food safety. Participants were selected based on their ability to contribute industry views as well as their willingness to participate in the process. On average, panel members possessed over 24 years of related food industry experience. The expert panel included participants from trade associations, logistic research institutes, academia, third-party logistics firms, companies that provide logistics support, and independent consultants with experience in consulting to food companies of varying sizes on logistics and transportation safety issues (Table 1). In identifying the experts, we relied on recommendations from FDA, various food industry personnel, and other experts in food transportation and food safety.

The study utilized a four-round design, with iterations following each round. In Round 1, we solicited background information from the experts on: (1) the types of food safety hazards that may increase the risk of food contamination during transportation and warehousing/storage; (2) the food product categories and modes of transportation for which the risk and severity of hazards could potentially vary; (3) intermodal transportation considerations; and (4) possible differences between food safety hazards for imported and domestic food products. Specifically, we presented our findings based on a literature review and

TABLE 2. Risk scoring grid

	Severity	
Frequency	**Low**	**High**
Low	1	3
High	2	4

discussions with industry experts and asked each expert to expand the various lists and provide additional comments on these issues.

The objective of Round 2 was to assess the risk posed by each of the fifteen food safety hazards by food sector and transport mode identified in Round 1. Experts were asked to assign a risk score from 1 to 4 based on the hazard's frequency and severity (Table 2). Thus, each expert first had to assess whether the problem occurred at a high or low frequency for the specified food sector and mode of transport (i.e., how widespread the problem is) and then to evaluate whether the probability that the problem could render the food unsafe was high or low (i.e., assess the severity of potential consequences, such as mortality, morbidity, and economic impacts, of the problem). Panel members were directed to skip questions for which they lacked sufficient knowledge for an informed assessment.

The objective of Round 3 was to obtain background information on preventive controls that may eliminate or mitigate the risk of food safety hazards in food transportation and warehousing/storage from our expert panel. Again, we presented our own findings on preventive controls to the panel and asked them to expand the list. In Round 4, experts identified the set of preventive controls necessary to eliminate or mitigate the risk posed by each of the fifteen food safety hazards. Experts were asked to ensure that the controls had the broadest applicability across all food product sectors and modes of transport.

As noted above, we used the Delphi technique to reach consensus for each round of questioning. Iteration rounds helped to stabilize results and increase agreement among participants. At the completion of all rounds, including iteration rounds, we sent each participant a summary of his responses for review and final confirmation. Because full consensus was not attainable, we relied on accepted aggregation procedures to pool expert estimates, where applicable.

Data analysis

We used Stata *(14)* to perform descriptive univariate analysis as well as factor analysis on the data collected. For factor analysis, we used Stata's *factor*, *rotate*, and *score* functions. Factor analysis is a data reduction technique that reduces the number of variables used in an analysis by creating new variables (called factors) that combine redundancy in the data. A factor analysis looks for correlations among the variables and the first step is to determine the number of relevant factors. While Stata's algorithms used to solve factor analyses include methods of determining an appropriate number of factors, it is also possible to specify (fix) the number of factors in the analysis. For this study, we allowed the algorithms to determine the number of factors and also used judgment in determining the appropriate number of factors. The output from the factor analysis generates a table that relates each variable to each factor and assigns a numerical value between -1 and 1 to each relationship. The numerical values are referred to as factor loadings and reflect the strength of relationship between the factors and the variables. Variables that are closely related to one another should all load highly on the same factor. Stata's *score* command produces estimates of these factors, which we used to develop indices of riskiness by food sector. Specifically, the method allowed us to generate an overall risk score for each food sector by mode of transport that combines the information in all of the fifteen food safety hazards, as well as multi-factor risk scores separately by food sector and mode of transport.

RESULTS

Descriptive analysis

Experts identified 15 food safety hazards that pose microbiological, chemical, and/or physical safety hazards to food during transportation and warehousing or storage (Table 3). The panel also identified 11 food product sectors to be considered when assessing the frequency and severity of these food safety hazards. In addition, the experts collectively identified the following modes of transport, as well as storage/warehousing, as having distinct risk rankings for food safety hazards: truck; rail; water; air; and intermodal. Different types of water transportation (e.g., deep sea freight versus inland water freight) were not considered separately, because of experts' suggestions that food safety hazards are not related specifically to the type of water transportation.

The total number of food safety hazards scored by panel members across food product sectors and transport modes substantially increased the respondent burden in the third round. An average of 13 out of 15 experts provided risk scores for each of the 990 individual risk rankings requested. Only 7 percent of all problem-sector-mode combinations resulted in an average risk score of 4 (high frequency, high severity) (61%). The majority of problem-sector-mode combinations resulted in average risk scores of 1 (low frequency, low severity) and 3 (low frequency, high severity) (28%). An analysis of the risk score data leads to the following observations:

- The top 5 food safety hazards that were the greatest concern across all modes of transportation were:
  - Lack of security for transportation units or storage facilities,
  - Improper holding practices for food products awaiting shipment or inspection,
  - Improper refrigeration or temperature control of food products,
  - Improper management of transportation units or storage facilities to preclude cross-contamination, and
  - Improper loading practices, conditions, or equipment.

TABLE 3. Fifteen food transportation safety hazards that increase the risk for physical, chemical, and/or microbial contamination, as identified by the expert panel

Food Transportation Safety Hazard
(1) Improper refrigeration or temperature control of food products (temperature abuse), including intentional (abuse or violation of practices by drivers, i.e., turning off refrigeration units) or unintentional (due to improper holding practices or shortages of appropriate shipping containers or vessels, etc.)
(2) Improper management of transportation units or storage facilities to preclude cross-contamination, including improper sanitation, backhauling hazardous materials, failure to maintain tanker wash records, improper disposal of wastewater, and aluminum phosphide fumigation methods in railcar transit
(3) Improper packing of transportation units or storage facilities, including incorrect use of packing materials and poor pallet quality
(4) Improper loading practices, conditions, or equipment, including improper sanitation of loading equipment, failure to use dedicated units where appropriate, inappropriate loading patterns, and transporting mixed loads that increase the risk for cross-contamination
(5) Improper unloading practices, conditions, or equipment, including improper sanitation of equipment and leaving raw materials on loading docks after hours
(6) Lack of security for transportation units or storage facilities, including lack of or improper use of security seals and lack of security checks or records of transporters
(7) Poor pest control in transportation units or storage facilities
(8) Lack of driver/employee training and/or supervisor/manager/owner knowledge of food safety and/or security
(9) Poor transportation unit design and construction
(10) Inadequate preventive maintenance for transportation units or storage facilities, resulting in roof leaks, gaps in doors, and dripping condensation or ice accumulations
(11) Poor employee hygiene
(12) Inadequate policies for the safe and/or secure transport or storage of foods
(13) Improper handling and tracking of rejected loads and salvaged, reworked, and returned products or products destined for disposal
(14) Improper holding practices for food products awaiting shipment or inspection, including unattended product, delayed holding of product, shipping of product while in quarantine, and poor rotation and throughput
(15) Lack of traceability for food products during transportation and storage

Note: Food safety hazards are listed in random order (as compiled by the expert panel).

- High-risk foods across all modes of transportation included:
  - Fresh produce (including all whole, raw, uncut, non-refrigerated fruits and vegetables, i.e., fresh, field-packed or bulk, fresh loads or bulk, fresh for processing);
  - Refrigerated raw and ready-to-eat (RTE) foods, (i.e., dairy products, prepared foods, deli items, raw ingredients, fresh-cut produce);
  - Frozen foods (i.e., frozen fruits and vegetables, entrees, meat, seafood, par-baked goods, ice);
  - Raw meat and poultry (i.e., carcasses and primal cuts, ice-packed chicken, frozen, bulk raw meat ingredients, rendering material, etc.);
  - Eggs and egg products (pasteurized and unpasteurized); and
  - Raw seafood.

Effective preventive controls are important in ensuring product safety in transportation and storage of food products. In addition to risk rankings, experts identified 23 preventive controls that may eliminate or mitigate the risk of food safety hazards in food transportation and warehousing/storage (Table 4).

The following seven controls had the broadest applicability across all food sectors and modes of transport: (1) employee awareness and training; (2) management review of records; 3) good communication between shipper, transporter and receiver; (4) appropriate loading procedures for transportation units; (5) appropriate unloading procedures for transportation units; (6) appropriate documentation accompanying each load (tanker wash record, seal numbers, temperature readings, time in-transit and time on docks, etc.); and (7) appropriate

TABLE 4. Preventive controls for food transportation safety hazards, as identified by the expert panel

Preventive Controls for Food Transportation Safety Hazards
(1) Appropriate packaging/packing of food products and transportation units (i.e., good quality pallets, correct use of packing materials)
(2) Proper use of refrigeration equipment
(3) Thermal insulated blankets over refrigerated/frozen items
(4) Temperature monitoring/recording devices
(5) Appropriate loading procedures for transportation units
(6) Appropriate unloading procedures for transportation units
(7) Use of appropriate transportation vehicles (i.e., dedicated vehicles when necessary)
(8) Physical security measures for facilities and transportation units (cargo locks, seals, etc.)
(9) Security checks and records of transporters
(10) Use of tracking technologies (i.e., satellite (GPS) or radio frequency identification)
(11) Appropriate documentation accompanying each load (i.e., tanker wash record, seal numbers, temperature readings, time in transit and time on docks, etc.)
(12) Vendor or food transporter certification programs
(13) Sanitation/Maintenance of transportation units, storage facilities, and/or containers
(14) Sanitation/Maintenance of loading/unloading equipment
(15) Proper disposal of wastewater
(16) Employee awareness and training
(17) Pest control programs
(18) Good communication between shipper, transporter and receiver
(19) HACCP or other management systems
(20) Third party audits of systems/policies/procedures
(21) Availability of handwashing/hygienic devices
(22) Proper labeling and/or signage and/or transporter instructions
(23) Management review of records

Note: Preventive controls are listed in random order (as compiled by the expert panel).

packaging/packing of food products and transportation units (i.e., good quality pallets, correct use of packing materials).

Factor analysis

Given the degree of overlap among various food safety hazards, we expect that some underlying factors (root causes), which are smaller in number than the number of variables (i.e., number of food safety hazards), are mainly responsible for the covariance among our variables. For example, improper loading procedures may be a result of lack of employee training, improper holding practices for food products awaiting shipment or inspection may result in improper refrigeration or temperature control of food products, and inadequate policies for the safe transport of food products may be responsible for the lack of security during transportation. Therefore, we performed a factor analysis to determine the number of underlying dimensions in the risk score data collected and how the information contained in the fifteen hazards could be combined to provide summary information.

The factor analysis technique allowed us to generate an overall risk score that combines the information for all of the 15 food safety problems. That is, we calculated the relationship among all of the variables and one underlying factor that we call "overall risk." An index of overall risk for each food product sector is presented in Table 5 by mode of transportation. Each index (read by the column only) has a mean of 100 and standard deviation of 10. This provides an indication of the relative risk of the food product sectors for each mode of transportation. A value that exceeds 100 indicates that overall risk in the relevant sector is greater than average risk. Index values are rounded to the nearest tenth to highlight subtle differences in relative risk between food product sectors.

TABLE 5. Overall risk indices for the fifteen food safety hazards by food product sector

Food Product Sector	Truck	Rail	Water	Air	Intermodal	Storage
Bulk liquids (dedicated tanker)	94.9 (8)	95.3 (8)	96.5 (7)	95.1 (10)	94.3 (8)	94.4 (8)
Bulk raw ingredients	95.2 (7)	95.4 (7)	95.9 (8)	95.9 (8)	96.1 (7)	96.6 (7)
Eggs and egg products	103.6 (6)	102.1 (6)	102.1 (5)	101.6 (4)	101.4 (6)	99.8 (6)
Frozen foods	104.6 (5)	104.0 (5)	101.8 (6)	100.7 (6)	102.7 (5)	103.0 (5)
Fresh produce	105.4 (4)	106.0 (4)	103.7 (4)	101.1 (5)	102.8 (4)	105.2 (4)
Meat & poultry (raw)	107.1 (2)	110.1 (2)	108.6 (2)	108.1 (2)	109.9 (2)	109.1 (2)
Other nonperishables	92.1 (10)	90.3 (10)	92.8 (10)	95.7 (9)	92.1 (9)	92.0 (10)
Packaging materials	89.3 (11)	86.7 (11)	90.1 (11)	91.1 (11)	89.5 (11)	89.4 (11)
Refrigerated raw & RTE	105.5 (3)	107.3 (3)	107.4 (3)	104.3 (3)	106.6 (3)	107.9 (3)
Soft-packed nonperishables	92.8 (9)	90.5 (9)	92.6 (9)	96.3 (7)	92.0 (10)	91.9 (9)
Seafood (raw)	109.0 (1)	111.9 (1)	108.7 (1)	109.7 (1)	111.9 (1)	111.3 (1)

Note: Obtained by factor analysis as described in the Materials and Methods Section. Each index (read by the column only) has a mean of 100 and standard deviation of 10 and provides an indication of the relative risk of the food product sectors for each mode of transportation. A value that exceeds 100 indicates that overall risk in the relevant sector is greater than average risk. Numbers in parentheses represent the rankings of food product sectors by overall risk index.

