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FOOD PROTECTION TRENDS

SCIENCE AND NEWS FROM THE INTERNATIONAL ASSOCIATION FOR FOOD PROTECTION

MARCH 2006

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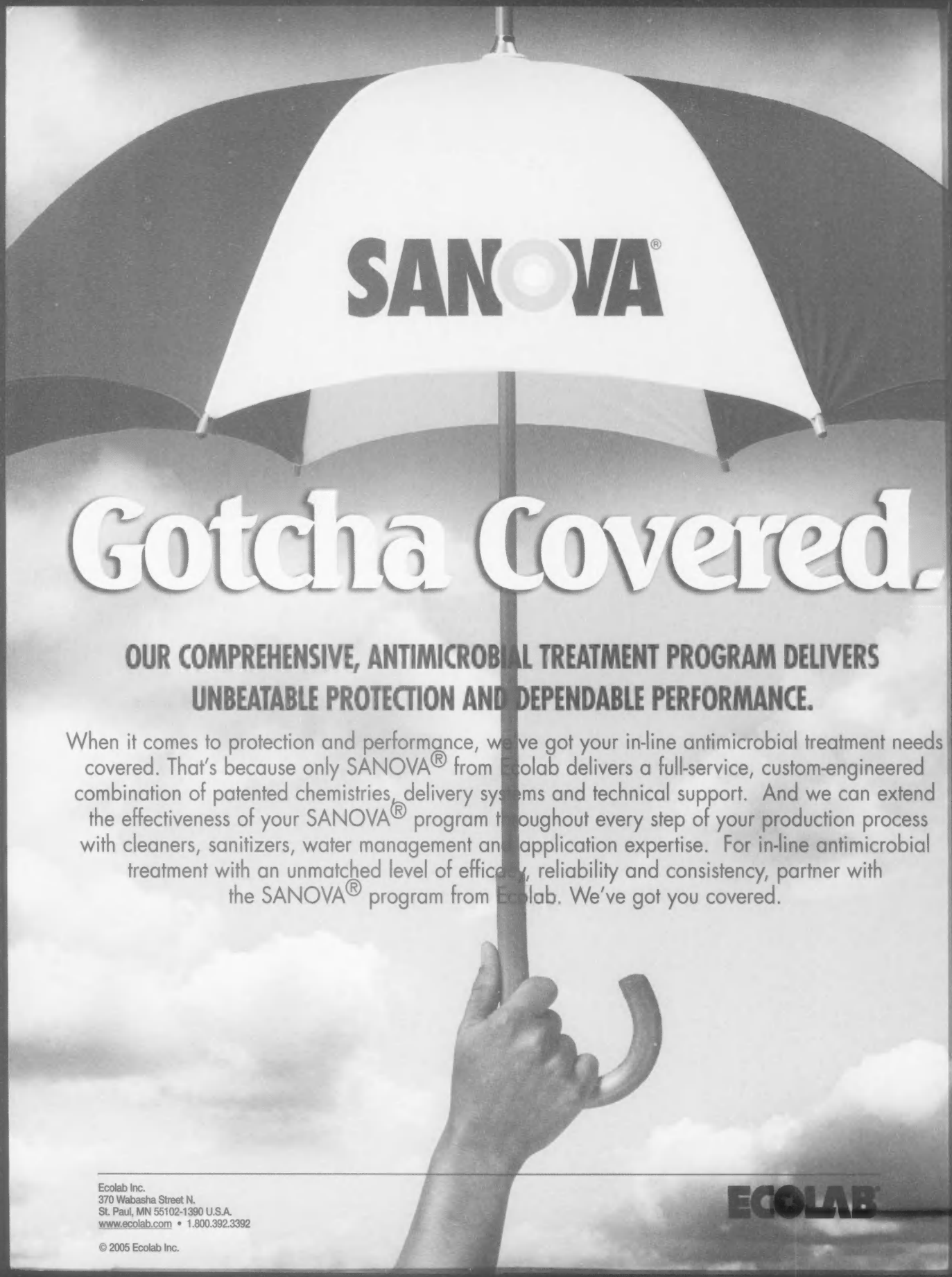

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References:

1. Rose, Bonnie E. 2001. Isolation and identification of *Salmonella* from meat, poultry and egg products. *In* Microbiology laboratory guidebook, 3rd ed., Food Safety and Inspection Service, U.S. Department of Agriculture, Washington, D.C.
2. U.S. Food and Drug Administration. 2003. Bacteriological analytical manual (online), AOAC International, Gaithersburg, MD.
3. International Organization for Standards (ISO). Microbiology of food and animal feeding stuffs – Horizontal method for the detection of *Salmonella* spp., 4th Edition, ISO 6579:2002.
4. Data on file, Diagnostic Systems, Sparks, MD 21152, USA.

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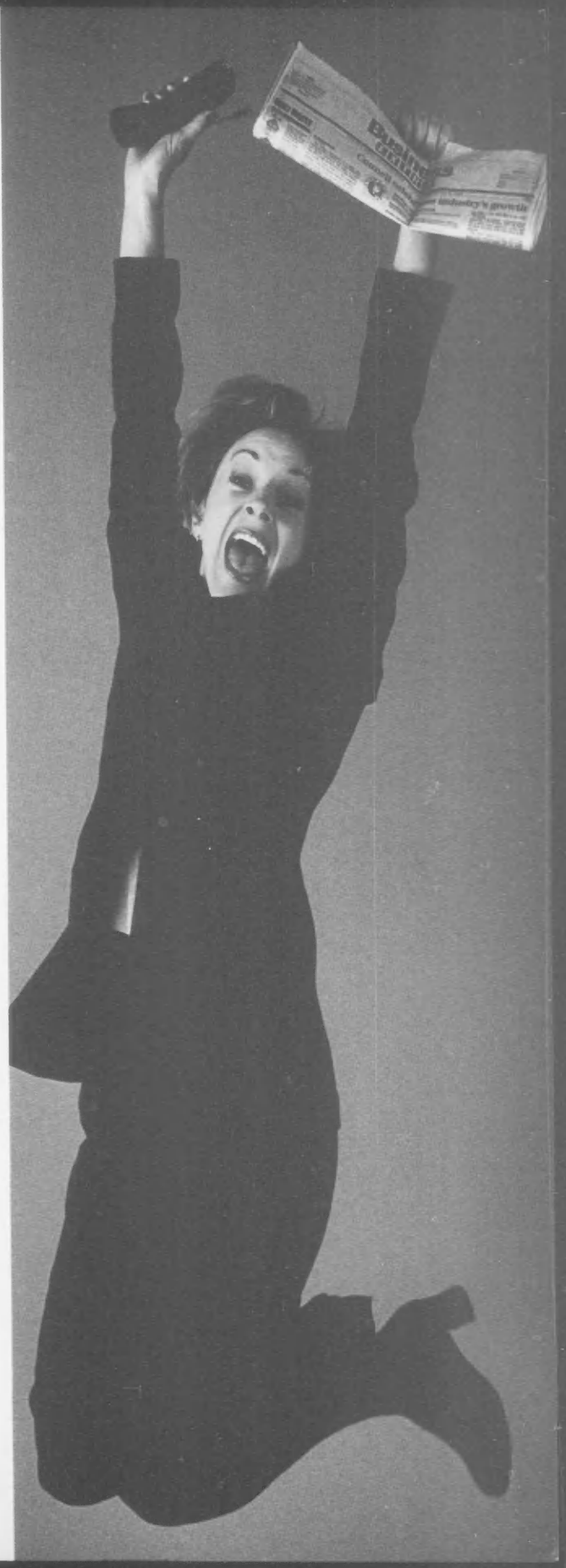

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FOOD PROTECTION TRENDS
SCIENCE AND NEWS FROM THE INTERNATIONAL ASSOCIATION FOR FOOD PROTECTION

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"PERSPECTIVES FROM NORTH OF THE 49TH"

I spoke to you last month about the future of our organization, IAFP Student Members. I would like to talk this month about the IAFP Foundation. The IAFP Foundation was established in the 1970s to support the mission of IAFP. The Foundation is currently funded through contributions from corporations and individuals with a large portion of the support provided by the Sustaining Members of IAFP. The Sustaining Membership Program is a unique way for organizations to partner with the Association. Many of you know how many important activities the Foundation actually finances. For example, it finances the Developing Scientist Competition, the Audio-visual Library of training tapes, the shipping of excess IAFP Journals to FAO for distribution to developing countries, speaker travel support for travel to the Annual Meeting, the Ivan Parkin Lecture at the Annual Meeting and the John H. Silliker Lecture which is made possible through a contribution from Silliker, Inc.

Currently, the Foundation Committee consists of a very dedicated group of people including Gale Prince, Chairperson; Gary Acuff, Stan Bailey, Zeb Blanton, Roger Cook, Bob Gravani, Peter Hibbard, Bob Marshall, Susan Sumner, Fred Weber, Frank Yiannas, and Don Zink. Wilbur Feagan and Paul Hall serve as advisors to the Committee. This great team of people who are on the Foundation Committee are working hard to come up with new ideas for attracting additional contributions for the Foundation and are making sure that the funds we do have are used and invested wisely.

By JEFFREY FARBER
PRESIDENT

"Besides all the activities the Foundation Fund supports, we are also expanding other Member services right now in a very exciting way"

Many of you will remember the great address (and pep talk!) that Gale Prince gave us last year in Baltimore. You will also remember the professional-looking donation pamphlets that were hung on your hotel door. That effort raised more than $6,000 as a direct result of this unique approach to fundraising. If anyone has creative fundraising ideas you are willing to share, please let us know!

The Foundation Committee is now hard at work finalizing a fantastic promotional video. By the time you read this article, we hope that the video will have been finalized. I think this is a major accomplishment for IAFP and a real achievement. The video will put IAFP on the map from a promotional standpoint. This video will show IAFP in action and will demonstrate how dynamic, innovative and great an organization we are. We are going to be able to use this new video in a multitude of ways. One of the key uses will be to showcase the video when we visit supporting organizations; this will definitely be a huge factor in our favor during our discussions with any organization. After viewing the video, I am sure organizations will better understand how IAFP works towards "Advancing Food Safety Worldwide®" and, as a result, they will be very receptive to us.