The high-risk food groups for each mode of transportation, as well as storage/warehousing of food products, can be discerned from Table 5. Across all modes of transit, the food sectors with the highest overall risk, in descending order, are raw seafood, raw meat and poultry, and refrigerated raw and ready-to-eat foods. Other food product sectors with overall greater-than-average risk for all modes of transport are eggs and egg products, frozen foods, and fresh produce. Packaging materials and both categories of non-perishables present less-than-average overall risk. The rankings of food product sectors by overall risk are the same for truck and rail transportation and warehouse/storage, however, they vary slightly for water, air, and intermodal transport (Table 5). The rankings by food product sector for food transportation by air are most different from rankings for the other modes of transportation.

We also performed exploratory factor analysis to consider food safety hazards across truck, rail, air, water and intermodal means of transportation (excluding storage). The results suggest that two underlying factors help to explain the risk score data for these modes of transport: "in-transit risk" and "organizational risk" (Table 6). The names of these factors are subjective and are derived from the food safety hazards that contribute most to each factor. For example, the "in-transit risk" factor gets its name from the fact that the food safety hazards that contribute most to it are "improper refrigeration," "improper loading," "improper unloading," and "improper holding practices for products awaiting shipment or inspection." Likewise, the food safety hazards that contribute most to the "organizational risk" factor are "lack of driver/employee training," "inadequate preventive maintenance," and "lack of traceability."

The same high-risk food products (as indicated by each factor risk index) show above-average risk for both the "in-transit risk" factor and the "organizational risk" factor (Table 6). However, the risk rankings by food product sector are not identical for the two risk factors. The food product sectors with the highest index value for the "in-transit risk" factor are raw seafood, raw meat and poultry, and fresh produce. The food product sectors with the highest index value for the "organizational risk" factor are raw meat and poultry; refrigerated raw and ready-to-eat foods, and raw seafood.

Because some 80 percent of food products are transported domestically by truck, we also conducted an analysis to consider the food safety hazards in truck transportation alone. Our analysis shows that truck transportation risks are best described by four underlying factors.

- In-transit product risk,
- Equipment-related risk,
- In-transit process risk, and
- Organizational or policy-related risk.

Table 7 shows that the rankings of risk by food product sector are not identical for each truck transportation risk factor. In some cases, certain sectors appear higher in the rankings than one might expect. For instance, soft-packed non-perishables are ranked sixth overall for the "equipment-related risk" factor. However, this sector has, on average, lower equipment-related risk, with an index of 99.1 compared to the mean for the equipment-related risk index of 100 (Table 7). This ranking, however, may reflect the potential for damage to soft-

TABLE 6. Factor risk indices by food product sector, all modes of transportation[a]

Food Product Sector	In-transit Risk[b]	Organizational Risk[c]
Bulk liquids (dedicated tanker)	95.5 (8)	97.3 (8)
Bulk raw ingredients	95.6 (7)	98.1 (7)
Eggs and egg products	102.1 (6)	100.1 (5)
Frozen foods	104.0 (5)	99.4 (6)
Fresh produce	105.1 (3)	100.6 (4)
Meat & poultry (raw)	107.3 (2)	106.9 (1)
Other nonperishables	92.3 (10)	95.9 (9)
Packaging materials	89.8 (11)	93.8 (11)
Refrigerated raw & RTE	104.8 (4)	106.2 (2)
Soft-packed nonperishables	93.3 (9)	95.6 (10)
Seafood (raw)	109.7 (1)	106.0 (3)

Note: Obtained by factor analysis as described in the Materials and Methods Section. Each index (read by the column only) has a mean of 100 and standard deviation of 10 and provides an indication of the relative risk of the food product sectors for each risk factor. A value that exceeds 100 indicates greater than average risk for that factor. Numbers in parentheses represent the rankings of food product sectors by the applicable risk factors. The names of factors are derived from those variables that contribute the most to the factor values.

[a]Includes truck, rail, water, air, and intermodal.

[b]The in-transit risk factor loads very highly on "improper refrigeration," "improper management of transportation units," "improper loading," "improper unloading", and "improper holding practices for products awaiting shipment or inspection."

[c]The organizational risk factor loads highly on "lack of driver/employee training," "inadequate preventive maintenance," "lack of traceability," and "poor employee hygiene."

packed non-perishables due to improper equipment used during transportation and storage of these products.

We also performed an exploratory factor analysis to consider the risks in the warehousing and storage of food products. Our analysis concluded that the risks for storage of food products are best described by the following three underlying factors (Table 8):

- Process-related risk,
- Equipment and/or facility risk, and
- Organizational or policy-related risk.

For this analysis, the rankings for the "equipment and/or facility-related risk" factor seem to be opposite, in a sense, from the other two factors. This is particularly apparent in the top ranking of bulk liquids (ranked first) and eggs and egg products (ranked second) for "equipment and/or facility-related risk." This ranking may reflect the high severity of food safety problems related to dedicated tankers and the possible consequences of a contamination event like the 1994 *Salmonella* outbreak following the transport of ice cream mix in tankers previously used for unpasteurized egg products.

Additional considerations

Throughout each round of the elicitation, experts were provided the opportunity to comment openly on food transportation risks. A number of comments described direct or indirect relationships between food safety concerns and cost saving measures for transporting food products. For example, experts expressed concern about the implications of rising energy costs and cost-saving measures such as shutting off engines until within distance of ports or raising temperature settings to marginal or inappropriate levels. Damage was noted as the biggest concern related to improper packing, where damage can be one function of cost-cutting measures leading to weaker packaging materials. Similarly, concern was expressed about cost-saving measures resulting in the use of inappropriate or inadequate equipment for transportation or storage.

DISCUSSION

This study was designed to characterize the baseline practices in the sectors involved in food transportation, such as refrigerated warehousing and storage, farm product warehousing and storage, deep sea freight transportation, coastal and great lakes freight transportation, inland water freight transportation, local

TABLE 7. Factor risk indices by food product sector, truck transportation

Food Product Sector	In-transit Product-related Risk[a]	Equipment -related Risk[b]	In-transit Process-related Risk[c]	Organizational or Policy-related Risk[d]
Bulk liquids (dedicated tanker)	94.9 (7)	96.1 (11)	95.0 (11)	104.6 (3)
Bulk raw ingredients	94.9 (8)	98.4 (8)	98.9 (5)	99.3 (7)
Eggs and egg products	104.4 (5)	97.3 (9)	96.7 (8)	101.2 (6)
Frozen foods	103.9 (6)	100.8 (5)	96.2 (10)	106.2 (1)
Fresh produce	106.4 (3)	101.5 (4)	104.6 (4)	98.4 (8)
Meat & poultry (raw)	107.6 (2)	101.7 (3)	106.0 (2)	103.9 (4)
Other nonperishables	92.3 (10)	97.2 (10)	96.8 (7)	92.6 (10)
Packaging materials	87.8 (11)	98.6 (7)	97.6 (6)	91.9 (11)
Refrigerated raw & RTE	105.6 (4)	105.8 (1)	106.2 (1)	104.6 (2)
Soft-packed nonperishables	92.5 (9)	99.1 (6)	96.5 (9)	95.2 (9)
Seafood (raw)	109.7 (1)	103.6 (2)	105.7 (3)	102.1 (5)

Note: Obtained by factor analysis as described in Methods Section. Each index (read by the column only) has a mean of 100 and standard deviation of 10 and provides an indication of the relative risk of the food product sectors for each risk factor. A value that exceeds 100 indicates greater than average risk for that factor. Numbers in parentheses represent the rankings of food product sectors by the applicable risk factors. The names of factors are derived from those variables that contribute the most to the factor values.

[a]The in-transit product-related risk factor loads very highly on "improper refrigeration," "improper management of transportation units," "improper loading," "improper unloading," and "improper holding practices for products awaiting shipment or inspection," and moderately high on "lack of driver/employee training and/or supervisor/manager/owner knowledge of food safety and/or security."

[b]The equipment-related risk factor loads very highly on "poor transportation unit design and/or construction" and moderately high on "inadequate preventive maintenance for transportation units."

[c]The process-related risk factor loads highly on "poor employee hygiene" and "lack of traceability," and moderately high on "improper handling/tracking of rejected loads, etc."

[d]The organizational or policy-related risk factor loads highly on "inadequate policies" and "lack of security," and moderately high on "lack of driver/employee training and/or supervisor/manager/owner knowledge of food safety and/or security."

and long distance general freight trucking, and others. It provides a global perspective on current food safety hazards in the food transportation and warehousing industry as well as information on the relative importance of these problems across various food sectors and modes of transport.

Through a literature review and expert opinion elicitation, we identified 15 food safety hazards that increase the risk of microbiological, chemical, and/or physical contamination during the transport and storage of food. The top 5 food safety hazards of greatest concern across all modes of transportation include: (1) lack of security; (2) improper holding practices; (3) improper refrigeration or temperature control; (4) improper management of transportation units or storage facilities to preclude cross-contamination; and (5) improper loading practices, conditions, or equipment.

As expected, the level of contamination risk posed by improper transportation and storage practices varies across food sectors. Raw seafood, raw meat and poultry, and refrigerated raw and ready-to-eat foods have the highest overall risk (in descending order) across all modes of transit followed by eggs and egg products, frozen foods, and fresh produce. Packaging materials and non-perishables have the lowest overall risk.

The study findings may have implications for food policy in general. As regulators are increasingly embracing a more risk-based approach to setting priorities and allocating resources for food safety, the results of this study can help focus their efforts. For example, results from the study indicate that employee awareness and training are key compo-

TABLE 8. Factor risk indices by food product sector, storage/warehouse

Food Product Sector	Process-related Risk[a]	Equipment and/ or Facility Risk[b]	Organizational or Policy-related Risk[c]
Bulk liquids (dedicated tanker)	96.4 (8)	107.7 (1)	100.8 (6)
Bulk raw ingredients	100.0 (7)	102.1 (6)	94.3 (8)
Eggs and egg products	103.2 (3)	106.6 (2)	102.0 (5)
Frozen foods	100.1 (6)	96.2 (7)	102.5 (4)
Fresh produce	103.0 (4)	90.8 (11)	97.6 (7)
Meat & poultry (raw)	104.1 (2)	93.3 (9)	107.7 (2)
Other nonperishables	95.2 (10)	105.2 (5)	93.8 (10)
Packaging materials	92.5 (11)	105.4 (4)	92.5 (11)
Refrigerated raw & RTE	100.2 (5)	90.9 (10)	108.2 (1)
Soft-packed nonperishables	95.8 (9)	105.8 (3)	93.9 (9)
Seafood (raw)	109.8 (1)	95.2 (8)	106.6 (3)

Note: Obtained by factor analysis as described in Methods Section. Each index (read by the column only) has mean of 100 and standard deviation of 10 and provides an indication of the relative risk of the food product sectors for each relevant risk factor. A value that exceeds 100 indicates greater than average risk for that factor. Numbers in parentheses represent the rankings of food product sectors by the applicable risk factors. The names of factors are derived from those variables that contribute the most to the factor values.

[a]The process-related risk factor loads very highly on "improper packing," and "improper loading," and highly on "improper refrigeration," "improper management of transportation units," "improper unloading", and "poor pest control."

[b]The equipment and/or facility risk factor loads very highly on "inadequate preventive maintenance for storage facilities," and moderately high on "poor storage facility design and/or construction" and "poor employee hygiene."

[c]The organizational or policy-related risk factor loads highly on "inadequate policies" and moderately high on "lack of driver/employee training and/or supervisor/manager/owner knowledge of food safety and/or security" and "improper holding practices."

nents in eliminating or mitigating safety hazards during transportation. Another finding is the critical nature of proper management of transportation units to preclude cross-contamination of foods, including adequate sanitization between loads. Policymakers may therefore want to further explore the role of government in improving employee training and establishing sanitation standards.

In light of industry challenges such as capacity problems, driver shortages, increasing consumer demands, and increasing costs, our findings may also aid the various industry players in prioritizing their food transportation safety initiatives. The study helps clarify which hazards are most likely to occur during transportation and storage, taking into account sector-specific challenges. This ranking can help transporters understand what processes pose the greatest risk in terms of food contamination. Furthermore, the study provides information on the most effective preventive controls available to increase the safety of the food that they transport. At the top of the list are better training and awareness of employees, management review of records, and good communication between shipper, transporter and receiver. In light of limited budgets, these data might help transporters determine where they should focus their resources to ensure that the foods that they transport are safe.