Support from individuals is also crucial in the growth of the IAFP Foundation. Contributions, big or small, make an impact on the programs supported by the Foundation. We will also be counting on you to act as ambassadors for this video and for the organization. I am sure that you all know one or two key individuals with whom we could make contact as we approach various organizations for donations. Remember, our goal is to reach $1.0 million in the Foundation reserves by the year 2010. This will enable the Foundation to directly support projects that supplement the work of IAFP and our mission.

Besides all the activities the Foundation supports, we are also expanding other Member services right now in a very exciting way. For example, in order to keep up the

great quality of the *Journal of Food Protection*, we engaged a fourth Editor, Dr. Elliot Ryser. At the same time, we instituted an online review process for the Journal, which will speed the time to publication for articles. We also now have the very successful student luncheon, and have expanded the number of student travel scholarships for travel to the Annual Meeting. Last year, we started our symposia series outside of North America and will continue the European Symposium again in 2006. In terms of the scientific program for the Annual Meeting, we are expanding the mechanism to support speaker travel. We want to be able to attract the best speakers in the world so that we can continue to be the premier food safety organization in the world.

News Flash – this just in! We have four new IAFP Sustaining Members! Burger King, Centrus International, The Kroger Co., and Randolph Associates. Welcome to the growing number of Sustaining Members and thanks for your support of IAFP. It is truly appreciated!

Please do not forget to cast your vote for our new Secretary. You should have received your ballots by now. If not, please contact the IAFP office and they will send you one right away. Again this year, we have two great nominees – Dr. Leon Gorris from Unilever in the UK and Ms. Vickie Lewandowski from Kraft. The deadline to return your ballot to the IAFP office is March 17.

Also, please remember that the award nominations are due on March 13th. I am sure you can think of a deserving colleague or company you can nominate for an IAFP Award. There is no greater honor for a Member than to be nominated by fellow colleagues for an award!

Quotes of the Month:

"My father used to say, 'You can spend a lot of time making money. The tough time comes when you have to give it away properly.' How to give something back, that's the tough part in life."

Lee Iacocca

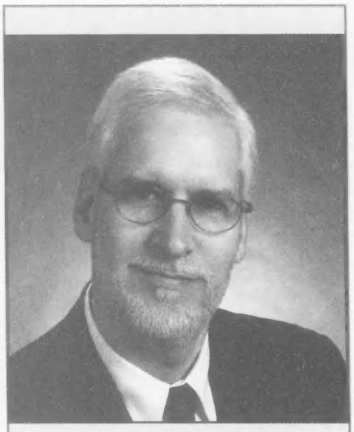
"I absolutely believe in the power of tithing and giving back. My own experience about all the blessings I've had in my life is that the more I give away, the more that comes back. That is the way life works, and that is the way energy works."

Ken Blanchard

As always, I can be reached by email at jeff_farber@hc-sc.gc.ca and would love to hear from you!

Have a great month.

"COMMENTARY"
FROM THE EXECUTIVE DIRECTOR



By DAVID W. THARP, CAE
EXECUTIVE DIRECTOR

"We will look at longer-term projects for IAFP to keep the Association serving your needs"

Next month, the IAFP Executive Board and staff will spend time together in a planning session. I bring this to your attention in case you have suggestions that you might like the Board to consider. During the session, we will look at longer-term projects for IAFP to keep the Association serving your needs! You are welcome to contact any of our Board Members, or me, to convey your ideas. We welcome your input!

While I was thinking ahead to our planning session, I wanted to review our last "formal" planning session to be able to "see" the progress we made. Our last planning was conducted two years ago in April of 2004. After a quick review, I was amazed at the progress we actually made! A few of the projects may now be obsolete, but for the most part, we have made huge strides in two years' time.

If you look back at the end of a day, a week or even a month, you don't realize how much progress is being made on any certain project. Many times we feel frustrated because we don't think that things are moving fast enough – especially in our fast-paced, "give-it-to-me-now" world! So, to be able to pull the two-year-old plan out and look it over was really fun to see the things we have accomplished.

Before I talk about the specific projects, I must explain that over these two years, the Board has kept constant monitoring of our plan as one of its priorities. I didn't want you to have the impression that we are just now pulling out the two-year-old planning document to see if we made any progress! At each Board meeting, we look the projects over, break them down into smaller pieces, define responsibilities as to who will move the project forward and establish timelines to be met.

The one project that I consider the most notable achievement was planning and holding our first stand-alone meeting outside of North America. This, of course, was our European Symposium on Food Safety that was held last October in Prague. IAFP wanted to hold a symposium in Europe and it was on our priority list for a number of years (since 2000 I believe). A couple of circumstances kept us from acting on our earlier desires, but once it was on our 2004 planning document, the planning moved more rapidly forward. Now, as you may be aware, we are planning a second European Symposium for October or November of 2006!

Another project that we are proud of and have seen great progress on is the goal to grow the Foundation Fund to $1 million by 2010. Over the last couple of years, we have increased our efforts to convey to IAFP Members all of the wonderful sponsorship and support the IAFP Foundation provides to IAFP. We conducted a filming project at IAFP 2005 and developed a DVD video presentation to use in our fundraising effort. Part of our effort concentrated on bringing the Foundation to a more visible level at IAFP 2005. Along with Gale Prince's challenge pledge at IAFP 2005, we raised more than $6,000 in contributions! Now the next phase is to put the DVD to use and make presentation visits to various companies who work with us to achieve our goal.

With monies already raised in the Foundation, we have been able to increase the support offered to students (through travel scholarships) and speakers at the Annual Meeting. There are many additional projects waiting to be funded as the Foundation grows!

The last major project that I'll review in this month's column is improving access to IAFP journal articles. Our goal was to place additional articles from both the *Journal of Food Protection* and *Food Protection Trends* online for faster Member access. Two years ago, there were just three years of *JFP* articles available to online users.

Over this period (the last two years) we placed additional volumes online and now have seven complete volumes available (back to 1999) and are adding the eighth year now (2006). *JFP* articles are fully searchable with linked references and very user-friendly! If you are searching for recent food science articles and not using *JFP* Online, you might want to consider adding access to your Membership!

For *FPT*, we undertook an effort to improve our online article availability for Members' access. IAFP Members may log in to a "Members' Only" section of the IAFP Web site to access *FPT* articles from 2000 through the current issue. So, if you are traveling and think about an article you recall seeing in *FPT*, you have immediate, 24-hour access to the article for reference purposes!

Just to note, the IAFP Member Directory has been available online since 2000. It is fully searchable by name (first or last), employer, city, state or province, or country. The online directory provides an easy way to communicate with colleagues from around the world!

So this provides an update on our two-year old, long-range plan. As was stated earlier, we will hold a planning meeting in April to once again "look to the future" and establish our long-range plan. Yes, there are items we can continue to work on from the last plan, but those ideas will be refined and molded into new goals for IAFP. Remember, if you have ideas for the Executive Board to consider, either contact a member of the Executive Board or me and we will be sure to include your input.

ARTICLES

Food Protection Trends, Vol. 26, No. 3, Pages 150–157

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

International Association for Food Protection

Restaurant-associated Outbreak of *Salmonella* Serotype Heidelberg Linked to Improperly Handled Mushrooms, Wyoming, 2003

KELLY N. WEIDENBACH,[1]* SCOTT A. SEYS,[1] JOSLYN D. CASSADY,[1,2] DEAN L. FINKENBINDER,[3] NEAL BLOOMENRADER,[3] ANNETTE G. HERYFORD,[1] WANDA A. MANLEY,[1] JAMES R. WALFORD,[1] and J. ERIC BUXMAN[1]

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SUMMARY

In May–June 2003, the Wyoming Department of Health investigated a protracted outbreak of *Salmonella* serotype Heidelberg associated with a restaurant in Park County, Wyoming. A total of 65 cases of salmonellosis were identified, of which 39 were laboratory-confirmed. Three state agencies coordinated a multidisciplinary, three-pronged outbreak investigation, which included epidemiologic techniques, a systems-based environmental health investigation, and laboratory methods. The case-control study revealed that mushrooms (OR=20.6; 95% CI=6.43–66.32) and Swiss cheese (OR=8.2, 95%CI=2.49–27.10) were associated with gastroenteritis. Mushrooms that had once been canned tested positive for *S.* Heidelberg. Pulsed-field gel electrophoresis (PFGE) results demonstrated that all *Salmonella* isolates from case-patients and from the mushrooms were indistinguishable. Approximately 90% of restaurant patrons who consumed mushrooms became ill. Contamination of the canned mushrooms during commercial processing was unlikely. The environmental assessment of food-handling practices revealed multiple opportunities for cross contamination of mushrooms and other food items with raw meat and poultry products. Additionally, foodhandlers had bare hand contact with these ready-to-eat food items. This outbreak investigation identified improperly handled mushrooms as the most likely vehicle of *Salmonella* Heidelberg. The implementation of a rigorous, multidisciplinary investigation was critical in identifying the vehicle of transmission, determining the food-handling practices that led to the outbreak, and implementing control measures.

A peer-reviewed article

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INTRODUCTION

An estimated 1.4 million cases of salmonellosis occur annually in the United States *(21, 26)*. *Salmonella* serotype Heidelberg is the fourth most common among *Salmonella* species, accounting for approximately 6% of *Salmonella* isolates with a known serotype *(1)*. In recent years, the incidence of *Salmonella* infections, including *Salmonella* Heidelberg, has been decreasing *(8, 28)*. Public health officials attribute this decrease to recent regulations in food safety (e.g., US Department of Agriculture's Pathogen Reduction–Hazard Analysis Critical Control Point systems regulations *[21, 28]*, which were implemented in 1997 *[34]*).

Salmonella infections, including those associated with *Salmonella* Heidelberg, have been primarily associated with foods of animal origin such as eggs *(17, 31)*, meat *(4)*, poultry *(22, 23, 24, 29)*, and dairy products *(15)*. Outbreaks of *Salmonella* have also been associated with exposure to pet reptiles such as turtles *(27, 32)*, snakes *(27)*, and lizards *(27, 35)*. In recent years, new food vehicles of *Salmonella* that have been identified include cereals *(5)*, tree nuts *(9)*, unpasteurized juice drinks *(6)*, and fresh produce (e.g., cantaloupe *[7]*, sprouts *[25, 36]*, and Roma tomatoes *[10]*). These discoveries of emerging vehicles of foodborne transmission frequently have come from outbreak investigations *(28)*.