This study serves only as a preliminary assessment of current food transportation and holding practices for food commodities. Both the lack of literature on the subject and the broad nature of the expert elicitation suggest a need for further study regarding food safety hazards involved in food transportation. In particular, the food transportation industry may benefit from a baseline quantitative assessment of both the frequency and severity of food safety hazards and the degree of implementation for various safe food transportation practices and preventive controls.

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REFERENCES

1. Adulterated Food. 21 USC 342, January 5, 2009. Available at: http://frwebgate.access.gpo.gov/cgi-bin/usc.cgi?ACTION=RETRIEVE&FILE=$$xa$$busc21.wais&start=478633&SIZE=25241&TYPE=PDF. Accessed 29 December 2009.
2. Ayyub, B. M. 2000. Methods for expert-opinion elicitation of probabilities and consequences for corps facilities. IWR Report-00-R-10 prepared for U.S. Army Corps of Engineers, Institute for Water Resources, Alexandria, VA.
3. Bendickson, N.J. 2007. Transportation and food distribution security. TransActions, NAOSH Week 2007 (Special Edition):15–17.
4. Böge, S. 1997. Freight transport, food production and consumption in the United States and Europe: or how far can you ship a bunch of onions in the United States? Wuppertal Paper No. 56.s, Wuppertal Institute for Climate, Energy and Environment, Wuppertal, Germany.
5. Clemen, R.T., and R. L. Winkler. 1997. Combining probability distributions from experts in risk analysis. *Risk Anal.* 19:187–203.
6. Erera, A. 2005. Providing Security to Food Transportation Systems without Compromising Productivity. Proceedings of the Institute of Food Technologists' First Annual Food Protection and Defense Research Conference, Atlanta, GA. November 3–4.
7. Heap, R., M. Kierstan, and G. Ford (eds.). 1998. Food transportation. Blackie Academic and Professional, London.
8. Keener, L. 2003. Transportation: The squeaky wheel of the food safety system. Available at: http://www.foodsafetymagazine.com/article.asp?id=1879&sub=sub1. Accessed 3 January 2008.
9. Kilcarr, S. 2001. Redefining refrigerated transport. Available at: http://driversmag.com/ar/fleet_redefining_refrigerated_transport/index.html. Accessed 3 January 2008.
10. Landeta, J. 2005. Current validity of the Delphi method in social sciences. *Technol. Forecast. Social Change.* 73(5):467–482.
11. Linstone, H.A., and M. Turoff. 2002. The Delphi Method: Techniques and Applications. Addison-Wesley, Reading, MA.
12. Saddle Creek Corporation. 2007. 2007 Food Logistics Industry Report. Saddle Creek Corporation White Paper Series. Available at: http://www.iwla.com/CustomFiles/downloads/E2A58C05-5382-482E-B419-577E089B0666.pdf. Accessed 6 August 2007.
13. Safe, Accountable, Flexible, and Efficient Transportation Equity Act: A Legacy for Users of 2005 (PL 109-59, August 10, 2005). Available at: http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=109_cong_public_laws&docid=f:publ059.109.pdf. Accessed 29 December 2009.
14. StataCorp. 2003. Stata Statistical Software: Release 8. College Station, TX, StataCorp LP.
15. Stier, R. F. 2004. Say goodbye to the weakest link. *Food Eng.* 76(6):20–21.
16. Terreri, A. 2007. Riding the fresh express. Available at: http://www.foodlogistics.com/print/Food-Logistics/Riding-The-Fresh-Express/1$1416. Accessed 16 November 2007.
17. United States Department of Agriculture. Transportation Services Branch, Transportation and Marketing Programs, Agriculture Marketing Service (USDA-AMS). 2007. Agricultural Refrigerated Truck Quarterly, 3rd Quarter, July-September. Available at: http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5064151&acct=atgeninfo. Accessed 6 February 2009.
18. United States Department of Transportation Federal Motor Carrier Safety Administration. "Hours of Service of Drivers." 49 CFR 395, 2008 ed. Available at: http://www.access.gpo.gov/nara/cfr/waisidx_08/49cfr395_08.html. Accessed 29 December 2009.
19. United States Food and Drug Administration. "Current good manufacturing practice in manufacturing, packing, or holding human food — warehousing and distribution." 21 CFR 110.93, 2009 ed. Available at: http://edocket.access.gpo.gov/cfr_2009/aprqtr/pdf/21cfr110.93.pdf. Accessed 29 December 2009.

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Controlled Vapor Oven Cooking and Holding Procedures Used for the Reduction of *Salmonella* and Prevention of Growth of *Clostridium perfringens* in Boneless Beef Rib Roasts

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ABSTRACT

The FDA 2005 Food Code whole meat roast cooking guidelines were used to evaluate controlled vapor oven cooking and holding of boneless beef rib roasts weighing 13.0 to 14.0 lb (5.89 to 6.35 kg) at 130°F (54.4°C). The efficacy of the controlled vapor oven cooking, holding, cooling, cold holding, and reheating procedures was evaluated on the basis of the ability of the procedures to produce a 5-log reduction of a *Salmonella* inoculum on the surface and in the center of the beef roasts and to control the growth of *Clostridium perfringens* in the center of the roasts. This study showed that 6-hour cooking of beef roasts at 130°F (54.4°C) Wet Bulb Temperature, with oven relative humidity of 30 to 90%, met regulatory requirements for the destruction of *Salmonella*, even though the roast temperatures reached only 120 to 128°F (48.9 to 53.3°C). There was a slight increase in *C. perfringens* counts during cooking, indicating spore germination and vegetative cell growth. However, when the roasts were held at 130°F (54.4°C) during post cook-hold, *C. perfringens* was reduced to an undetectable level. During post-cook-chill-hold and retherm (reheating), a small population of *C. perfringens* that had been reduced to undetectable levels (< 10 CFU/g) was detected. This observation indicates that a safer way to hold cooked roast beef is to hold the roasts at a controlled vapor oven temperature of 130°F (54.4°C) until consumed rather than to cool and reheat leftovers.

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INTRODUCTION

The purpose of this study was to determine the effectiveness of controlled vapor oven processing procedures for the reduction of pathogenic bacteria such as *Salmonella* and *Clostridium perfringens* in large cuts of meat, using FDA 2005 Food Code *(8)* §3-401.11 (B) (1) whole meat roast cooking guidelines as a reference. The safety of controlled vapor oven cooking procedures was evaluated on the basis of the ability of the procedures to produce a reduction of a *Salmonella* inoculum on roast surfaces and in minced beef contained within dialysis tubes placed in the center of beef roasts, as well as the effect of cooking, holding, cooling, storage, and retherm (reheating) procedures on the outgrowth of spores and destruction of vegetative cells of *C. perfringens* in minced beef contained in dialysis tubes placed in the center of the roasts.

MATERIALS AND METHODS

Equipment and product

A CVap oven (Model CAC507) (Winston Industries, LLC, Louisville, KY) was used for this experiment. Operator accessible controls of this equipment are the Wet Bulb Temperature (T_{wb}) and Dry Bulb Temperature (T_{db}) *(11)*. T_{wb} is controlled by a temperature-controlled water evaporator at the bottom of the food chamber. T_{db} is controlled by temperature-controlled air heaters in the upper food chamber.

Seven boneless beef rib roasts (USDA Choice) weighing 13.0 to 14.0 lb (5.89 to 6.35 kg) were procured from a local distributor. The roasts were stored at 32 to 34°F (0 to 1.1°C) and used within 3 to 7 days of procurement.

Test microorganisms

Three serotypes of *Salmonella* were used: Enteritidis (ATCC 13076), Typhimurium (ATCC 14028), and Montevideo (ATCC 8387). Each *Salmonella* serotype was grown separately at 95°F (35°C) for 24 hours in Tryptic Soy Broth (TSB) and underwent at least two serial transfers. Bacterial cells for each culture were harvested by centrifugation at 10,000 × *g* for 10 min. and washed with Butterfield's Phosphate Buffer, pH 7.2 (BPB). Each strain was then resuspended, concentrated, and combined in BPB to obtain a final cocktail suspension containing equal concentrations of each strain (i.e., ca. 10^{10} CFU/ml), which was used to inoculate the product.

The three strains of *C. perfringens* used in this study were NCTC 8238 (ATCC 12916), NCTC 8239 (ATCC 12917), and NCTC 10240 (ATCC 14810). Each strain was individually cultured in fresh Fluid Thioglycollate Broth (FTB) and then transferred to, and individually cultured in, a medium designed to promote the maximum formation of spores *(2)*. Spores from each culture were harvested by centrifugation at 10,000 × *g* for 10 min. and the pellets resuspended in sterile distilled water and stored at 35 to 38°F (1.7 to 3.3°C). Aliquots of the spore suspensions were combined to prepare a final working (cocktail) suspension containing approximately equal numbers of spores of each strain (i.e., ca. 10,000 CFU/ml), which was used to inoculate the product. The final working suspension was heat treated (i.e., 20 min. at 167°F (75°C) and immediately cooled to 39°F (4°C)) just prior to inoculation to ensure that only spores were present. The final working suspension was enumerated on Tryptose Sulfite Cycloserine (TSC) agar without egg yolk.

Sample inoculation and preparation

The boneless beef rib roasts contained insertions of the *Salmonella* cocktail and *C. perfringens* spore cocktail, using the dialysis tubing technique for containment of microbial populations *(1, 9)*. This was accomplished by mincing, inoculating, and mixing approximately 300 g of the raw product (beef roast) with ca. 30 ml of *C. perfringens* spore cocktail. Another ca. 300-g portion of raw product was minced, inoculated, and mixed with 3.0 ml of the *Salmonella* cocktail inoculum. For each pathogen, three 10-to-15-g aliquots of the inoculated minced product were analyzed microbiologically to establish initial counts. The respective inoculated product portions had ca. 5 × 10^3 CFU/g of *C. perfringens* and ca. 2 × 10^8 CFU/g of *Salmonella*.

For *C. perfringens*, the remaining inoculated, minced product was portioned into 18 sample aliquots (ca. 10 g each) that were placed into moistened 20.4 mm diameter dialysis tube segments. For *Salmonella*, the remaining inoculated minced product was portioned into 9 sample aliquots (ca. 10 g each) that were placed into moistened 20.4 mm diameter dialysis tube segments. The dialysis segments were closed at each end with thread, resulting in a small tube of inoculated product about 3 cm long. The dialysis sample units were color coded to differentiate the *Salmonella* from the *C. perfringens* inoculum and were kept refrigerated until insertion into the beef roasts, which was performed within 24 hours.

Incisions were made in the geometric center of three roasts. Three dialysis sample units of both *Salmonella* and *C. perfringens* were carefully inserted through each incision and were placed at the approximate geometric center of each roast. The incision was then closed.

A 10 cm^2 surface site on each of the 3 roasts containing the dialysis sample units of *Salmonella* and *C. perfringens* was inoculated with 0.1 ml of the *Salmonella* suspension in 0.01 ml droplets. The inoculated surface sites were marked to identify the sites for subsequent microbial analysis. This inoculum technique delivered about 10^9 CFU/cm^2 to each designated surface site. After surface inoculation, the roasts were held refrigerated for at least 30 minutes to allow bacterial attachment and consistent temperature equilibration prior to control sampling (time-zero) or cooking.

Experimental cooling cycle development

Procedures were tested for cooling and holding cooked roasts in a refrigerator with an air temperature of 38 ± 2°F (3.3 ± 1°C), from 130 to 41°F (54.4 to 5°C) in a time that would allow germination and multiplication of *C. perfringens*, over approximately 24 h. This cooling time was chosen to be representative of abusive cooling of roasts that occurs in retail food establishment refrigeration units and is sufficient for the growth of *C. perfringens*.

For the roast cooling experiment, 2 roasts were fitted with thermocouples at their geometric center and heated in the controlled vapor oven set at 130°F (54.4°C) T_{wb}. When the roasts reached a temperature of 130°F (54.4°C), they were removed from the oven and placed in a refrigeration unit set at 38°F (3.3°C) and with a restricted airflow to allow slow cooling. One roast was uncovered, and one was covered with aluminum foil. This trial indicated that the roasts without a foil cover cooled from 130 to 41°F (54.4 to 5°C) in about 24 hours, thus assuring the germination and multiplication of surviving *C. perfringens*.

Processing and physical data recording

Each of the 6 roasts that contained the dialysis sample units was fitted with 2 thermocouples (one internal thermocouple at the geometric center adjacent to the inserted dialysis units and a second thermocouple at 1.6 mm below the surface), for a total of 12 thermocouples. Internal and near-surface temperatures of the designated roasts were recorded at 5-min. intervals throughout the cooking, holding, cooling, and reheating procedures.