Often, identifying the vehicle and the source of contamination of a foodborne outbreak is difficult because of limitations in outbreak investigations, including untimely disease reporting, deficiencies in specimen collection from case-patients, and the complexity of interagency collaboration. The vehicle is not identified in approximately 46% of investigated foodborne outbreaks *(19)*. Thorough outbreak investigations incorporate a three-pronged approach that includes systems-based environmental health investigations, laboratory methods, and traditional epidemiologic techniques. This approach allows for complete collection of both quantitative and qualitative data, ensuring that investigators consider all processes from food production to food consumption. It allows investigators to synthesize disparate data to scrutinize the conditions and antecedents that lead to the outbreak and implement appropriate control measures to help prevent future cases of foodborne illness. Finally, it allows for collaboration among authorities regarding different components of the investigation (e.g., epidemiologists, microbiologists, consumer health specialists, and engineers).

A systems-based environmental health approach was utilized previously in Wyoming during two waterborne disease outbreak investigations in 2001 *(2, 30)*. An integrated systems-based approach evaluates the entire operation of a facility, such as the interaction of the water supply, food preparation, or sewage disposal systems, with a specific focus on identifying vulnerabilities *(3, 11)*. A key component of this approach is investigating the environmental antecedents to better understand what factors contributed to the outbreak and how they can be corrected to prevent future incidents *(16)*. This component is incorporated into the establishment of the Environmental Health Services Network (EHS-Net) of the Centers for Disease Control and Prevention (CDC) *(20)*.

On May 8, 2003, the Wyoming Department of Health (WDH) identified a cluster of six *Salmonella* infections associated with a restaurant in Park County, Wyoming through routine investigation of reportable foodborne diseases. Standard follow-up questionnaires for foodborne illnesses revealed multiple case-patients with exposure to the same restaurant. Additionally, WDH contacted the infection control practitioner at the local hospital to inquire about additional cases of gastroenteritis that might be associated with the restaurant. That same day, our team of epidemiologists, consumer health specialists, and laboratorians from the WDH, the Wyoming Department of Agriculture (WDA), and the Wyoming Public Health Laboratory (WPHL) initiated an outbreak investigation of *Salmonella* Heidelberg infection associated with the restaurant by using a multidisciplinary, three-pronged approach. The approach included active public health surveillance, a case-control study, a systems-based environmental health investigation, and laboratory testing of patients, environmental specimens, and food samples. The goals of our investigation were to confirm the etiology of the illness, assess the extent of the outbreak, determine the vehicle of transmission and source of the outbreak, and recommend measures for control and prevention of further illness.

MATERIALS AND METHODS

Case identification

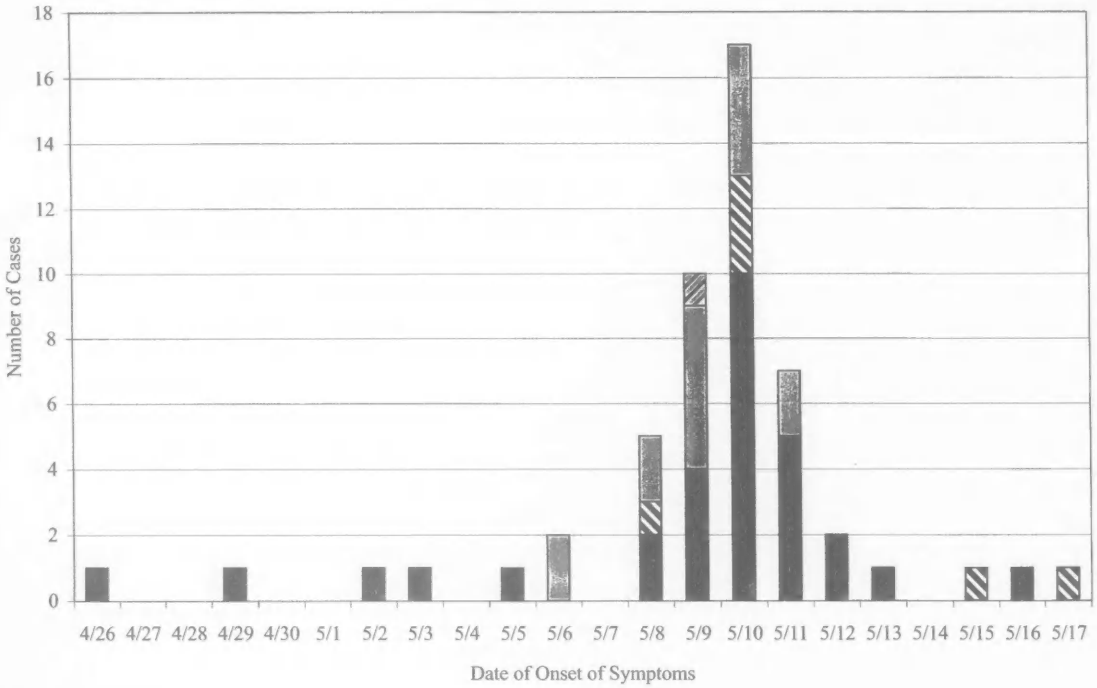
We defined a confirmed case-patient as a patron or employee of the restaurant who experienced gastroenteritis within 6–72 hours after dining at the restaurant during April 20 through May 11, 2003 and who had laboratory confirmation of *Salmonella* infection (i.e., isolation of *Salmonella* from stool culture). A probable case-patient was defined as a patron or employee of the restaurant who experienced gastrointestinal illness within 6–72 hours after dining at the restaurant during April 20 through May 11, 2003, but was not tested or laboratory-confirmed. Gastroenteritis was defined as three or more loose stools in any 24-hour period or as vomiting with fever.

We used both active and passive public health surveillance methods for case identification. The index case and certain subsequent cases were identified through Wyoming's passive Reportable Diseases and Conditions surveillance system, which requires clinicians to report cases of salmonellosis to WDH. On May 12, 2003, our epidemiology team was onsite to initiate enhanced active surveillance as well as to aid in the environmental health assessment. We conducted active case finding in three ways: (1) We established a sentinel reporting system in conjunction with three local clinics. The sentinel clinics were the three most utilized healthcare facilities in the small Wyoming town and included the local hospital emergency department, an urgent care center, and a private outpatient clinic. The clinics generated a daily listing of patients presenting to their facility with gastroenteritis during May 12 through May 16, 2003. (2) The restaurant manager provided names of patrons and employees who had called the restaurant to report having gastroenteritis. (3) The local public health nursing office generated a list of persons who contacted their office to report gastroenteritis during May 12 through May 16, 2003. We interviewed possible case-patients willing to participate in a standardized, telephone-administered questionnaire regarding their illness onset, symptoms, and exposure history. Additional case-patients were identified during the interview process. Non-ill persons who had eaten meals at the restaurant during the exposure period were identified as control subjects for the case-control study.

Case-control study

We conducted a case-control study by using a standardized, telephone-administered questionnaire to determine risk factors for illness. We interviewed a total of 112 persons, including 50 ill and 62 well patrons or employees of the restau-

FIGURE 1. Epidemic curve for restaurant-associated outbreak of salmonellosis in Park County, Wyoming, April–June 2003



Legend for Figure 1:

- Laboratory-confirmed patrons
- Laboratory-confirmed employees
- Probable patrons
- Probable employees

rant. Both confirmed and probable case-patients were included in the study. Study participants were selected by convenience. All persons enrolled in the study had dined at the restaurant during April 20 through May 11, 2003. The exposure period was chosen on the basis of the index patient's exposure date and the date that the restaurant voluntarily closed. We identified case-patients and control subjects by use of the methods described previously.

We calculated unadjusted and adjusted Mantel-Haenszel odds ratios (OR) and 95% confidence intervals (95% CI) in Epi-Info 2002 (Centers for Disease Control and Prevention, Atlanta, GA). Variables were considered statistically significant if the *P*-value was ≤ 0.05. We conducted multivariate analyses by using logistic regression procedures in SAS Version 8.0 (SAS Institute, 1999, Cary, NC) to determine adjusted estimates of effect.

Environmental investigation

Consumer health specialists from WDA were on site on May 8, 2003, a few hours after the cluster of illnesses was identified by WDH. During multiple visits to the restaurant, consumer health specialists thoroughly inspected the restaurant and conducted a full assessment of meal preparation, including raw food handling, cooking, hot- and cold-holding, and food storage. The consumer health specialists also interviewed food-handling employees to establish typical food-handling practices and to investigate possible routes for food contamination. From these interviews, the consumer health specialists were able to produce detailed meal-production diagrams, where critical control points were identified and opportunities for contamination were noted. A total of 12 food samples from the restaurant (sliced roast beef, beef gravy, chicken salad, raw ground beef, raw tomato, lettuce garnish, commercially bagged lettuce, two samples of mushrooms from cans that had been opened, one unopened can of mushrooms, Cheddar cheese, and raw chicken) were tested. We also collected 12 specimens from environmental surfaces throughout the restaurant kitchen and restroom. All samples were sent to WPHL for testing.

TABLE 1. Unadjusted and adjusted odds ratio for selected food items associated with outbreak of *Salmonella* Heidelberg, Wyoming, April–June 2003

Food Item	OR[a]	95% CI	*P*-value	aOR[b]	95% CI	*P*-value	No. cases exposed (%)	No. controls exposed (%)
Canned mushrooms	26.6	8.89–79.60	<0.0001	20.6	6.43–66.32	< 0.0001	35 (70)	5 (8.1)
Swiss cheese	11.9	4.33–32.62	<0.0001	8.2	2.49–27.10	0.0005	28 (56)	6 (9.7)
Cheddar cheese	4.9	0.97–24.67	0.0379	6.5	0.89–46.80	0.0649	7 (14)	2 (3.2)
Onion[c]	7.5	2.32–24.07	0.0002	1.1	0.22–5.96	0.8713	17 (34)	4 (6.5)
Raw tomato[c]	4.9	1.27–18.99	0.0132	2.8	0.44–18.02	0.2717	10 (20)	3 (4.8)
French fries	3.2	1.23–8.22	0.0148	3.3	0.86–12.59	0.0835	16 (32)	8 (12.9)
Lettuce on sandwich[c]	4.1	0.79–21.24	0.0744	2.6	0.28–24.50	0.3980	6 (12)	2 (3.2)
Chopped steak[c]	4.1	0.79–21.24	0.0744	3.3	0.41–26.27	0.2615	6 (12)	2 (3.2)
Sliced roast beef	8.0	2.90–21.81	<0.0001	0.6	0.12–2.63	0.4687	23 (46)	6 (9.7)
Hamburger[c]	3.7	0.94–14.96	0.4950	1.3	0.17–9.77	0.8006	8 (16)	3 (4.8)

[a] Crude Cochran Mantel Haenszel odds ratios.

[b] Maximum likelihood estimates adjusted for canned mushrooms and Swiss cheese.

[c] Might be unstable estimates of effect due to low cell counts.

Laboratory investigation

WPHL tested all food and environmental specimens. Patient specimens were first sent to the local hospital laboratory for testing, and identified *Salmonella* isolates were then sent to WPHL for confirmation, serotyping, and PFGE. Isolates from case-patients and from food samples were cross-checked nationally with other isolates by using PulseNet (Centers for Disease Control and Prevention, Atlanta, GA) *(33)*. In a cooperative agreement with the manager of the restaurant, 32 restaurant employees were referred to the local hospital laboratory to submit stool samples. As a condition for reopening, the restaurant was required to have all food-handling employees test negative for *Salmonella* before returning to work. To be considered *Salmonella*-free, a food-handler needed to have two negative stool samples taken at least 24 hours apart.

RESULTS

Descriptive epidemiology

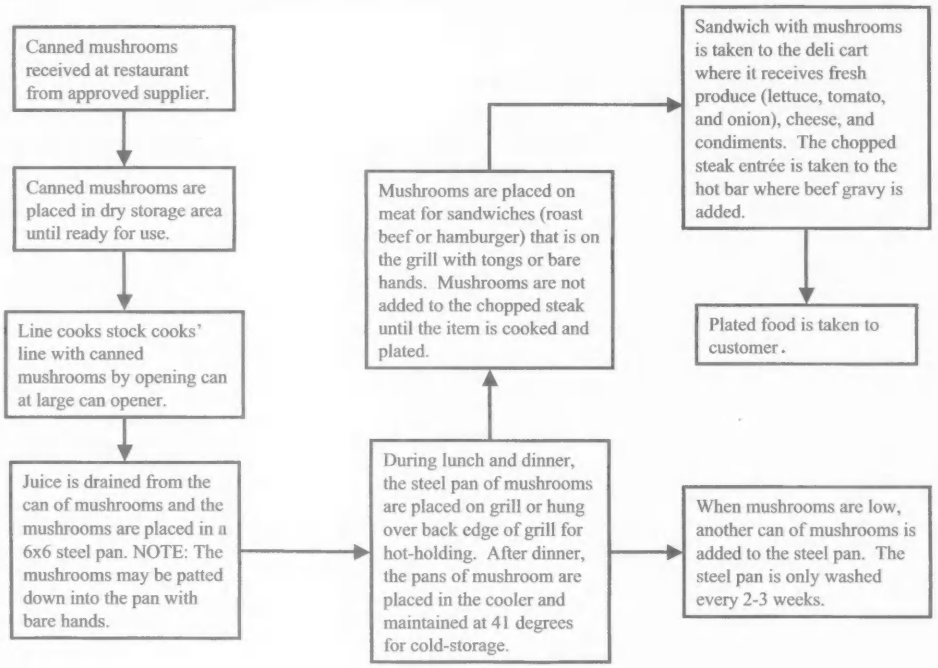
We identified a total of 65 cases, which included 39 laboratory-confirmed cases and 26 probable cases with onset of symptoms during April 26 through May 17, 2003. Evaluation of the epidemic curve indicated a protracted outbreak with onset of illness peaking at May 10, 2003 (Fig. 1). *Salmonella* Heidelberg was isolated from all 39 case-patients with laboratory-confirmed illness. The typical incubation period ranged from 6 to 72 hours (median = 16 hours), with only two case-patients reporting onset of signs and symptoms outside this range at 6–7 days. Illness was characterized by diarrhea (72%), nausea (62%), stomach cramps (62%), fever (57%), headache (54%), and vomiting (35%). Thirty-nine case-patients (60%) responded that they sought medical care from their health-care providers. Twenty-seven of these patients (42% of all case-patients) visited the emergency department, and 14 (22% of all case-patients) were hospitalized. Case-patients' ages ranged from 11 months to 88 years (median = 41 years). Overall, 51% of case-patients were female. Most case-patients were residents of Wyoming; however, five resided in other states and had dined at the restaurant during the period of interest. Preliminary data analysis suggested certain lunch and dinner menu items were commonly reported in food histories by case-patients. These food items included the French dip sandwich, the roast beef deluxe sandwich, the "Mushroom 'N Swiss" hamburger, and the chopped steak entrée, which typically were served with mushrooms. We did not identify any case-patients who had eaten at the restaurant for breakfast only.

Case-control study

Fifty ill case-patients (76.9% of cases) and 62 well control subjects participated in the case-control study. Multiple food items were associated with statistical significance in the univariate analysis (Table 1). Mushrooms (OR = 26.6; 95% CI = 8.89–79.60) had the highest OR and were consumed by 70% of case-patients. Swiss cheese was also associated with illness (OR = 11.9; 95% CI = 4.33–32.62). Other food items such as Cheddar cheese, French fries, sliced roast beef, onion, and raw tomato were also identified as significant in the univariate analysis (Table 1).

Most foods that were significant in the univariate analysis typically were served with the mushrooms as part of the restaurant's specialty sandwiches and chopped steak entrées. These food items were not statistically significant when mushrooms and Swiss cheese were controlled for. Only mushrooms (OR = 20.6;

FIGURE 2. Food-handling flow chart of canned mushrooms associated with an outbreak of *Salmonella* Heidelberg infection, Wyoming, April–June 2003



95% CI = 6.43–66.32) and Swiss cheese (OR = 8.2; 95% CI = 2.49–27.10) were significant in the multivariate analyses (Table 1). Only eight case-patients consumed neither mushrooms nor Swiss cheese.

Environmental investigation

Interviews with foodhandlers indicated the plausibility of cross-contamination of mushrooms with other food items. Restaurant employees described how cans of mushrooms were opened and dumped into a 6-in. by 6-in. stainless steel pan. Often, the mushrooms were packed down into the pan with bare hands. The Wyoming Food Safety Rule states that these mushrooms, once opened and removed from their cans, should be maintained at 140°F (60°C) for hot-holding (*37*). Employee interviews revealed that the pan was often placed over the back edge of the grill and not directly on the grill; therefore, it was possible that the pan was getting insufficient heat. The location of the pan of mushrooms also provided the potential for cross contamination through fluids and particulate matter from raw meat or poultry products being grilled or transferred over the grill (Fig. 2).

Bare hands or tongs were used to transfer mushrooms from the steel pan onto food items such as sandwiches and hamburgers. We noted that certain foodhandlers used the same tongs for multiple purposes, and a foodhandler might have used a pair of tongs to handle raw meat or poultry products and then have used the same pair of tongs to place mushrooms on a sandwich. Furthermore, employees described how newly opened cans of mushrooms were continuously added to the top of the existing steel pan of mushrooms every 3–4 days. This pan of mushrooms typically was cleaned out and started anew only every 2–3 weeks. Leftover mushrooms in the steel pan were covered with plastic wrap and placed in the refrigerator every evening when the restaurant closed and were brought out in the early morning in preparation for lunchtime. We suspected that the mushrooms had been continuously contaminated in this way and that the moist, warm environment was ideal for growth of *Salmonella* colonies.

Other opportunities for cross contamination were plentiful. Often sandwiches and other items containing mushrooms were transferred from the grill to a deli cart where condiments, fresh produce, and cheese were added, and the sandwich was then sliced and plated for patron consumption. Again, employees noted that food preparation utensils were used for multiple purposes, and the use of a kitchen utensil for raw products and then for cooked products was possible.

Laboratory studies

Salmonella cultures from mushrooms from opened cans and lettuce garnish yielded *Salmonella* Heidelberg colonies that were indistinguishable by PFGE from the stool isolates of the 39 case-patients with laboratory-confirmed illness. Of the 32 restaurant employees who submitted stool samples, seven were confirmed as having *S.* Heidelberg infection. We considered six (all foodhandlers) to be case-patients because they all had eaten at the restaurant during the exposure period and had gotten ill during the peak of illness. One *Salmonella*-positive employee was asymptomatic and was never ill. This employee had also eaten at the restaurant during the period of interest. All seven employees with *Salmonella*-positive isolates were required to submit two negative stool samples before returning to work. WPHL tested an unopened can of mushrooms from the same lot number as the other cans of mushrooms, and the result was negative for *Salmonella*. The

national PulseNet search did not reveal any concurrent *Salmonella* serotype Heidelberg outbreaks with similar PFGE patterns. No national or regional outbreaks associated with canned mushrooms were identified at that time.

All 12 environmental samples were negative for *Salmonella*. Our investigation team did not find evidence of widespread environmental contamination. The protracted nature of the outbreak was most likely caused by continuous recontamination of mushrooms at the restaurant with localized cross contamination with the cheese and produce in the deli cart. The investigation did not yield any data suggesting the initial source of the *Salmonella*.

DISCUSSION

We identified mushrooms as the likely vehicle for this outbreak of *Salmonella* Heidelberg, although other food items might have been contaminated also. We identified 65 total case-patients. A laboratory sample of these mushrooms tested positive for *Salmonella* Heidelberg and was indistinguishable from the isolates of stool from case-patients. The mushrooms were most likely contaminated through unsafe food-handling practices at the restaurant, not during production. The public does not usually consider canned goods to be high-risk foods and might not realize that multiple opportunities exist for canned goods to become contaminated after being opened. This outbreak demonstrates the potential for even hermetically sealed, low-risk food products to be contaminated after being opened if improperly handled.