Oven temperature was also monitored. The T_{db} temperature and relative humidity in the controlled vapor oven were electronically recorded (5- or 10-min. intervals) during all processing steps, using type K thermocouples, an Omega OMB-DAQ-55 USB data acquisition system with a OMB-PDQ1 expansion module (Omega Engineering, Stamford, CT) and a humidity probe (Global Sensors' Humidity Logger DW-HS-B-16, Mt. Holly, NC – Accuracy of 3% to 60°C and 5% to 77°C). The temperature in the refrigerator was also electronically monitored and recorded during the cooling cycle and subsequent refrigerated holding. The temperature and relative humidity display readings on the controlled vapor oven were manually recorded from the oven display panel at approximately 1-hour intervals and whenever samples were collected during processing (i.e., initial cook-hold and retherm (reheating)). Additionally, 1 roast was fitted with an internal temperature probe that was integral with the controlled vapor oven for manual recordings. The processing and sampling steps for the beef roasts were as follows:

1. At time-zero, 1 roast was surface inoculated with only *Salmonella*; 3 roasts were surface inoculated with *Salmonella* and contained 3 inserted dialysis sample units of both *Salmonella* and *C. perfringens*; 3 roasts contained only inserted dialysis sample units of *C. perfringens*. The first inoculated roast, the control, was immediately surface sampled for *Salmonella* and center sampled for *C. perfringens*.
2. The controlled vapor oven was set at 130°F (54.4°C) T_{wb} and 170°F (76.7°C) T_{db} and preheated.
3. Three roasts were placed on a 18 × 26 inch sheet pan on the bottom rack of the controlled vapor oven, and 3 roasts were placed on a pan on the middle rack in the oven.
4. The roasts were set to cook for 6 hours to achieve a center temperature of 130°F (54.4°C). At the end of the 6 hours, 1 roast was removed from the oven. The 3 internal *Salmonella* samples in dialysis tubes were recovered and removed, along with the 3 *C. perfringens* samples in dialysis tubes. The presence of *Salmonella* on the roast surface was determined by excising the 10 cm^2 surface sample for *Salmonella* recovery and enumeration.
5. After the 6-hour cook, the T_{wb} of the oven was left at 130°F (54.4°C), and the T_{db} was set at 131°F (55°C). These settings were used to hold the beef at a center temperature of 130°F (54.4°C) and a surface temperature of 131°F (55°C) at 90% relative humidity for 121 minutes, to meet the FDA *Salmonella* reduction requirement *(8)*. At the completion of this 121-minute holding step #1 (i.e., 8 hours and 1 minute after start of cook), one inoculated roast was removed from the oven for dialysis sample tube recovery and determination of *Salmonella* and *C. perfringens*.
6. Holding continued at 130°F (54.4°C) T_{wb} and 131°F (55°C) T_{db} for 28 hours to simulate restaurant hot holding. At the completion of this step, about 36 hours after start of cooking, one inoculated roast was removed, and *Salmonella* was recovered and enumerated from the surface of the roast. *Salmonella* and *C. perfringens* were recovered and enumerated from the dialysis tube samples within the center of the roast.
7. The remaining 3 roasts (which contained only *C. perfringens* dialysis tube samples) were placed in a refrigerator and cooled from 130°F (54.4°C) center temperature to 41°F (5°C) in about 24 h. After cooling to 41°F (5°C) center temperature, 1 roast was removed, and the 3 *C. perfringens* dialysis tubes from the center of the roast were removed for *C. perfringens* recovery and enumeration.
8. The remaining 2 roasts were held refrigerated at 38 to 41°F (3.3 to 5°C) for about 24 h. After this refrigerated hold, 1 roast was removed, and the 3 dialysis tubes were extracted for *C. perfringens* recovery and enumeration.
9. For the final step, the remaining refrigerated roast was reheated for 6 hours in the controlled vapor oven set at 130°F (54.4°C) T_{wb} and at 170°F (76.7°C) T_{db}. At 6 hours, the T_{db} was changed to 131°F (55°C) and the roast was held for an additional 4 hours. The roast was then removed from the oven, the dialysis tube samples were removed from the roast, and *C. perfringens* was recovered and enumerated.

Recovery

For recovery of inoculated samples, the 10-g contents of a dialysis tube were placed in a Stomacher bag with BPB to obtain a 1:10 dilution. Samples were stomached for 1 minute and the homogenate serially diluted in BPB. For the surface *Salmonella* inoculated samples, the designated inoculation sites (10

TABLE 1. ***Salmonella* lethality delivered to beef roasts during controlled vapor oven processing**

Sample Variable		Internal *Salmonella* counts CFU/g	Internal *Salmonella* counts Log CFU/g	Surface *Salmonella* counts CFU/cm²	Surface *Salmonella* counts Log CFU/cm²
Pre-cook	rep. 1	140,000,000	8.15	1,700,000,000	9.23
	rep. 2	290,000,000	8.46	1,400,000,000	9.15
	rep. 3	280,000,000	8.45	1,500,000,000	9.18
	Mean		**8.35**		**9.18**
	Std. Dev.		0.18		0.04
Post-cook	rep. 1	6,200	3.79	< 10[a]	< 1.00
[6 h to 130°F (54.4°C) CT[b]]	rep. 2	5	0.70	< 10	< 1.00
	rep. 3	1,800	3.26	< 10	< 1.00
	Mean		**2.58**		**< 1.00**
	Std. Dev.		1.65		0.00
	Log Reduction[c]		**5.77**		**> 8.18**
Post-cook/FDA hold	rep. 1	22,000	4.34	< 10	< 1.00
[6 h to 130°F (54.4°C) CT	rep. 2	8,200	3.91	< 10	< 1.00
plus 121 min @ 130°F	rep. 3	490	2.69	< 10	< 1.00
(54.4°C)]	**Mean**		**3.65**		**< 1.00**
	Std. Dev.		0.86		0.00
	Log Reduction		**4.70**		**> 8.18**
Post-cook/Sell hold	rep. 1	< 5	< 0.70	< 10	<1.00
[6 h to 130°F (54.4°C) CT	rep. 2	< 5	< 0.70	< 10	< 1.00
plus 121 min @ 130°F	rep. 3	< 5	< 0.70	< 10	< 1.00
(54.4°C) plus 28 h	**Mean**		**< 0.70**		**< 1.00**
@130°F (54.4°C)]	Std. Dev.		0.00		0.00
	Log Reduction		**> 7.65**		**> 8.18**

[a]A "less than" (<) sign indicates no surviving *Salmonella* were detected in the subject sample

[b]CT = center temperature

[c]Log Reduction = (pre-cook mean log/g) - (subject post-cook/hold mean log/g)

cm²) were sampled by use of a surface excision technique. The designated surface site was aseptically excised to a depth of 5 mm; the sample was placed in a Stomacher bag and diluted with sterile BPB diluent to obtain a 1:10 weight dilution. Excised samples were stomached for 1 min. and the homogenates serially diluted in sterile BPB diluent as required. *Salmonella* was enumerated by Surface Plating on XLT agar, using the Thin Agar Layer method (TAL) with Trypticase Soy Agar (TSA) to enhance recovery of sublethally injured bacterial cells *(4)*. *Clostridium perfringens* was enumerated in designated samples using Tryptose Sulfite Cycloserine (TSC) agar without egg yolk and standard microbiological methods *(6)*.

RESULTS

Results were expressed as colony forming units (CFU) per gram for internal samples and CFU per cm² for surface samples. Counts of each pathogen were converted to log values for calculation of means and standard deviations. Mean *Salmonella* log reductions (as compared to time zero) were calculated for each sample set at each process step.

Process temperatures, cooking, hold, and sell hold

Electronic temperature results indicated that the center temperatures of the roasts ranged from 120 to 125°F (48.9 to 51.7°C) at the end of cook and 123 to 128°F (50.6 to 53.3°C) at the end of the FDA 2-hour hold *(8)*. The internal temperature of some roasts did reach 129°F (53.9°C) during the sell hold. Electronic relative humidity readings showed that the oven took about 3 hours after start of cooking to reach the range of 82 to 91% relative humidity, after which there was little variability.

Roast cooling after controlled vapor oven cook, FDA hold, and sell hold temperature data

During cooling, the internal temperature of the roasts decreased from about 130 to 41°F (54.4 to 5°C) in about 24 hours. The refrigerator temperature was steady at about 41°F (5°C) during the 24-hour hold. The electronic temperature results indicated that the internal temperature of the test roast was 126°F (52.2°C) during retherm (reheat) and sell hold.

Salmonella analysis: Pre-cook and post-cook

As shown in Table 1, the initial mean internal and surface inoculum counts were 8.35 log and 9.18 log, respectively. At the end of cook (heating), the center temperature of the beef roasts was at 120 to 126°F (48.9 to 52.2°C), while the T_{wb} oven temperature was 130°F (54.4°C). At 120°F (48.9°C), the time for a 1-log reduction of *Salmonella* is 173 minutes, and at 125°F (51.7°C) it is 54.5 minutes *(1)*. Some survival would be expected. Temperature at the surface was adequate for an 8.18-log reduction of *Salmonella*, as shown in Table 1. No *Salmonella* were detected on the surface of the beef roasts at the end of the 6-hour cook, and there was a 5.77-log *Salmonella* reduction in the center of the roast beef. A 6.5-log *Salmonella* reduction is required by the FDA food code *(8)*. Although it did not meet FDA whole meat cooking guidelines exactly, the center had as much *Salmonella* reduction as required by the FDA code for ground meat (greater than 5 logs) at the end of the 6-hour cook. It is expected that the roast would be safe from vegetative bacterial pathogens such as *Salmonella*.

Salmonella analysis: Post-cook / FDA hold

The center temperature of the roasts continued to rise about 1.0°F (0.55°C) during the next 2 hours, until the center temperature ranged from 123 to 128°F (50.6 to 53.3°C), and the oven completed the 2-hour FDA hold mode. The thermocouple probe within the roast indicated a temperature of 127 to 128°F (52.8 to 53.3°C) when the oven registered 130°F (54.4°C). The *Salmonella* count was not markedly different from the count at 6 hours. As mentioned previously, if the center temperature had reached 130°F (54.4°C), it is expected that the small number of surviving *Salmonella* in the center would have been killed.

Salmonella analysis: Post-cook-sell-hold+28 hours at 130°F (54.4°C)

As expected, there was no *Salmonella* survival internally or on the surface of the roasts. This shows that the controlled vapor oven has the capability of safely holding food at 130°F (54.4°C) and preventing the growth of *Salmonella*. This temperature would also kill *Salmonella* if there is a slight amount of cross-contamination, as might occur when the meat is being taken in and out of the oven for slicing and then put back. Since vegetative bacterial pathogens such as *Salmonella* are killed at these temperatures, this indicates that roasts, such as the beef roasts used in this study, will meet the FDA requirement for control of *Salmonella* if the temperature in all parts of large cuts of meat / poultry cooked in a controlled vapor oven is greater than 130°F (54.4°C).

Clostridium perfringens: microbiological results

The microbiological results for *C. perfringens* inoculated internally into the boneless beef rib roasts subjected to the controlled vapor oven cook, FDA hold, and sell hold process steps, as well as a designated cooling procedure, a cold-hold procedure and a CVap oven retherm (reheat) process, are presented in Table 2. Note that the pre-cook *C. perfringens* counts were comprised of spores (due to the inoculum preparation methods), whereas the counts for subsequent sampling times could be comprised of both spores and/or vegetative cells of *C. perfringens*.

Clostridium perfringens: Post-cook / FDA hold

These results indicate that there was apparent germination and outgrowth of spores of *C. perfringens* in some samples during the cook process and during the combination cook / FDA hold process. As a result, *C. perfringens* counts were reduced, which will not occur if *C. perfringens* is in its heat-resistant spore state. The research studies of Willardsen et al. *(10)* and Shigahisa et al. *(7)* indicate that this is to be expected in meat when come-up time to hot holding is as long as 6 hours, as it was in this study. A temperature of 203°F (95°C) for 52 minutes, a temperature much higher than the temperatures achieved within the roasts in this study, is required for spore inactivation *(3)*. Conversely, the vegetative cells of *C. perfringens* are easily inactivated at temperatures of 130°F (54.4°C) and higher *(5)*. Some sample-to-sample variation was observed for each of these sample sets (i.e., post-cook and post-cook / FDA hold), but such variation is not unusual for this kind of study. There was no *C. perfringens* recovered (i.e., mean count of < 10 CFU/g) after the sell hold process at 130°F (54.4°C) for 28 hours. The post-sell hold results indicate that the *C. perfringens* spore outgrowth as vegetative cells during the previous process steps are significantly reduced during the sell hold process.