Our discovery of restaurant employees with laboratory-confirmed illness and the protracted nature of the outbreak initially indicated that foodhandlers were directly responsible for the introduction of *Salmonella* to the restaurant. However, upon further investigation, we identified six of seven *Salmonella*-positive employees to be case-patients who had experienced gastroenteritis during the peak of the outbreak. The onset date of the first employee to become ill was May 6, 2003, which is 10 days after the onset date of the first patron case-patient. All employees with *Salmonella*-positive isolates had eaten meals during April 26 through May 11. One of these employees had not experienced gastroenteritis, but she had little opportunity to handle food because she was not part of the kitchen staff. One food-handling employee had owned a pet iguana, which had recently died. We took laboratory specimens from the iguana's cage and habitat, which had not yet been cleaned. These specimens were negative for *Salmonella*. *Salmonella* Heidelberg is less commonly associated with reptiles than other serotypes such as *Salmonella* Marina, Typhimurium, and Enteritidis *(27, 28)*. Evidence to suggest that the employee's iguana had been the source of the outbreak was scanty. Cross contamination from another food item in the kitchen (e.g., raw meat, poultry, or eggs) to the mushrooms was the most likely cause of the outbreak. Previous studies have demonstrated the feasibility of this type of environmental cross contamination *(13, 14)*.

Although the outbreak was protracted, the epidemic curve had a clearly defined peak of illness onset at May 10. This peak might be explained by the 2–3 week time period in which the steel container used to hold mushrooms was not cleaned. The daily use of mushrooms from the same steel pan refilled without daily cleaning might have functioned to allow proliferation of the *Salmonella* colonies over time by decreasing the amount of mushrooms in the pan, slowly incubating them on the back of the grill, and not replenishing them with fresh mushrooms for several days. Pasteurized Swiss cheese was also implicated in the statistical analyses, and lettuce garnish was implicated by laboratory data. Both items were stored for use in the kitchen's deli cart. Although either of these items might have been responsible for introducing *Salmonella* into the restaurant, we suspect that both became contaminated through improper food-handling when employees used contaminated tongs or bare hands to dress the sandwiches.

This outbreak investigation has multiple limitations. Cases were primarily identified through Wyoming's Reportable Disease Surveillance System or through contact with the restaurant manager. Park County, Wyoming is a popular tourist destination during the summer months because it is adjacent to Yellowstone National Park and offers the closest dining and lodging venues to the majority of the park. Tourists often patronize the restaurant, and unidentified case-patients may have become ill after returning to their home state. Our case finding strategies may not have identified those case-patients who resided in other towns or other states, those who did not seek medical attention, or those who were not well-acquainted with the restaurant manager. Selection bias might be a problem because of the choice of case-patients and control subjects, both of whom were chosen by convenience. Certain control subjects were relatives or associates of case-patients who had attended the same meals at the restaurant and might not have been representative of all patrons of the restaurant. In certain instances, case-patient or control subject interviews were conducted days to weeks after the person had patronized the restaurant. Therefore, this study is subject to recall bias, which can result in a strengthened association between illness and mushroom consumption.

Of the two samples of mushrooms that tested positive for *Salmonella* Heidelberg, one sample had been recovered from the kitchen's waste bin. The restaurant manager had had high suspicion of the mushrooms, and had thrown away leftover mushrooms from the steel pan before the consumer health specialists' visit. The second sample of mushrooms was acquired from mushrooms that had been newly opened and added to the steel pan for hot-holding. The second sample did not contain enough material for laboratory testing; therefore, remnants not used from the first sample were added to the second sample. Both samples tested positive for *Salmonella* Heidelberg. Although contamination with *Salmonella* might have occurred in the waste receptacle, the mushrooms were discarded and collected on the same morning. The mushrooms collected were easily accessible for collection because the waste receptacle had been emptied the previous evening and opportunity for mixing of waste contents was slight. The isolates from these mushroom samples were indistinguishable from isolates of all 39 case-patients with laboratory-confirmed illness, and they were also indistinguishable from the *Salmonella* isolated from lettuce garnish that was sampled from the deli cart, demonstrating that the mushrooms had been contaminated before they had been placed in the waste bin. Laboratory testing of the Swiss cheese would have provided useful information for the investigation; however, the Swiss cheese was not tested for *Salmonella* because it was not implicated until after the on-site investigation had ceased and the statistical analyses were completed.

The laboratory results of the environmental samples might inaccurately depict the true level of surface contamination at the restaurant at the time of the outbreak because the samples were taken after the outbreak had been identified, the restaurant had been closed, and the kitchen had been thoroughly cleaned multiple times. Widespread environmental cross contamination might have been more evident had the environmental samples been taken in a more timely manner. However, few other food items were implicated in our analyses, which indicates that contamination was most

likely limited to the pan of mushrooms on the grill and possibly the deli cart area. Lastly, we did not identify the primary source of the outbreak. Identification of the source of the organism might have aided in the development of future prevention strategies. However, the multidisciplinary approach was successful in that multiple state agencies implemented a cooperative, interdisciplinary response; conducted exhaustive epidemiologic, environmental, and laboratory investigations; identified the probable vehicle of transmission; and prevented additional cases.

CONCLUSIONS

Although recent highly publicized, geographically wide outbreaks have been attributed to changes in the food production industry and consumer demand *(12)*, improper food-handling and storage, especially by restaurant employees, are still cited as the most common causes of foodborne outbreaks *(12, 18, 19)*. A multidisciplinary, three-pronged approach, including a systems-based environmental health investigation, provides the most effective investigative tool in both geographically wide and localized outbreaks. In this outbreak investigation, the combination of epidemiologic and laboratory methods with the systems-based environmental health investigation was critical in determining the vehicle of transmission, identifying breaks in food safety protocols, and allowing for specific directives for control and prevention. Our results demonstrate an increased need for foodhandler education and training that emphasize the potential opportunities for cross contamination, even with low-risk foods. Bare hand contact with ready-to-eat food should not be permitted. Additionally, all employees experiencing gastroenteritis should be required to stay home from work for 72 hours after their symptoms cease. Currently, Wyoming does not mandate food safety training courses for restaurant staff. Future prevention efforts could entail mandatory food safety training courses for all restaurant foodhandlers. Foodborne illness can be prevented if basic food safety policies are correctly executed.

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New York State Cottage Cheese Shelf-life Characteristics: A Sixteen-year Perspective

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SUMMARY

By multiple criteria, the quality of cottage cheese products manufactured in New York State has improved measurably between 1988 and 2004. From 1999 to 2004, the average sell-by date on cottage cheese products collected in New York State was 46.9 days post-packaging, in contrast to an average 28.0 day sell-by date on similar products from 1988 to 1992. At 28 days of storage at 6.1°C, gram-negative bacteria were detected in 2.0% of cottage cheese samples collected from 1999 to 2004 (n=179), as compared to 29.4% of samples collected from 1988 to 1992 (n=80). While 5.0% of the samples analyzed from 1999 to 2004 were determined to be "unacceptable" by sensory analyses at 28 days post-processing, fully 35.0% of samples tested from 1988 to 1992 were "unacceptable" at 28 days. Factors contributing to the improvements measured in New York State cottage cheese product characteristics, including adoption of carbon dioxide addition to cottage cheese dressing prior to blending, are discussed.

INTRODUCTION

Cottage cheese is defined in the US as a "soft uncured cheese prepared by mixing cottage cheese dry curd with a creaming mixture" (21CFR 133.128) *(4)*. Cottage cheese dry curd (21 CFR 133.129) *(4)* is manufactured by the acid coagulation of pasteurized skim milk, typically through starter culture activity, although the milk may be directly acidified. The creaming mixture, or cottage cheese "dressing," is traditionally made from cream, milk and salt *(17)*, but many modern manufacturers supplement the solids content by addition of dairy ingredients (e.g., nonfat milk, whey, whey protein concentrate) and include additional functional ingredients for stabilization (e.g., guar gum, carrageenan, locust bean gum) or preservation (e.g., potassium sorbate, Microgard®).

Cottage cheese is considered a fresh product with a limited shelf life *(17)*. Shelf-life limitations typically result from the growth of psychrotrophic yeasts, molds or gram-negative bacteria *(6, 10, 13, 18, 21)*. Product spoilage may be evident as visible surface growth (e.g., slimy or gelatinous curd, discoloration, mold mycelia) and/or the development of off-flavors (e.g., bitter, unclean, fermented, musty, yeasty). Gram-negative bacteria, including psychrotrophic pseudomonads and coliform bacteria, associated with cottage cheese spoilage are destroyed by heat treatments used for cottage cheese pro-

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TABLE 1. Cottage cheese manufactured in the US in 2003[a]

Cottage Cheese Product	Millions of Pounds Cottage Cheese Manufactured in: NY	CA	IL	OH	IA	Other	US Total
4% fat	63.1	31.3	37.2	21.0	18.5	208.7	385.2
Low fat	92.5	65.4	29.3	31.0	17.7	130.9	380.0
Total	155.6	96.7	66.5	52.0	36.2	339.6	765.2

[a]Adapted from *Dairy Facts* 2004, International Dairy Foods Association

duction such as milk and cream dressing pasteurization and curd cooking procedures when sufficient temperatures are achieved *(2, 9, 10, 21)*. Yeast and molds are likely inactivated or substantially reduced by the heating processes, although specific information on the heat stability of these types of organisms in cottage cheese is lacking. Although less frequently associated with cottage cheese spoilage, gram-positive organisms, including lactic acid bacteria, may be associated with product defects such as excessive acidity, bitterness and, in some cases, gas production.

To manufacture high quality products with extended shelf lives, it is essential to start with high quality ingredients and to design and implement sanitation, manufacturing and handling practices to prevent post-processing contamination. Additional means of extending cottage cheese shelf life that have been investigated and used in the industry include preservatives such as potassium sorbate *(13, 24, 26)* and microbial-based inhibitors such as fermentation derived antimicrobials *(1, 25, 26)* or active cultures *(22)*. Modified atmosphere packaging by gas flushing of package headspace (e.g., CO_2) has also been investigated *(16, 19, 23)*, although this generally requires significant modifications of packaging equipment and procedures to provide sufficient headspace gas concentrations. As an alternative to headspace flushing, Chen and Hotchkiss *(8)* developed a simplified procedure for adding CO_2 directly to cottage cheese dressing prior to blending with curd. Carbon dioxide was added through a sparging unit in a product transfer pipe, allowing the gas to dissolve in the dressing and thereby disperse throughout the product. Microbial growth and subsequent spoilage of cottage cheese inoculated with psychrotrophic pseudomonads was substantially reduced in samples with dissolved CO_2, compared with untreated samples. The addition of 350 to 450 ppm CO_2 in the blended cheese, which was undetectable by sensory evaluation, doubled the time required for psychrotrophic gram-negative bacteria to reach 10^6 CFU/g, compared with control samples without CO_2 *(18)*. Moir et al. *(23)* also reported that dispersing CO_2 throughout cottage cheese reduced the growth rate of pseudomonads and was superior to package head-space flushing. They found CO_2 to be most effective when initial bacterial contamination levels were low, emphasizing the need for effective sanitation measures. Although modifications in the package filling process are not required when adding CO_2 to the cream dressing, high-barrier packaging and top sealing of the carton help ensure retention of CO_2 within the product *(3)*.

In the United States, New York State (NYS) has been the leading manufacturer of cottage cheese for many years, producing over 155 million lbs in 2003 *(5)*. Other states with significant cottage cheese output include California, Illinois, Ohio and Iowa (Table 1). Domestic demand for United States cottage cheese products declined in the 1980s, falling from 4.5 lbs per capita in 1980 to 3.4 lbs in 1990 *(5)*. Following this decline in demand, the quantity of cottage cheese manufactured in NYS also decreased, reaching a low of 127.4 million lbs in 1993, in contrast to 156.8 million lbs manufactured in 1986 *(7, 15)*.

Alarmed by this trend of reduced cottage cheese manufacture and sales, Richard Ledford of Cornell University initiated a study in 1988 to evaluate the microbiological and sensory qualities of cottage cheese in New York State. Five major plants that produced conventional, cold-packed cottage cheese agreed to participate in the study. In 1991, shelf life results from cottage cheese collected from the five plants were summarized and presented to the study participants, along with an overview of potential sources of microbial contamination and recommended measures for its reduction. The concept of cottage cheese shelf-life extension through CO_2 addition to the cream dressing was also introduced.

Following the 1991 meeting, plants involved in the Cornell study implemented or enhanced measures to improve processing procedures and reduce microbial contamination in order to improve cottage cheese quality and shelf life. Throughout the 1990s, all five plants also adopted CO_2 addition to cream dressing as a means of extending product shelf lives. In this study, shelf-life characteristics of cottage cheese samples collected from the five New York State plants from 1988 to 1992 are compared with those of samples collected from 1999 to 2004, providing a perspective of product quality spanning 16 years. Factors contributing to improved NYS cottage cheese product quality and shelf life extension are presented.

MATERIALS AND METHODS

Sample collection, handling and storage

Samples of cottage cheese in consumer packages (12 oz., 16 oz. or 24 oz.) were collected from each of five plants in New York State and transported to the laboratory at ≤ 4.4 C. Sufficient numbers of each product lot were collected to analyze one package initially between 2 and 5 days post-packaging ("initial day" testing) and two packages on each subsequent shelf-life test day. All packages were stored at 6.1 C. Samples collected from 1988 to 1992, manufactured prior to the use of CO_2 as a shelf-life extender ("pre-CO_2"), were tested for microbiological and sensory characteristics initially and after 14 and 28 days (±1 day) of storage. Samples collected from 1999 to 2004,

TABLE 2. Numbers of cottage cheese products analyzed and average "sell-by" days and ranges for each sampling period

Sampling Period[c]	Number of Samples Tested[a]				"Sell-By" Average & Range[b]		
	Total	4%	LF	NF	Average	Minimum	Maximum
1988–1992	80	40	30	10	28.0	24	40
1999–2004	179	59	60	60	46.9	32	67

[a]Numbers represent individual products collected. Product types tested included 4% minimum milk fat (4%), lowfat (LF) and nonfat (NF).

[b]"Sell-by" reflects the number of days from processing to the date stamped on the product package.

[c]Sampling periods represent the calendar years when samples were collected.

TABLE 3. Percent of cottage cheese samples with detectable a coliform bacteria (≥ 1 CFU/g) at initial, 14, 28, 42 and 56 days for each sampling period[a]

Sampling Period	% Samples with Coliform Counts ≥ 1 CFU/g (No. of Samples Tested)				
	Initial Day	Day 14	Day 28	Day 42	Day 56
1988–1992	10.0 (80)	6.2 (160)	5.6 (160)	NT[b]	NT
1999–2004	2.3 (173)	1.4 (350)	1.7 (356)	1.1 (356)	0.3 (354)

[a]Initial testing performed 2–5 days after processing on a single package. Cottage cheese samples were subsequently stored at 6.1°C and previously unopened replicate packages were tested at 14, 28, 42 and 56 days post processing. Percentages were calculated based on total packages tested.

[b]Samples collected from 1988–1992 were not tested beyond 28 days (NT).

manufactured after implementation of CO_2 technology ("post-CO_2"), were tested initially and after 14, 28, 42 and 56 days (±3 days) of storage. The participating plants represented five of the six major cottage cheese manufacturers in New York State; one major manufacturer of hot-pack cottage cheese that does not utilize CO_2 technology was not included in the study.

Shelf-life evaluations

For each test day, all samples were evaluated for Standard Plate Count (SPC) and the presence of coliform bacteria, gram-negative bacteria (crystal violet tetrazolium chloride method, incubated 5 days at 21°C), and yeasts and molds (antibiotic plate count method, incubated 5 days at 21°C) *(20)*. Presumptive coliform colonies on violet red bile agar were confirmed using brilliant green bile broth. Only confirmed coliform counts were reported. All packages were sanitized with 70% ethanol prior to opening. Cottage cheese samples were stirred manually with a sterile spoon for two minutes, after which 11 g were weighed into a sterile stomacher bag. To the 11 g, 99 ml of sterile 2% sodium citrate was added and the sample was blended (stomached) for two minutes. Further dilutions were made with sterile phosphate buffer, as needed.

Sensory evaluation was performed following the guidelines of the American Dairy Science Association as described by Bodyfelt et al. *(6)*. Acceptability scores were determined by averaging individual scores of 4 to 8 trained panelists. Although the same panelists evaluated each given set of samples over its shelf life, personnel serving as panelists did change over the 16-year sampling period. Cottage cheese samples were scored on a scale of 1 to 10, with scores ≥ 8.0 considered "good" and scores < 6.0 considered "unacceptable." From well-mixed packages, approximately 30 to 40 g of cheese were distributed to each panelist in covered cups. One package of cottage cheese was evaluated on the initial test day. Although duplicate packages were microbiologically analyzed on each subsequent test day to improve chances of detecting random contamination (i.e., non-uniform growth of spoilage organisms across multiple packages from the same lot), only one of the duplicates, selected at random, was used for sensory analysis. Carbon dioxide levels were not measured in any of the products tested.

RESULTS AND DISCUSSION

Sample summary

The total numbers and types of cottage cheese samples tested during each sampling period are listed in Table 2. A total of 80 samples were tested from the five plants pre-CO_2 (1988 to 1992) whereas 179 samples were collected from the same five plants from 1999 to 2004, after they adopted CO_2 technology. The average sell-by dates or days in code for the pre- and post-CO_2 samples were 28.0 days and 46.9 days, respectively.

TABLE 4. Percent of cottage cheese samples with gram-negative bacteria counts (GN) ≥ 10 CFU/g or ≥ 1,000,000 CFU/g at initial, 14, 28, 42 and 56 days for each sampling period[a]

Sampling Period	% Samples with GN ≥ Indicated (No. of Samples Tested)				
	Initial Day	Day 14	Day 28	Day 42	Day 56
GN ≥ 10 CFU per g					
1988–1992	12.5 (80)	20.6 (160)	29.4 (160)	NT[b]	NT
1999–2004	1.7 (173)	1.1 (350)	2.0 (356)	0.6 (356)	1.1 (354)
GN ≥ 1,000,000 CFU per g					
1988–1992	0.0 (80)	6.2 (160)	11.2 (160)	NT[b]	NT
1999–2004	0.0 (173)	0.0 (350)	0.3 (356)	0.0 (356)	0.0 (354)

[a]Initial testing performed 2–5 days after processing on a single package. Cottage cheese samples were subsequently stored at 6.1°C and previously unopened replicate packages were tested at 14, 28, 42 and 56 days post processing. Percentages were calculated based on total packages tested.

[b]Samples collected from 1988–1992 were not tested beyond 28 days (NT).

TABLE 5. Percent of cottage cheese samples with yeast and mold counts (Y & M) ≥ 10 CFU/g or ≥ 10,000 CFU/g at initial, 14, 28, 42 and 56 days for each sampling period[a]

Sampling Period	% Samples with Y & M ≥ Indicated (No. of Samples Tested)				
	Initial Day	Day 14	Day 28	Day 42	Day 56
Y & M ≥ 10 CFU/g					
1988–1992	3.8 (80)	27.5 (160)	48.1 (160)	NT[b]	NT
1999–2004	2.3 (173)	7.7 (350)	12.7 (355)	17.4 (356)	21.8 (354)
Y & M ≥ 10,000 CFU/g					
1988–1992	0.0 (80)	5.0 (160)	18.1 (160)	NT[b]	NT
1999–2004	0.0 (173)	0.6 (350)	3.4 (355)	4.8 (356)	7.6 (354)

[a]Initial testing performed 2–5 days after processing on a single package. Cottage cheese samples were subsequently stored at 6.1°C and previously unopened replicate packages were tested at 14, 28, 42 and 56 days post processing. Percentages were calculated based on total packages tested.

[b]Samples collected from 1988–1992 were not tested beyond 28 days (NT).

Shelf-life evaluation

Cottage cheese contamination with potential spoilage organisms (i.e. yeasts, molds, gram-negative bacteria) is generally associated with handling steps after the heat processes. Potential sources of contaminants include inadequately treated curd wash water, soiled food contact surfaces and utensils, personnel and airborne contaminants *(2, 21)*. The results of the microbial analyses from the pre-CO_2 and the post-CO_2 sampling periods are displayed in Tables 3–6. Coliforms were detected in 10.0% of the samples tested on initial day in the pre-CO_2 period compared to 2.3% of the post-CO_2 samples (Table 3). Goel et al. *(12)* had reported previously that some coliform strains decline in numbers in cottage cheese during refrigerated storage while other strains can increase to high numbers. In the present study, the percent of coliform-positive samples decreased over shelf life during both periods, suggesting that coliforms did not reproduce and, in some cases, declined in numbers during refrigerated storage in the products tested. The data further suggest that coliform contamination, or the ability of coliforms to persist in these products, or both, was reduced in the post-CO_2 period as compared to the pre-CO_2 period.