Clostridium perfringens: Post-chill / hold

The mean *C. perfringens* count was 1.16 log CFU/g following the designated 24-hour chill procedure and 2.21 log CFU/g following the designated cold hold procedure at 38°F (3.3°C). These

TABLE 2. ***Clostridium perfringens*** **results in beef roasts during controlled vapor oven processing**

Sample Variable		Internal *C. perfringens* counts CFU/g	Log CFU/g
Pre-cook	rep. 1	5,300	3.72
	rep. 2	5,200	3.72
	rep. 3	4,800	3.68
	Mean		**3.71**
	Std. Dev.		0.02
Post-cook	rep. 1	< 10[a]	< 1.00
[6 h to 130°F (54.4°C) CT[b]]	rep. 2	700	2.85
	rep. 3	97,000	4.99
	Mean		**2.94**
	Std. Dev.		2.00
Post-cook/FDA hold	rep. 1	2,600	3.41
[6 h to 130°F (54.4°C) CT plus 121 min	rep. 2	120,000	5.08
@ 130°F (54.4°C)]	rep. 3	160,000	5.20
	Mean		**4.57**
	Std. Dev.		1.00
Post-cook/Sell hold	rep. 1	< 10	< 1.00
[6 h to 130°F (54.4°C) CT plus 121 min	rep. 2	< 10	< 1.00
@ 130°F (54.4°C) plus 28 h @ 130°F	rep. 3	< 10	< 1.00
(54.4°C)]	**Mean**		**< 1.00**
	Std. Dev.		0.00
Post-chill	rep. 1	10	1.00
[130 to 41°F (54.4 to 5°C) in 24 h	rep. 2	< 10	< 1.00
	rep. 3	30	1.48
	Mean		**1.16**
	Std. Dev.		0.28
Post-chill/Hold	rep. 1	390	2.59
[130 to 41°F (54.4 to 5°C) in 24 h	rep. 2	160	2.20
plus 24 h hold @ 38°F (3.3°C)]	rep. 3	70	1.85
	Mean		**2.21**
	Std. Dev.		0.37
Post-retherm cook/Hold	rep. 1	980	2.99
[130 to 41°F (54.4 to 5°C) in 24 h	rep. 2	8,100	3.91
plus 24 h hold @ 38°F (3.3°C)	rep. 3	13,000	4.11
plus 10 h Retherm cook]	**Mean**		**3.67**
	Std. Dev.		0.60

[a]A "less than" (<) sign indicates that no surviving *C. perfringens* were detected in the subject sample

[b]CT = center temperature

results indicate that, while undetectable at the end of sell hold, there were some low levels of spores, and there was some outgrowth of *C. perfringens* spores during the designated chill procedure and during the designated cold hold procedure. *Clostridium perfringens* does not multiply at temperatures below 50°F (10°C) *(3)*; therefore, this apparent growth may be a result of spore outgrowth and increase in vegetative cells during slow cooling.

Clostridium perfringens: Post retherm (reheat) and hold

The mean *C. perfringens* count was 3.67 log CFU/g following the controlled vapor oven retherm process, indicating that the retherm process allowed some multiplication of *C. perfringens*.

DISCUSSION

This 6-hour cooking process of beef roasts in a controlled vapor oven meets regulatory requirements for a safe roast product. The oven relative humidity was in the range of 20 to 40% for approximately the first two hours of cooking and then increased to 82 to 91% for the remaining cooking and post-cook hold. The experiment shows that this is sufficient to assure the destruction of *Salmonella* on the surface of the meat. The meat surface had a greater than 6.5-log *Salmonella* reduction at the end of 6 hours. The center temperature of the meat was always lower than the temperature of the oven by a few degrees, and destruction of *Salmonella* in the center of the roast was not as rapid. If roasts are cooked to a center temperature of 130°F (54.4°C) there is a greater than 5 log reduction in the center of the roasts at the end of the 6 hour cook. Note that the log reduction after 121 minutes of hold was slightly lower (4.7 log), but within sampling variation. *Salmonella* is not a food safety concern in meat that is cooked in a controlled vapor oven. The oven used in this study effectively reduced *Salmonella* 5 logs and more.

When the meat was cooked, held for 28 hours, and cooled, *C. perfringens* was undetectable. However, during hot hold after cooling and holding, a small number of vegetative cells of *C. perfringens* were detected (probably due to spore germination and outgrowth during cooling). This means that the safest use of a slow-cook oven is not to remove food from the oven to cool it and then later retherm (reheat) it. The safest procedure is to maintain roasts in the oven at a temperature of 130°F (54.4°C) or slightly above until the entire roast is served. The controlled vapor oven is capable of stable operation at 130°F (54.4°C), and at this temperature, *Salmonella* and *C. perfringens* in cooked roasts will not multiply.

ACKNOWLEDGMENTS

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REFERENCES

1. Goodfellow, S. J., and W. I. Brown. 1978. Fate of *Salmonella* inoculated into beef for cooking. *J. Food Prot.* 41:598–605
2. Hsieh, P. Y., and R. Labbe. 2007. Influence of peptone source on sporulation of *Clostridium perfringens* Type A. *J. Food Prot.* 70:1730–1734.
3. International Commission of Microbiological Specifications for Foods (ICMSF). 1996. Microorganisms in Foods 5, Microbiological specifications of food pathogens. Blackie Academic & Professional, New York, NY.
4. Kang, D.- H., and D. Y. C. Fung. 1999. Thin agar layer method of recovery of heat-injured *Listeria monocytogenes*. *J. Food Prot.* 62:1346–1349.
5. Labbe, R. 1989. *Clostridium perfringens*, p. 191–235. *In* M. P. Doyle (ed.), Foodborne bacterial pathogens. Marcel Dekker, Inc., New York, NY.
6. Labbe, R.G. 2001. *Clostridium perfringens*, Chapter 34, p. 325–330. *In* F. P. Downes, and K. Ito (ed.), Compendium of methods for the microbiological examination of foods. 4th ed. American Public Health Association, Washington, D.C.
7. Shigehisa, T., T. Nakagami, and S.Taji. 1985. Influence of heating and cooling rates on spore germination of *Clostridium perfringens* in media and in roast beef. *Jpn. J. Vet. Sci.* 47:259–267.
8. US Food and Drug Administration. 2005. Food Code. Available at: http://www.cfsan.fda.gov/~dms/fc05-toc.html. Accessed 19 March 2009.
9. Willardsen, R. R., F. F. Busta, and C.E. Allen. 1977. Dialysis technique for containment of microbial populations inoculated into food systems. *Appl. Environ. Microbiol.* 34:240–241.
10. Willardsen, R. R., F. F. Busta, C. E. Allen, and L. B. Smith. 1977. Growth and survival of *Clostridium perfringens* during constantly rising temperatures. *J. Food Sci.* 43:470–475.
11. Zimmerman, O.T., and I. Lavine. 1964. Industrial research service's psychrometric tables and charts. Industrial Research Service, Inc. 2nd ed. Dover, NH.

ILSI North America Future Leader Awards

The North American branch of the International Life Sciences Institute (ILSI N.A.) is a public, non-profit scientific foundation, advancing the understanding and application of scientific issues related to the nutritional quality and safety of the food supply. ILSI N.A. strives to foster the career and development of outstanding new scientists, and is soliciting nominations of individuals to be considered to receive its 2011 Future Leader Awards.

The ILSI N.A. Future Leader Award, given to promising nutrition and food scientists, allows new investigators the opportunity to add to an existing project or to conduct exploratory research that might not receive funding from other sources. Proposed research must be in the areas of experimental nutrition, nutrition and food safety, or nutrition and food science. These 2 year grants ($15,000US per year) may not be used for overhead or to support the investigator's salary.

Nominees must: have a doctoral degree; and be within 5 years of the 1st tenure track position, or stable employment at a reputable research institute; be a resident of the U.S. or Canada. Nominees should: request 3 letters of nomination to be submitted to ILSI N.A., one by the department head and from 2 other senior faculty or former professors (letters should include specific information on the nominee's leadership qualities, area of interest, and special capabilities); send a one page letter to ILSI N.A. with complete contact information, indicating names of referees, and include a curriculum vitae.

DEADLINE FOR RECEIPT OF ALL MATERIAL IS FRIDAY, JUNE 18, 2010

For further information, contact:

Ms. Courtney Kelly; Tel: 202-659-0074 ex. 143; Email: ckelly@ilsi.org; Website: www.ilsina.org

Highlights of the Executive Board Meeting

February 7, 2010
Anaheim, California

Following is an unofficial summary of actions from the Executive Board Meeting held in Anaheim, California on February 7, 2010.

Approved the following:

- Minutes of October 22–23, 2009 Executive Board meeting
- Minutes of October 22, 2009 Executive Board Executive Session meeting
- Apply $25,000 to Berlin Symposium from the Speaker Fund
- Auditor's report for FYE August 31, 2009

Discussed the following:

- Committee recommendations from IAFP 2009
- Reviewed and revised FAQ for Committee Chairs and Vice Chairs
- PDG Webinars and other Webinar issues
- Organizational meeting for Packaging PDG
- IAFP 2010 planning update
- IAFP 2010 events
- IAFP 2010 Program
- Committee meeting schedule switched morning and afternoon times for 2010
- Parkin & Silliker Lecturers – Mike Taylor and Bob Buchanan, respectively
- IAFP 2010 sponsorship and exhibitor report
- Format for IAFP's long-range planning session, spring 2010
- International meetings' updates – Dubai, Colombia, China and Australia
- European Symposium – Dublin; program make up, poster session, early registration discount
- Future European and International Symposia locations
- Financial results from the Berlin Symposium
- Financial results from the Asia Pacific Symposium
- Guidelines for future International Symposia
- IAFP support of the Consumer Goods Forum, Washington, D.C.
- Investment results for 2008 and 2009
- Journal comparisons
- 100 year anniversary
- APHA Compendium
- Non O157 *E. coli* white paper
- WHO-NGO status
- 3-A Sanitary Standards
- IFPTI – name close to IAFP's
- Posting supplemental information from *JFP* articles to IAFP Web site
- Annual Meeting future site planning

Reports received:

- *IAFP Report*
- *Food Protection Trends*
- *Journal of Food Protection*
- IAFP Web site
- Membership update
- Financial statements
- Board Members attending Affiliate meetings
- *Affiliate View* newsletter
- Future Annual Meeting schedule
- Future Exhibiting by IAFP

Next Executive Board meeting – April 26–28, 2010.

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WHAT'S HAPPENING IN FOOD SAFETY

USDA Announces Food Safety Initiatives for School Lunch and Other Food and Nutrition Assistance Programs

Agriculture Secretary Tom Vilsack has announced several new initiatives to assure the safety and quality of food purchased by USDA for the National School Lunch Program and other food and nutrition assistance programs.

"Nothing is more important than the health and well-being of our nation's school children. We must do everything we can to ensure that our kids are being served safe, high quality foods at school. This announcement demonstrates our commitment to constantly improving the safety and quality of foods purchased by USDA," said Secretary Vilsack.

The initiatives announced are a combined effort of five USDA agencies – the Agricultural Marketing Service (AMS), the Agricultural Research Service (ARS), the Food Safety and Inspection Service (FSIS), the Farm Service Agency (FSA) and the Food and Nutrition Service (FNS).

Secretary Vilsack announced the following initiatives by these agencies:

- AMS will implement new food safety purchasing requirements for its beef suppliers as a result of a review of the beef purchase program conducted by FSIS and ARS. AMS will continue its zero tolerance for *Salmonella* and *E. coli* O157:H7 for its products and will continue to use onsite meat acceptance specialists and other control measures.
- ARS and FSIS will provide technical assistance to AMS for School Lunch and other Federal nutrition assistance programs.
- In addition to the reviews by FSIS and ARS, AMS has asked the National Academy of Sciences (NAS) to review the ground beef purchasing program. By the summer, NAS will conduct a thorough evaluation of the scientific validity of the current AMS technical requirements. This review will include benchmarking AMS vendor requirements against recognized industry leading programs that supply product directly to consumers.
- AMS will increase information sharing with other agencies in order to better monitor vendor performance and identify potential food safety issues in the process. Information on in-plant enforcement actions, positive pathogen test results, contract suspensions, recall notifications, and more will be better shared between USDA agencies.
- FSIS will work with AMS to review and evaluate meat, poultry, and processed egg vendors as part of the AMS vendor eligibility process.
- FNS will review and evaluate methods currently being used by state agencies to communicate with schools and school districts regarding product recalls. FNS will develop performance criteria for states that allows them to provide rapid communication to schools and school districts. FNS will provide financial assistance to states to allow them to upgrade the speed and accuracy of their food safety messages.
- FNS will also establish a Center of Excellence devoted to research on school food safety issues in FNS child nutrition programs. Research is needed in areas such as produce safety, proper cooling practices, evaluation of in-school food safety programs, and the containment of norovirus, which is the leading cause of foodborne illness in schools.
- FSA is evaluating and strengthening current requirements and will amend those requirements to better reflect compliance with Good Manufacturing Practices and use of a verified Hazard Analysis Critical Control Points program. FSA will ensure that commercial suppliers are able to provide a qualified level of food safety assurance for USDA programs.

These changes and continuous reviews will ensure that the food USDA distributes to school children and others meets the highest quality and safety standards.

Consumers' Use and Understanding of Nutrition Food Labels from the International Food Information Council

As the Food and Drug Administration (FDA) and others consider various food labeling formats, recent research by the International Food Information

Council Foundation (Foundation) provides valuable insight into how consumers perceive and use the Nutrition Facts panel (NFP) found on food and beverage labels.