The percentages of cottage cheese samples with detectable (≥ 10 CFU/g) and high (≥ 1,000,000 CFU/g) levels of gram-negative bacteria are shown in Table 4. Gram-negative bacteria were significant contaminants in the pre-CO_2 period; they

TABLE 6. Log average SPC values and % of cottage cheese samples with SPC ≥ 1,000,000 CFU/g at initial, 14, 28, 42 and 56 days for each sampling period[a]

Sampling Period	SPC Characteristics of Samples (No. of Samples Tested): Initial	Day 14	Day 28	Day 42	Day 56
Log average SPC of samples tested					
1988–1992	3.72 (80)	4.61 (160)	5.49 (160)	NT[b]	NT
1999–2004	4.26 (172)	4.77 (348)	5.67 (353)	6.03 (352)	6.23 (353)
% samples with SPC ≥ 1,000,000					
1988–1992	3.8 (80)	18.8 (160)	44.4 (160)	NT[b]	NT
1999–2004	14.5 (172)	20.4 (348)	44.2 (353)	53.7 (352)	58.9 (353)

[a]Initial testing performed 2–5 days after processing on a single package. Cottage cheese samples were subsequently stored at 6.1°C and previously unopened replicate packages were tested at 14, 28, 42 and 56 days post processing. Percentages were calculated based on total packages tested.

[b]Samples collected from 1988–1992 were not tested beyond 28 days.

were detected in 12.5% of samples on initial testing and in 29.4% of the samples at 28 days of storage. High levels of gram-negative bacteria were found in 6.2% and 11.2% of the pre-CO_2 samples at 14 and 28 days, respectively, indicating that these products were at or approaching the point at which defects could become evident. For all post-CO_2 test days, gram-negative bacteria were found in ≤ 2% of the test samples. Detection varied over subsequent test days, suggesting occasional, random-package contamination within a sample lot. Only one post-CO_2 package, on day 28, had a count ≥ 1,000,000 CFU/g. Based on results obtained, the potential for gram-negative bacterial spoilage in products manufactured in the participating plants appears to have been vastly reduced between 1988 and 2004.

Table 5 provides a summary of the percent samples in which yeast and/or mold were detected and in which counts were ≥ 10,000 CFU/g, indicating a substantial level of contamination and growth of these organisms. With the exception of initial-day testing, the incidence of detection and the percent samples with substantial counts were considerably higher in the pre-CO_2 period than in the post-CO_2 period. In the post-CO_2 period, the day-56 yeast and mold levels were still far below the pre-CO_2 day-28 results. Detection often appeared to represent occasional, random package contamination, as these organisms were not detected in all subsequent test-day packages of a given product. While yeasts or molds still appeared as potential spoilage organisms in products tested from the five participating plants, the fraction of contaminated products was much lower in the post-CO_2 period than in to the pre-CO_2 period.

No standards have been established for total bacteria counts in cottage cheese. The presence of high numbers of bacteria may reflect starter culture organisms that survive sub-lethal curd cook temperatures *(9, 11)* and/or their subsequent growth, post-heat addition of active cultures *(22)*, or the growth of gram-negative bacteria or other contaminants. Non-starter lactic acid bacteria and other gram-positive organisms also may be present in cottage cheese. On initial testing, the average log SPC was lower and a smaller fraction of samples with SPC values ≥ 1,000,000 CFU/g were observed in the pre-CO_2 period than in the post-CO_2 period (Table 6). In both test periods, the values of these parameters increased dramatically during storage, indicating psychrotrophic growth. Gram-negative bacteria were at least partly responsible for the high SPC values in the pre-CO_2 day 14 and day 28 samples, with counts ≥ 1,000,000 CFU/g in 6.2% and 11.2% of the samples, respectively (Table 4).

In the absence of evidence of gram-negative bacterial contamination and growth, other bacterial groups were responsible for increased SPC values. Based on the evidence (typical lactic acid bacteria colony morphology on SPC plates; characterization of gram-positive, catalase-negative cocci from some plates; and observed decreases in pH associated with increases in SPC values), it was considered likely that the predominant SPC microflora in both pre- and post-CO_2 samples often consisted of lactic acid bacteria. Whether these were surviving starter culture organisms or non-starter contaminants was not determined. Although lactic acid bacteria are not generally associated with cottage cheese spoilage, some samples with high SPC values had reduced pH values and pronounced acid, or in some cases bitter, flavors (data not shown). Average initial pH for post-CO_2 samples was 5.05, while 15.8% of the packages tested at 56 days had pH values below 4.70, with the pH of some samples decreasing by as much as 0.70 pH units.

Table 7 displays the average flavor scores and percent of samples considered unacceptable (scores < 6.0). Average scores were higher and the percentages of product failures were considerably less initially and at 14 and 28 days in the post-CO_2 period compared to the pre-CO_2 sampling. In the post-CO_2 period, the average flavor score was still acceptable, and only 20.7% of the samples had failed at 56 days of storage. Based on product acceptability as determined by trained panelists, these results indicate that the overall shelf-life potential of cottage cheese manufactured by the plants involved in this study had improved from 1988 to 2004.

TABLE 7. Average flavor scores and percent of samples with unacceptable flavor scores (< 6.0) at initial, 14, 28, 42 and 56 days for each sampling period[a]

Sampling Period	Flavor Score Characteristics for Samples (No. of Samples Tested): Initial Day	Day 14	Day 28	Day 42	Day 56
Average Flavor Scores					
1988–1992	7.3 (80)	6.9 (80)	6.0 (80)	NT[b]	NT
1999–2004	8.2 (173)	8.1 (179)	7.7 (179)	7.1 (179)	6.6 (179)
% of Samples Tested with Flavor Scores < 6.0					
1988–1992	6.2 (80)	8.8 (80)	35.0 (80)	NT[b]	NT
1999–2004	0.0 (173)	0.0 (179)	5.0 (179)	10.6 (179)	20.7 (179)

[a]Initial testing performed 2–5 days after processing on a single package. Cottage cheese samples were subsequently stored at 6.1°C and previously unopened packages were tested at 14, 28, 42 and 56 days post processing.

[b]Samples collected from 1988–1992 were not tested beyond 28 days.

SUMMARY

The shelf-life characteristics of conventionally packaged cottage cheese products manufactured by the five plants included in this report improved measurably over the 16-year span of this study. The incidence of contamination and growth of spoilage microorganisms had been dramatically reduced, and approximately 80% of the post-CO_2 samples were acceptable by sensory analysis at 56 days, as opposed to only 65% at just 28 days for pre-CO_2 samples. In response, average sell-by dates of tested samples increased from 28.0 days (1988 to 1992) to 46.9 days (1999 to 2004). The use of CO_2 has undoubtedly contributed to the product quality improvement and shelf-life extension observed in this study, especially to the reduced growth of gram-negative bacteria. Improvements in processing plant equipment and procedures designed to minimize post-processing contamination and the application of other shelf-life extension technologies also contributed to product quality and increased shelf lives. The plants involved in the study have extensive plant quality assurance programs.

Although the quantity of cottage cheese manufactured in New York State had fallen to a low in 1993, production has increased steadily since then *(5, 14, 15)*. Improving the quality and extending the shelf life of dairy products will allow manufacturers to distribute products over broader geographic regions while ensuring greater customer satisfaction. In a 1959 Cottage Cheese Symposium at the 54th Annual Meeting of the American Dairy Science Association *(2)*, Neil Angevine, addressing distribution and quality concerns of the industry, stated "We must be prepared to produce a dry or creamed cottage cheese that will retain a fresh, clean, mild acid flavor for 7 to 14 days." The cottage cheese industry has come a long way.

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Food Drying Workshops Promote Safe Home Drying Methods

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SUMMARY

Illnesses associated with dried foods have raised concerns about the safety of home drying methods. Studies at Colorado State University with apples, beef, carrots, parsley, peaches, potatoes and tomatoes showed that traditional drying methods may allow survival of *Escherichia coli* O157:H7, *Salmonella* and *Listeria monocytogenes*, and that simple modifications enhanced pathogen inactivation during dehydration. To encourage adoption of modified recommendations, a booklet, *Drying Foods*, and workshop were developed and pilot-tested with extension educators and volunteers (n = 75). Social Cognitive Theory and the Health Belief Model guided development of the materials and workshop. Surveys assessed food drying knowledge, attitudes and behavior pre-, post-and 6 weeks following the workshop. Sensory assessments of dried carrot and potato slices prepared using modified treatments enhanced experiential learning. Knowledge and attitude scores regarding safe food drying methods significantly ($P < 0.05$) improved between the pre-workshop evaluation and the follow-up evaluation. Participants also indicated improvements in food drying practices at the 6-week follow up. Acid-blanched potato slices received higher ($P < 0.05$) scores for appearance, flavor and overall acceptability, compared with untreated slices. Carrot samples received similar scores for flavor and acceptability regardless of treatment. Outcomes indicate improved subject knowledge, attitude and behavior, which may reinforce adoption of new food drying guidelines.

INTRODUCTION

Low moisture foods were once considered unlikely sources of foodborne illness; however, *Escherichia coli* O157:H7 infection and salmonellosis have been associated with consumption of meat jerky, dehydrated milk, infant cereal, chocolate, potato chips and a chip-type savory snack *(15, 16, 17, 31, 38, 42, 44)*. In New Mexico between 1966 and 1995, eight gastroenteritis outbreaks due to consumption of locally produced meat jerky contaminated with *Salmonella* and *Staphylococcus aureus* were associated with 250 illnesses *(26)*. In 1995, an outbreak of salmonellosis resulting in an estimated 1,000 illnesses was linked to contaminated paprika-powdered potato chips. Levels of 0.04 to 0.45 cells per gram were found in the chips leading investigators to conclude that even extremely low numbers of salmonellae adapted to the dry state may be able to cause illness *(44)*. From 1990 to 1999, the cumulative prevalence of *Listeria monocytogenes* in jerky produced in federally inspected plants was 0.52% *(46)*. *L. monocytogenes* is an environmental contaminant, and listeriosis has a high fatality rate in high risk populations; therefore, the Food Safety Inspection Service (FSIS) has established a zero tolerance (no detectable level permitted) for this pathogen in ready-to-eat foods. Beef jerky is included in the monitoring program *(29)*.