Based on the overall findings from its three-phase research project, the Foundation learned that consumers generally have a positive perception of the food label, but also found that there are several ways the label potentially could be enhanced to help people understand the information provided and use it even more effectively:

- Mentioning a government body, like the FDA, in a highly used area of the NFP, such as a header in the main body of the NFP, increases consumer trust in the information provided, particularly serving size;
- Moving the location of calories into the main body of the NFP appears to encourage greater use of this information;
- Adding the percent Daily Value (%DV) of calories helps consumers consider a product's calorie contribution within the context of their daily diet; and
- Moving the information in the current footnote into an easily referenced column in the main body of the NFP greatly increases consumers' ability to evaluate a product.

"We believe that addressing consumers' need for usable information on the Nutrition Facts panel will accelerate efforts to improve the diet and health of Americans," said International Food Information Council Foundation President and CEO David B. Schmidt.

With the FDA looking into NFP changes and studying how these changes may affect consumers' understanding of the information provided on the label, the Foundation has shared this research to assist the Agency with its work. The Foundation's research highlights the critical need for conducting additional consumer research to determine if the benefits of certain enhancements to the NFP outweigh any confusion they may generate. Also, any changes must be accompanied by appropriate consumer education to ensure that people know how to use the information provided.

Key findings from the three Foundation research studies, including visuals of the consumer-suggested label enhancements tested: (1) *Food Label Consumer Research: Qualitative Phases Summary Report* (2008), (2) *Food Label Consumer Research Project: Quantitative Phase III Summary Report* (2009), and (3) *Food & Health Survey* (2009), are available at www.foodinsight.org.

For the full research reports and any other questions, please contact the Foundation media team at 202.296.6540, Mittenthal@ific.org or Matthews@ific.org.

USDA Announces New Framework for Animal Disease Traceability

Agriculture Secretary Vilsack has announced that the USDA will develop a new, flexible framework for animal disease traceability in the United States, and undertake several other actions to further strengthen its disease prevention and response capabilities.

"After concluding our listening tour on the National Animal Identification System in 15 cities across the country, receiving thousands of comments from the public and input from States, Tribal Nations, industry groups, and representatives for small and organic farmers, it is apparent that a new strategy for animal disease traceability is needed," said Agriculture Secretary Tom Vilsack. "I've decided to revise the prior policy and offer a new approach to animal disease traceability with changes that respond directly to the feedback we heard."

The framework, announced at the National Association of State Department of Agriculture's (NASDA) Mid-Year meeting, provides the basic tenets of an improved animal disease traceability capability in the United States. USDA's efforts will:

- Only apply to animals moved in interstate commerce;
- Be administered by the States and Tribal Nations to provide more flexibility;
- Encourage the use of lower-cost technology; and
- Be implemented transparently through federal regulations and the full rulemaking process.

"One of my main goals for this new approach is to build a collaborative process for shaping and implementing our framework for animal disease traceability," said Sec. Vilsack. "We are committed to working in partnership with States, Tribal Nations and industry in the coming months to address many of the details of this framework, and giving ample opportunity for farmers and ranchers and the public to provide us with continued input through this process."

One of USDA's first steps will be to convene a forum with animal health leaders for the States and Tribal Nations to initiate a dialogue about the possible ways of achieving the flexible, coordinated approach to animal disease traceability we envision. Additionally, USDA will be revamping the Secretary's Advisory Committee on Animal Health to address specific issues, such as confidentiality and liability.

Although USDA has a robust system in place to protect US agriculture, with the announcement, the Department will also be taking several additional actions to further strengthen protections against the entry and spread of disease. These steps will include accelerating actions to lessen the risk from diseases–such as tuberculosis–posed by imported animals, initiating and updating analyses on how animal diseases travel into the country, improving response capabilities, and focusing on greater collaboration and analyses with States and industry on potential disease risk overall.

More information on USDA's new direction on animal traceability and the steps to improve disease prevention and control is available at http://www.aphis.usda.gov/traceability.

AFS Technologies, Inc. Promotes Lance Anderson to Vice President, National Sales

AFS Technologies, Inc. is pleased to announce the appointment of Lance Anderson to the position of vice president, national sales with a focus on the food manufacturing segment. Mr. Anderson has over fifteen years experience in the food industry, with the last six years at IRM Corporation and AFS. During his tenure, Lance has worked with many of the largest food manufacturers in the areas of trade promotions management, business intelligence, and analytics. His extensive knowledge and background in the food and beverage industry has been instrumental in AFS Technologies' rapid growth in the food manufacturing segment.

"Lance has been a key member of the AFS team and this new position reflects not only the value of his past contributions, but more importantly the expanded role he will play as AFS increases its presence in food manufacturing," said Kurien Jacob, AFS Technologies' CEO.

FMI Congratulates James V. Olsen on Appointment as President of Food Industry Association Executives

The Food Marketing Institute (FMI) issued the following statement from Leslie G. Sarasin, president and chief executive officer, on the announcement of the appointment of James V. Olsen to the position of president of the Food Industry Association Executives (FIAE).

"On behalf of all of the members of FMI, it is my pleasure to salute Jim Olsen as the new leader of FIAE. His formidable experience includes 36 years of association management, including his work as president and CEO of the Utah Retail Grocers Association and president and CEO of the Utah Merchants Association. We have worked closely with him to address industry issues and concerns on local, state and national levels, and he served two terms on FMI's Government Relations Committee. In fact, under his guidance, FMI fostered strong relationships with all of the Members of Congress from Utah."

"His stellar leadership skills and industry acumen are why FMI recognized Jim with the prestigious Donald H. MacManus Award in 1997. Our long-standing and mutually supportive work with FIAE and Jim will certainly continue to flourish, and we look forward to continuing to work with Jim in his new role."

In Memory

Dr. Edward C. Mather
Okemos, Michigan

We extend our deepest sympathy to the family of Ed Mather who passed away on January 27, 2010. IAFP will always have sincere gratitude for his contribution to the Association and the profession.

Dr. Mather was awarded the Stange Memorial Award from Iowa State University, where he earned his DVM degree. He received a Ph.D. in Physiology from the University of Missouri. He was the originator and former director of the Online Master of Science Program in Food Safety at Michigan State University until he retired in September 2008.

Dr. Mather had been an IAFP Member since 2002 and received the IAFP Food Safety Innovation Award in 2006.

INDUSTRY PRODUCTS

Synbiosis

New ProtoCOL 2 UV Imaging Accessory from Synbiosis

Synbiosis, a manufacturer of automated microbiological systems, is delighted to introduce ProcUV, its new UV imaging accessory for the ProtoCOL 2 system. ProcUV permits instant imaging of fluorescent colonies and plaques so they can be automatically counted or analyzed by ProtoCOL 2, thus saving time and improving accuracy of results.

Based on advanced fluorescent imaging technology, the compact ProcUV accessory, which can be simply connected to the ProtoCOL 2 system, consists of a cabinet with a sliding, auto-locking door to prevent accidental UV exposure. The cabinet contains a high resolution camera and internal UV and white lighting and is also equipped with specialized interchangeable filters, to allow microbiologists to view fluorescing bacteria, such as *Pseudomonas fluorescens*, fluorescent plaques and bacteria expressing Green Fluorescent Proteins.

ProcUV is simple to set up as its automatic exposure time settings ensure users can capture colony images at the touch of a button. The high-quality images can then be directly transferred into the ProtoCOL 2 in seconds, where the ProtoCOL 2 counts and analyzes results automatically, to save microbiologists countless hours of repetitive work.

Martin Smith of Synbiosis stated, "Fluorescent colonies and plaques are the most difficult ones to count, as they require specific UV lighting conditions to be able to see them. This means that a powerful imaging system equipped with specialized filters to enable the camera to image each fluorescing colony is required."

Martin Smith added, "We have risen to this challenge and by utilizing the decades of imaging expertise we have in-house, we have come up with the perfect cost-effective solution in the ProcUV. For any microbiology laboratory wanting to extend the capability of their ProtoCOL 2 system to perform different types of fluorescent colony and plaque analyses, the ProcUV is ideal."

Synbiosis
+44.0.1462.635327
Hertfordshire, United Kingdom
www.synbiosis.com

Optimal Quality Assurance for Balances and Scales from Mettler Toledo

Mettler Toledo is pleased to announce the launch of GWP® Risk Check for balances and scales. Risk Check is an interactive online assessment tool that provides both qualitative and quantitative analysis of balance performance and weighing environment. In a matter of minutes, Risk Check provides advice on optimizing quality assurance. Quality Managers gain insight on improving weighing processes to save time and money, and to reduce waste.

"Risk Check interacts with every type of balance, independent of model, type, or manufacturer," explains Martin Huber, Ph.D., marketing manager for laboratory balances at Mettler Toledo. "It offers orientation in the mass of regulation guidelines."

Risk Check helps quality managers assess the appropriateness of their weighing environment, and balance testing frequency. Then, by plugging in real-world data, quality managers discover if their "weighing risk"–the possibility that poor weighing accuracy or the environment are skewing measurements–is low, or if they need to make changes to help ensure safe, accurate and consistent results.

Finally, Risk Check provides expert advice on which adjustments will optimize balance performance and reduce the risk of inaccurate measurements. This can be critical in industries where external auditors test a company's quality system according to set standards. "It serves as a sort of 'mock audit'–a rehearsal for the actual audit," explains Huber.

Risk Check analyzes weighing risks based on the international weighing guideline Good Weighing Practice™, or GWP®. The guideline is appropriate for use by quality, laboratory and manufacturing managers in the pharmaceutical, chemical and food and beverage industries, or in any industry that relies on accurate

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

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materials weighing to produce uniform results.

In order to determine the level of weighing risk in a current working environment and discover how to obtain more consistent, precise results for better quality assurance, visit www.good-weighing-practice.com and select "Risk Check."

Mettler Toledo
800.786.0038
Columbus, OH
www.mt.com

Dickson Publishes Print and/or Video Support Guides for Chart Recorders and Data Loggers on Web

Dickson announces web publication of online support guides—both in downloadable PDF formats and as videos on YouTube and the Dickson web site (to help its many thousands of worldwide customers to easily monitor temperature, humidity, pressure and other electronic signal "events" important to critical storage.

These video or print support guides can be accessed via the "SUPPORT" tab on each product page at www.dicksondata.com.

These support guides cover information such as:

- Product applications and useful features
- Product specifications
- Getting started
- DicksonWare software specifications
- Product accessories
- Frequently asked questions
- Calibrations
- Troubleshooting
- Warranty/factory service and returns

Dickson (which offers a wide selection of data loggers and chart recorders to monitor temperature, humidity, pressure, or electronic signals) created this service to help organizations with needs to capture critical data get up and running with the least delay throughout the lifetime of the Dickson product.

Dickson
800.323.2448
Addison, IL
www.dicksondata.com

Onset Announces Enhancements to Web-based Monitoring Systems

Onset, a supplier of data loggers, has announced a number of new enhancements to the company's HOBO® U30 web-based energy and environmental monitoring systems.

Expanded cellular network coverage – Using a new, low-cost global cellular network plan through Wyless, HOBO U30/GSM system customers can now use their monitoring systems in over 30 international countries. This flexible data network provides the added advantage of being able to deploy and remotely access U30 systems in any AT&T or T-Mobile coverage area within the United States.

Customizable display – Customers can now easily configure data display settings within HOBOlink® – Onset's web-enabled software platform for HOBO U30 systems. For example, users can now create a single screen that displays key measurement data and trends for HOBO U30 systems deployed in multiple locations.

Eco-friendly weatherproof enclosure – The HOBO U30 system's weatherproof, NEMA-rated enclosure is now constructed of materials derived from 85 percent post-consumer plastic waste. This boosts the company's efforts to help preserve the environment, while providing customers with a rugged, attractive enclosure designed to withstand harsh conditions.

"These enhancements will provide a number of exciting benefits for HOBO U30 customers in both the environmental research and energy management market segments," said Paul Gannett, product marketing manager for Onset. "Researchers conducting ecology and climate change studies, for example, will benefit from being able to buy U30 systems here in the US and deploy them in other countries. Energy consultants performing building energy performance contracts will appreciate the ability to create more customized displays of real-time energy use data and, of course, the new environmentally-responsible case design."

Onset HOBO U30 systems combine plug-and-play convenience with research-grade performance. Ideal for a range of applications, from agricultural research to energy management, HOBO U30 systems offer users a choice of GSM cellular, Wi-Fi, Ethernet, and USB-based communications options, and plug-and-play sensors for a broad range of energy and environmental measurements.

Onset Computer Corporation
800.564.4377
Bourne, MA
www.onsetcomp.com

KD Scientific

The Next Generation in Syringe Pumps from KD Scientific

The new Legato 200 Series from KD Scientific is the next generation of syringe pumps.

The Legato 200 Series offers unparalleled ease of use through the high resolution color touch screen user interface. The full touch screen interface enable the user to quickly create configurations and recall them for easy use. The intuitive run screen combines multiple parameters simultaneously with internationally recognized graphic icons which allow the Legato 200 Series to provide a new level of intuitive syringe pump operation.

Three basic models ensure the right pump for your application. Infuse only, Infuse and Withdraw and Push Pull.

Each of these pumps is available in a programmable version for maximum flexibility and capability.

Each of the basic models work with one syringe or two and can be reconfigured in the field to use with multiple syringes.

The Legato Series optimizes laboratory bench space. For limited laboratory space the Legato 200 Series can be placed on its side to reduce the footprint by 4 times. The footprint is only 3.5 in × 9.75 in. The display also tilts with the change to allow the user to operate the pump vertically.

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

KD Scientific
508.429.6809
Holliston, MA
www.kdscientific.com

Thermo Fisher Scientific Ships 2000th iCAP 6000 Series ICP Emission Spectrometer

Thermo Fisher Scientific Inc. has announced that Bormioli Rocco, a producer of glass and plastic pharmaceutical packaging, glass containers for perfumery and foodstuffs and glass tableware, has purchased and deployed the 2000th Thermo Scientific iCAP 6000 Series inductively coupled plasma (ICP) emission spectrometer. The company relies on ICP emission spectrometry to ensure that alkaline metal concentrations in their glass materials conform to current European legislation. Since deployment, Bormioli Rocco has increased lab productivity while lowering its costs.

Bormioli Rocco selected the Thermo Scientific iCAP 6300 Duo ICP for its flexibility and exceptional performance capabilities, which ensure accurate, precise analytical results and higher productivity. Also important was the small footprint of the system, which makes it easier to transport and install, an important benefit for modern labs where bench space is increasingly limited.

Gareth Jones, product group director, Trace Elemental Analysis, Thermo Fisher Scientific, comments: "Our iCAP 6000 Series delivers outstanding performance, ease-of-use and low cost-of-ownership, all in a uniquely compact instrument. These benefits are possible because of the expertise, hard work and commitment that goes into producing such a superior analytical solution. Achieving the 2000th-order milestone clearly demonstrates that customers value the instrument's quality and reliability."

The iCAP 6300 Duo ICP spectrometer features dedicated radial and duo plasma viewing options for enhanced application flexibility. The instrument's high-efficiency optical design facilitates simultaneous analysis of 66 elements, providing detection limits at less than 1ppb. In addition, the system offers powerful full-frame technology for fingerprinting and retrospective analysis, as well as unique EMT torch technology for routine maintenance operations without switching off the plasma.

Laboratories use the iCAP 6000 Series ICP emission spectrometers to detect and measure low levels of toxic elements and a diverse range of pollutant elements in the global environmental, metallurgical, petrochemical, food and pharmaceutical industries. In spring 2009, the iCAP 6000 received a Queens Award for Enterprise as one of the year's most outstanding technical innovations and it was a finalist in the IMechE Business Innovation of the Year Category of the National Business Awards.

Thermo Scientific Inc.
+ 44.1477.539.539
Cambridge, UK
www.thermofisher.com

IAFP 2010 ANAHEIM, CA
AUGUST 1-4, 2010 ANNUAL MEETING

IAFP 2010 Preliminary Program

SUNDAY, AUGUST 1

Opening Session – 6:00 p.m.

Ivan Parkin Lecture – Michael R. Taylor, Deputy Commissioner for Foods, U.S. Food and Drug Administration, Washington, D.C.

MONDAY, AUGUST 2

Poster Session

- Antimicrobials
- Seafood
- Risk Assessment
- Novel Laboratory Methods
- Beverages and Water
- Sanitation
- Epidemiology
- Communication Outreach and Education
- Dairy and Other Food Commodities

Morning

Symposia

- Data Deluge, Interacting Players, and Complex Networks in Food Science
- Global Water Storages: Their Impact on Water Safety and Quality
- Microbiological Environmental Testing and Validation: Leading Edge Issues for Low-moisture Foods
- Human Pathogens Associated with Edible Plants
- Government, Academic, and Industry Collaborations to Advance the Development and Use of Microbiological Risk Assessments
- Converging Industry Initiatives on Traceability
- Ripple of Tsunami? Riding the Regulatory Wave to Safer Bottled Water and Water Beverages

Roundtable

- Research Needs a Roundtable: Retail and Foodservice Food Safety

Technical Session

- Applied Laboratory and Novel Laboratory Methods

Afternoon

Symposia

- Buy Local? Addressing the Safety Issues Behind Green Food Trends
- Less Recognized and Presumptive Pathogens: What Now, What Next?
- What's Been Keeping You Up at Night? – Selected Unanswered Food Safety Questions
- 'Ingredient' is a Ten-letter Word for Financial Disaster
- Good Agricultural Practices and the Small Scale Producer: What's Really Going on Out There?
- Flour Food Safety: The Changing Landscape – *E. coli* O157:H7

Technical Sessions

- Pathogens, Sanitation and Seafood
- Antimicrobials and Microbial Food Spoilage

TUESDAY, AUGUST 3

Poster Session

- Applied Laboratory Methods
- Microbial Food Spoilage
- Non-microbial Food Safety
- General Microbiology
- Pathogens
- Food Toxicology

Morning

Symposia

- Risk-based Design of Thermally Processed Foods – A Look into the Future
- European Concept on Hygiene Monitoring in the Food Supply Chain – 'Farm-to-Fork' Concept in Practice
- National Institute of Food and Agriculture Showcase
- The *Salmonella* Smorgasbord: The Problem with Too Many Choices
- Food Packaging Technology: Opportunities and Challenges That Enhance Food Safety
- Non-O157:H7 *E. coli*: An Increasing International Concern
- Global Product Safety Harmonization: Exploring the Comparative Differences of International Policies

Technical Sessions

- Produce
- Meat and Poultry

Afternoon

Symposia

- Surveillance for Foodborne Disease: Challenging Phases
- Way before the Fork: Impact of Pre-harvest Management Programs and Supply Chain Influences on the Control of Shiga Toxin-producing *E. coli* Contamination in Beef
- Food and Food Environment Test Considerations in View of Changing Regulations
- Human Noroviruses: Attribution, Transmission, and Control
- Advances in Detection Technologies to Address Food Safety and Food Defense Needs

Technical Sessions

- Produce and Communication Outreach and Education
- Risk Assessment and Epidemiology

WEDNESDAY, AUGUST 4

Poster Session

- Produce
- Meat and Poultry

Morning

Symposia

- Global Issues and Impact of Gluten Allergy and Celiac Disease
- Foodborne Disease Outbreak Update
- Food Safety in Developing Countries
- Setting the Science-based Agenda for Co-management of Watershed Quality and Produce Safety
- A Practical Approach to Risk Communication: Engaging Stakeholders and the Public
- Maintaining Consumer and Market Continuity during Animal Disease Outbreaks

Afternoon

Symposia

- Bacterial Toxins: A Past or an Emerging Issue for Food and Beverage Safety?
- WHO's Epidemiological Approach to Estimating Foodborne Diseases – WHO FERG
- Tools for Predictive Microbiology and Microbial Risk Assessment
- Issues in Production and Manufacture of Nuts and Nut-containing Products: Nuts to You
- Risk Benefit Analysis of Food Production and Consumption
- New Definitions in Imported Seafood Safety

4:00 p.m. — 4:45 p.m.

John H. Silliker Lecture – Robert L. Buchanan, Ph.D., Director and Professor, Center for Food Safety and Security Systems, University of Maryland, College Park, MD

Ivan Parkin Lecture

MICHAEL R. TAYLOR

Deputy Commissioner for Foods
U.S. Food and Drug Administration
Washington, D.C.

At the Opening Session
Sunday, August 1
6:00 p.m. - 7:30 p.m.

Mr. Michael R. Taylor was named Deputy Commissioner for Foods at the U.S. Food and Drug Administration (FDA) in January 2010. He is the first individual to hold the position, which was created along with a new Office of Foods in August 2009. Mr. Taylor is leading FDA efforts to develop and carry out a prevention-based strategy for food safety; plan for new food safety legislation; and ensure that food labels contain clear and accurate information on nutrition.

Mr. Taylor joined the FDA in July 2009, as Senior Advisor to the Commissioner of Food and Drugs, with responsibility for overseeing the planning and implementation of food safety reform at FDA.

From June 2000 until joining FDA, Mr. Taylor worked in academic and research settings as a research professor at The George Washington University School of Public Health and Health Services, a professor at the University of Maryland's School of Medicine, and a senior fellow at Resources for the Future.

Mr. Taylor has served in government as Administrator of USDA's Food Safety and Inspection Service (1994–1996), Deputy Commissioner for Policy at the Food and Drug Administration (1991–1994), and FDA Staff Lawyer and Executive Assistant to the FDA Commissioner (1976–1981).

In the private sector, he established and led the food and drug law practice at King & Spalding (1981–1991 and November 1996–September 1998) and was Vice President for Public Policy at Monsanto Company (October 1998–January 2000).

Mr. Taylor has served on several National Academy of Sciences committees studying food-related issues. Until joining the FDA, he was a senior fellow with The Partnership to Cut Hunger and Poverty in Africa and a board member of Resolve, Inc. and the Alliance to End Hunger.

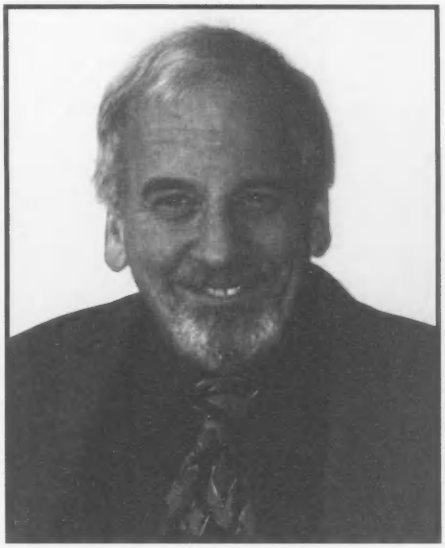
Mr. Taylor received his law degree from the University of Virginia and his B.A. in Political Science from Davidson College.

John H. Silliker Lecture

ROBERT L. BUCHANAN, PH.D.

Director and Professor, Center for Food Safety and Security Systems
College of Agriculture and Natural Resources
University of Maryland
College Park, Maryland

Wednesday, August 4
4:00 p.m. - 4:45 p.m.



Dr. Robert L. Buchanan received his B.S., M.S. M. Phil, and Ph.D. degrees in Food Science from Rutgers University, and post-doctoral training in Mycotoxicology at the University of Georgia. Since then, he has had over 30 years of experience teaching and conducting research in food safety, first in academia, then with the USDA Agricultural Research Service and the Food and Drug Administration.

Dr. Buchanan recently joined the faculty of the University of Maryland as Professor and Director of the new Center for Food Safety and Security Systems. His scientific interests are diverse and include extensive experience in predictive microbiology, quantitative microbial risk assessment, microbial physiology, mycotoxicology, and food safety systems. He has published over 400 manuscripts, book chapters, and abstracts on a wide range of subjects related to food safety, and has given hundreds of invited lectures on five continents. Additionally, he is one of the co-developers of the widely used USDA Pathogen Modeling Program, and served on the boards of editors of several journals.

Dr. Buchanan holds an ongoing interest in the development of science-based public health policy. He served as the FDA Center for Food Safety and Applied Nutrition's Senior Science Advisor, as the Director of the CFSAN Office of Science, the FDA Lead Scientist for the U.S. Food Safety Initiative, and as Deputy Administrator for Science with the USDA Food Safety and Inspection Service.

Dr. Buchanan served on numerous national and international advisory bodies, including as the U.S. Delegate to the Codex Alimentarius Commission Committee on Food Hygiene and a permanent member of the International Commission on Microbiological Specification for Foods. Dr. Buchanan also served as a member of the National Academy of Science's Institute of Medicine Committee on Emerging Microbial Threats, the National Advisory Committee on Microbiological Criteria for Foods, and numerous international expert consultations for the FAO and WHO. Dr. Buchanan received numerous national and international honors and is a Fellow of both the American Academy for Microbiology and the Institute of Food Technologists.

IAFP 2010 Activities

IAFP 2010 | ANAHEIM, CA
AUGUST 1-4, 2010 ANNUAL MEETING

SATURDAY, JULY 31

COMMITTEE MEETINGS
3:00 p.m. - 4:30 p.m.

WELCOME RECEPTION
5:00 p.m. - 6:30 p.m.
Sponsored by Eurofins Scientific

SUNDAY, AUGUST 1

COMMITTEE MEETINGS
7:00 a.m. - 5:30 p.m.

STUDENT LUNCHEON (ticket required)
12:00 p.m. - 1:30 p.m.

EDITORIAL BOARD RECEPTION (by invitation)
4:30 p.m. - 5:30 p.m.

OPENING SESSION AND IVAN PARKIN LECTURE
6:00 p.m. - 7:30 p.m.

CHEESE AND WINE RECEPTION
7:30 p.m. - 9:30 p.m.
Sponsored by Kraft Foods

IAFP JOB FAIR
Sunday, August 1 through Wednesday, August 4

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

MONDAY, AUGUST 2

COMMITTEE AND PDG CHAIRPERSON BREAKFAST (by invitation)
7:00 a.m. - 9:00 a.m.

EXHIBIT HALL LUNCH
12:00 p.m. - 1:00 p.m.
Sponsored by Johnson Diversey

EXHIBIT HALL RECEPTION
5:00 p.m. - 6:00 p.m.
Sponsored by DuPont Qualicon

TUESDAY, AUGUST 3

EXHIBIT HALL LUNCH
12:00 p.m. - 1:00 p.m.
Sponsored by DNV

BUSINESS MEETING
12:15 p.m. - 1:00 p.m.

EXHIBIT HALL RECEPTION
5:00 p.m. - 6:00 p.m.
Sponsored by 3M Food Safety

PRESIDENT'S RECEPTION (by invitation)
6:00 p.m. - 7:00 p.m.

WEDNESDAY, AUGUST 4

JOHN H. SILLIKER LECTURE
4:00 p.m. - 4:45 p.m.

AWARDS RECEPTION AND BANQUET
6:00 p.m. - 9:30 p.m.

TOURS

IAFP has partnered with Southern California Gray Line to offer daily sightseeing tours to all major Southern California attractions. Specialty tours include LA/Hollywood and San Diego/Tijuana city tours, OC beaches, shopping excursions, movie stars' homes and Catalina Island. Book your tours now at www.graylineanaheim.com with your special IAFP discount coupon available under 'Special Promotions.' Or visit the IAFP Registration Desk once you arrive in Anaheim to arrange your tours.

IAFP
2010 | ANAHEIM, CA
AUGUST 1-4, 2010 ANNUAL MEETING

IAFP 2010 General Information

REGISTER ONLINE

Register online at www.foodprotection.org.

REGISTRATION

Register to attend the world's leading food safety conference. Full Registration includes:

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

GUEST REGISTRATION

Guest registration includes:

- Welcome Reception
- Ivan Parkin Lecture
- Cheese and Wine Reception
- Exhibit Hall Admittance
- Exhibit Hall Lunch (Mon. & Tues.)
- Exhibit Hall Reception (Mon. & Tues.)

Please note that Guest registration applies to those individuals who are not employed in the food safety arena.

PRESENTATION HOURS

Sunday, Aug. 1

Opening Session	6:00 p.m. – 7:30 p.m.

Monday, Aug. 2

Symposia & Technical Sessions	8:30 a.m. – 5:00 p.m.

Tuesday, Aug. 3

Symposia & Technical Sessions	8:30 a.m. – 5:00 p.m.

Wednesday, Aug. 4

Symposia & Technical Sessions	8:30 a.m. – 3:30 p.m.
Closing Session	4:00 p.m. – 4:45 p.m.

FOUNDATION GOLF TOURNAMENT

Saturday, July 31

Golf Tournament

To be determined

EVENING EVENTS

Sunday, Aug. 1

Opening Session	6:00 p.m. – 7:30 p.m.
Cheese and Wine Reception *Sponsored by Kraft Foods*	7:30 p.m. – 9:30 p.m.

Monday, Aug. 2

Exhibit Hall Reception *Sponsored by DuPont Qualicon*	5:00 p.m. – 6:00 p.m.

Tuesday, Aug. 3

Exhibit Hall Reception *Sponsored by 3M Food Safety*	5:00 p.m. – 6:00 p.m.

Wednesday, Aug. 4

Awards Banquet Reception	6:00 p.m. – 7:00 p.m.
Awards Banquet	7:00 p.m.– 9:30 p.m.

SPECIAL EVENTS

NFPA Alumni and Friends Reception

To be determined

EXHIBIT HOURS

Sunday, Aug. 1	7:30 p.m. – 9:30 p.m.
Monday, Aug. 2	10:00 a.m. – 6:00 p.m.
Tuesday, Aug. 3	10:00 a.m. – 6:00 p.m.

HOTEL INFORMATION

Hotel reservations can be made online at www.foodprotection.org. The IAFP Annual Meeting Sessions, Exhibits and Events will take place at the Anaheim Convention Center.

Hilton Anaheim $149.00 per night

CANCELLATION POLICY

Registration fees, less a $50 administration fee and any applicable bank charges, will be refunded for written cancellations received by July 16, 2010. No refunds will be made after July 16, 2010 however, the registration may be transferred to a colleague with written notification. Refunds will be processed after August 9, 2010.

Event and extra tickets purchased are nonrefundable.

International Association for Food Protection
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Web site: www.foodprotection.org

COMING EVENTS

MAY

- **4–6, Florida Association for Food Protection Annual Educational Conference,** Sunny Isles Beach, FL. For more information, contact Zeb Blanton at 407.618.4893 or go to www.fafp.net.
- **4–6, Fundamentals of Food Science Short Course,** University Park, PA. For more information, go to www.agsci.psu.edu/fundamentals.
- **5, Carolinas Association for Food Protection Annual Meeting,** North Carolina Research Campus, Kannapolis, NC. For more information, contact Steve Tracey at smtracey@foodlion.com.
- **5, Metropolitan Association for Food Protection Spring Seminar,** Douglass Student Center, Rutgers University, New Brunswick, NJ. For more information, contact Carol Schwar at cschwar@co.warren.nj.us or go to www.metrofoodprotection.org.
- **5–8, ISOPOL XVII International Symposium on Problems of Listeriosis,** Alfandega Congress Centre, Porto, Portugal. For more information, go to www.esb.ucp.pt/isopol2010.
- **6, Metropolitan Association for Food Protection Spring Seminar,** Rutgers University, Cook College Campus, New Brunswick, NJ. For more information, contact Carol Schwar at 908.475.7960; E-mail: cschwar@co.warren.nj.us.
- **6–7, Associated Illinois Milk, Food and Environmental Sanitarians Spring Conference,** Eastland Suites, Bloomington, IL. For more information, contact Steve DiVencenzo at Steve.DiVencenzo@illinois.gov.
- **6–8, High-throughput Methods for Detecting Foodborne Pathogens Workshop,** York College, Jamaica, NY. For more information, go to www.york.cuny.edu/conted/fdaworkshops/2008-fda-workshop/preliminary-program.
- **11–13, FMI 2010,** Mandalay Bay Convention Center, Las Vegas, NV. For more information, go to www.fmi.org/events.
- **12–13, Pennsylvania Association of Milk, Food and Environmental Sanitarians Annual Conference,** Nittany Lion Inn, State College, PA. For more information, contact Gene Frey at erfrey@landolakes.com.
- **17–21, 3-A 2010 Education Program and Annual Meeting,** Wyndham Milwaukee Airport Hotel and Convention Center, Milwaukee, WI. For more information, go to www.3-a.org.
- **18–19, The 4th Annual Congress on Food Safety & Quality 2010,** Shanghai, China. For more information, contact Fanny Wang at +8621.51720126 or go to http://www.foodsafetycongress.com/.
- **18–20, Food Microbiology Short Course,** University Park, PA. For more information, go to http://agsci.psu.edu.
- **23–27, 110th General Meeting of the American Society for Microbiology,** San Diego Convention Center, San Diego, CA. For more information, go to www.gm.asm.org.

JUNE

- **6–9, NEHA Annual Educational Conference,** Albuquerque, New Mexico. For more information, go to http://www.neha.org.
- **8–10, 2nd International MoniQA Conference,** Krakow, Poland. For more information, go to http://krakow.moniqa.org.
- **8–11, 2nd International Symposium on Gluten-free Cereal Products and Beverages,** Tampere, Finland. For more information, go to http://www.helsinki.fi/gf10.
- **9–11, IAFP's Sixth European Symposium on Food Safety,** University College Dublin, Dublin, Ireland. For more information, go to www.foodprotection.org.
- **11–18, Rapid Methods and Automation in Microbiology Workshop,** Kansas State University, Manhattan, KS. For more information, go to http://www.dce.k-state.edu/conf/rapidmethods.
- **14–15, Brazil Association for Food Protection Annual Meeting,** Conselho Regional de Quimica, São Paulo, SP, Brazil. For more information, E-mail Maria Teresa Destro at mtdestro@usp.br or go to www.abrappa.org.br.
- **18–20, Food Processing Suppliers Association Annual Conference,** Chicago, IL. For more information, call 703.761.2600 or go to www.fpsa.org.
- **19–23, AFDO 114th Annual Educational Conference,** Sheraton Waterside Hotel, Norfolk, VA. For more information, contact Leigh Ann Stambaugh at 717.757.2888 or go to www.afdo.org.
- **28–July 2, The Molecular Methods in Food Microbiology Symposium and Workshop,** Fort Collins, CO. For more information, contact Kendra Nightingale at Kendra.Nightingale@ColoState.edu.

JULY

- **5–8, Society for Applied Microbiology's Summer Conference,** Brighton, UK. For more information, call +44 (0)1234 761752 or go to www.sfam.org.uk.
- **14–16, NACCHO Annual Meeting,** Marriott Memphis Downtown, Memphis Cook Convention Center, Memphis, TN. For more information, go to www.naccho.org.

COMING EVENTS

- **17–21, IFT 2010 Annual Meeting and Food Expo,** McCormick Place, Chicago, IL. For more information, go to www.am-fe.ift.org/cms/.
- **18–20, FPSA Process Expo – 2010,** McCormick Place, Chicago, IL. For more information, call 703.761.2600 or go www. fpsa.org.
- **30–31, IAFP Workshops,** Anaheim Convention Center, Anaheim, CA. For more information, go to www.foodprotection.org.

AUGUST

- **1–4, IAFP 2010 Annual Meeting,** Anaheim Convention Center, Anaheim, CA. For more information, go to www. foodprotection.org.
- **18–19, 5th Innovative Foods Conference: Higher Valued Foods (FIESTA 2010),** Melbourne, Australia. For more information, go to www.innovativefoods2010.com.
- **25–26, 2010 BioPro Expo,** Cobb Galleria Centre, Atlanta, GA. For more information call 800.332.8686 or go to www.tappi.org.
- **30–Sept. 3, FoodMicro 2010,** Copenhagen, Denmark. For more information, go to www.foodmicro.dk/.

SEPTEMBER

- **15–17, China International Food Safety and Quality Conference & Expo,** Beijing, P.R.C. For more information, go to www.chinafood-safety.com.
- **21–23, New York State Association for Food Protection 87th Annual Meeting,** Syracuse, NY. For more information, contact Janene Lucia at 607.255.2892; E-mail: jgg@cornell.edu.
- **21–24, IAFP's Latin American Symposium of Food Safety,** Bogota, Colombia. For more information, go to www.acta.org.co/Congreso2010.php.
- **22–23, Wisconsin Association for Food Protection Joint Education Conference,** Holiday Inn, Eau Claire, WI. For more information, go to www.wafp-wi.org.
- **22–24, Kansas Environmental Health Association Fall Conference,** Great Wolf Lodge, Kansas City, KS. For more information, go to www.e-keha.org.
- **22–24, Washington Association for Food Protection Annual Conference,** Campbell's Resort, Lake Chelan, WA. Contact Stephanie Olmsted at 206.660.4594 or go to www.waffp.org.
- **28–29, Arkansas Association for Food Protection Annual Meeting,** Tyson Foods, Springdale, AR. For more information, contact Mike Sostrin at 479.277.8641 or go to http://arkafp.org.

OCTOBER

- **5–6, Iowa Association for Food Protection Annual Conference,** Quality Inn & Suites, Ames, IA. For more information, contact Lynne Melchert at 563.599.2394 or E-mail lynne.melchert@swissvalley.com.
- **13–14, Metropolitan Association for Food Protection Fall Seminar,** Douglass Student Center, Rutgers University, New Brunswick, NJ. For more information, contact Carol Schwar at cschwar@co.warren.nj.us or go to www.metrofoodprotection.org.
- **26–28, North Dakota Environmental Health Association Annual Conference,** Bismarck, ND. For more information, go to www.ndeha.org.

IAFP UPCOMING MEETINGS

AUGUST 1-4, 2010
Anaheim, California

JULY 31-AUGUST 1, 2011
Milwaukee, Wisconsin

JULY 22-25, 2012
Providence, Rhode Island

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In Memory

Lindsay E. Pearce
Palmerston, New Zealand

We extend our deepest sympathy to the family of Lindsay Pearce, who recently passed away. Dr. Pearce had been an IAFP Member since 2004 and served on the Microbial Risk Analysis and Dairy Quality and Safety Professional Development Groups.

Dr. Pearce made outstanding contributions to international dairy science and his scientific influence and expertise will be greatly missed.

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