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TABLE 1. Mean knowledge scores[a] pre-, post (immediately following) and 6 weeks following participation in food drying workshop (n = 53)

Question	% Correct		
	Pre-	Post	Follow up
1. Foodborne illness outbreaks have been associated with beef jerky and venison jerky.[b]	84.6[A]	100.0[B]	98.1[B]
2. Microorganisms are not able to survive on dried fruits and vegetables.[c]	84.9[A]	100.0[B]	100.0[B]
3. In the past 15 years, the number of produce-associated foodborne illness outbreaks per year has decreased.[c]	84.9[A]	88.7[A]	88.7[A]
4. To maintain the best flavor and quality, store jerky in the refrigerator or freezer.[b]	83.0[A]	92.5[A]	96.2[A]
5. Dipping fruits in a solution containing ascorbic acid (Vitamin C), citric acid, or lemon juice may help enhance destruction of microorganisms during drying.[b]	77.4[A]	98.1[B]	88.7[AB]
6. Steam blanching vegetables before drying effectively enhances destruction of microorganisms.[c]	24.5[A]	73.6[B]	62.3[B]
7. Water blanching vegetables before drying effectively enhances destruction of microorganisms.[b]	59.6[A]	76.9[B]	84.6[B]
8. Sun/solar drying is a safe way to dry meats.[c]	90.6[A]	100.0[B]	100.0[B]
9. Sun/solar drying is a safe way to dry fruits and vegetables.[c]	56.6[A]	100.0[B]	98.1[B]
10. Dried fruits and vegetables should never be conditioned before storage.[c]	92.0[A]	86.0[A]	80.0[B]
Overall knowledge score	73.8[A]	91.6[B]	90.0[B]

[a]Knowledge items were scored on a scale of agree/disagree and presented as percent correct (% Correct) for each item.

[b]Scored on a scale of agree = correct and disagree = incorrect.

[c]Scored on a scale of disagree = correct and agree = incorrect.

A–B values with different superscripts within a row are significantly different ($P < 0.05$).

Cooperative Extension Services provide recommendations for drying foods at home, but these recommendations may not always be based on scientific documentation. Studies on dried meats, fruits and vegetables have continued to show that traditional home drying methods may allow survival of pathogens and that simple adjustments in preparation methods enhanced inactivation of bacteria during home-type dehydration and storage *(1, 2, 12–14, 20, 21, 23–25, 33, 53, 63)*. Albright et al. *(2)* reported that beef strips inoculated with a 4-strain mixture of *E. coli* O157:H7 (5.7–7.5 log CFU/cm^2) and marinated using a traditional recipe *(55)* had bacterial reductions of only 2.2 and 3.0–4.6 log CFU/cm^2 after 10 h of drying at 62.5 and 68.3°C, respectively. It was concluded that alternative treatments were needed to adequately destroy potential pathogen contamination during home-type dehydration of beef jerky.

Albright et al. *(2)* studied the fate of *E. coli* O157:H7 in beef jerky prepared using alternative treatments, dried in home-type dehydrators for up to 10 h at 62.5°C and stored at 21°C for up to 90 days. Among the methods evaluated, only the hot pickle cure method *(22)* consistently resulted in a greater than 5-log reduction in bacteria during drying (5.7–5.8 log CFU/cm^2). A consumer panel (n = 120) rated the jerky as moderately acceptable (3.7–3.9 on a 7-point scale with 7 = extremely acceptable) *(1)*. Dipping meat slices in 5% acetic acid (vinegar) followed by traditional marinade *(55)* was also shown to improve the effectiveness of drying on reducing numbers of *L. monocytogenes (12)*, *Salmonella (13)* and *E. coli* O157:H7 *(14)*.

Cooperative Extension Services recommend immersing fruits in organic acid or sulfite solutions before home-type dehydration as an optional treatment to help preserve the inherent characteristics (appearance, texture) of the final product *(4, 9, 22, 32, 40, 49, 61)*. Studies at Colorado State University with apples, peaches and tomatoes showed that treatment with organic acid or sulfite solutions enhanced inactivation of *E. coli* O157:H7, *Salmonella* and *L. monocytogenes* during fruit dehydration and storage *(11, 18, 20, 21, 63)*.

Cooperative Extension Services recommend blanching or immersion in a salt solution before drying, or oven heating after drying, to inhibit browning and extend the shelf life of home-dried veg-

TABLE 2. Respondent's attitude[a] toward the safe preparation of home dried foods pre-, post (immediately following) and 6 weeks following participation in food drying workshop (n = 53)

Question	% Agree		
	Pre-	Post	Follow up
1. I think it's important to monitor oven temperature throughout food drying.[b]	94.3[A]	98.1[A]	100.0[A]
2. I think it's important to monitor dehydrator temperature throughout food drying.[b]	90.4[A]	96.2[A]	98.1[A]
3. I don't worry that jerky may be contaminated with microorganisms and make me sick.[c]	90.6[A]	100[B]	100[B]
4. I don't worry that dried fruits and vegetables may be contaminated with microorganisms and make me sick.[c]	84.9[A]	98.1[B]	100[B]
5. I am not concerned about case-hardening of meats during drying.[c]	75.5[A]	100[B]	100[B]
6. I am not concerned about case-hardening of fruits and vegetables during drying.[c]	72.9[A]	100[B]	97.9[B]
7. I don't think it's important to store dried meats (jerky) in airtight containers.[c]	100[A]	100[A]	98.1[A]
8. I don't think it's important to store dried fruits and vegetables in airtight containers.[c]	98.1[A]	100[A]	100[A]
9. I think it's better to dry foods in a food dehydrator than an oven.[b]	77.4[A]	98.1[B]	98.1[B]
10. I think it's important to condition dried meats before packing them for storage.[b]	82.4[A]	90.2[A]	93.5[A]
Overall attitude score[b]	86.7[A]	98.0[B]	98.6[B]

[a]Attitude items were scored on a scale of agree/disagree and presented as respondent's percent agreement (% Agree) with the most safe food drying attitude.

[b]Scored on a scale of agree = most safe attitude and disagree = least safe attitude.

[c]Reverse coded so that agree = most safe attitude.

A–B values with different superscripts within a row are significantly different ($P < 0.05$).

etables *(9, 19, 32, 34, 41, 50, 56, 59)*. DiPersio et al. *(23)* evaluated the influence of steam blanching (88°C, 3 min), water blanching (88°C, 3 min), immersion in 3.23% NaCl (25 ± 3°C, 5 min), and post-drying oven heating (80°C, 15 min) on *Salmonella* populations during dehydration (60°C, 6h) and storage of carrot slices. All samples had populations > 1.7 log CFU/g after 6 h of drying and 30 days of storage at 25°C and therefore may pose a food safety risk if contaminated. In follow-up studies, DiPersio et al. *(24, 25)* showed that using longer blanching times (4 min water blanching or 10 min steam blanching), or blanching in a 0.105% or 0.210% citric acid solution before drying (4 min) enhanced *Salmonella* destruction during home-type dehydration and storage of carrot and potato slices.

Guidelines for the preparation of safe and palatable dried foods must be made available to, and adopted by, home food preservers to help reduce foodborne illness associated with home dried foods. Specifically, home food preservers need knowledge of safe drying methods and the motivation to act on that knowledge as preconditions to behavior change *(48)*. The objectives were to develop theory-driven, research-based educational materials and train-the-trainer workshops designed to encourage adoption of acceptable (safety, taste, appearance) home drying guidelines for meats, fruits and vegetables. Sensory assessments of dried carrot and potato slices left untreated or blanched in 0.105% or 0.210% citric acid before drying were included in the workshop to enhance experiential learning *(5, 6)*. Surveys were used to assess food drying knowledge, attitude and behavior immediately before, immediately following and 6 weeks following the intervention.

MATERIALS AND METHODS

Participants

Participants (n = 75) were recruited through Cooperative Extension Services and included Master Food Preservers, Cooperative Extension agents and volunteers, and consumers interested in food preservation. The Human Research Committee, Office of Regulatory Compliance, approved the consent forms and surveys used in the study.

TABLE 3. Food drying behavior patterns pre- and 6 weeks following participation in food drying workshop

	Pre-workshop Mean[a] ± SD	6 weeks post workshop Mean[a] ± SD
I would rate my food drying practices as:	4.4 ± 1.2B	
Before attending the workshop, I would rate my food drying practices as:		3.7 ± 1.1A
As a **direct result** of attending the workshop, I would **now** rate my food drying practices as:		4.8 ± 0.7B

[a]Mean scores (SD) are based on a five-point scale (1 = "Unsafe," 3 = "Somewhat Safe," 5 = "Extremely Safe").

A–B values with different superscripts are significantly different ($P < 0.05$).

Instrument development

Elements of the Health Belief Model *(30, 37)* were used to develop evaluation instruments administered immediately before, immediately following and 6 weeks following the intervention and designed to assess changes in knowledge, attitudes and behavior as a result of workshop attendance.

Questions addressing knowledge, attitude and behavior concerning the safe preparation of home-dried foods were reviewed by experts in the fields of food safety, food microbiology and nutrition education for content validity; culled; and then tested for reliability by 20 consumers who completed the surveys at 0 and 14 days without any food drying instruction in the interim (test, retest method) *(43)*. The McNemar's Test of symmetry for paired observations showed no significant ($P > 0.05$) change from test to retest for items addressing subject knowledge, attitude and behavior. Cronbach's coefficient alpha for the ten knowledge and ten attitude questions was 0.75. Because a Cronbach's coefficient alpha of > 0.70 indicates item homogeneity *(43, 58)*, all 20 questions were included in the evaluation instrument.

Education

The educational materials and workshop were designed to provide those trained with both an understanding of why changes are recommended and the skills to show others how to make the changes. Social Cognitive Theory *(5, 6)* and The Health Belief Model *(30, 37)* were used to develop theory-driven, research-based train-the-trainer workshops that promoted guidelines for safe home drying of meats, fruits and vegetables. Outcome expectancy is a person's estimate that a given behavior will lead to certain outcomes. This component of Social Learning Theory was used to develop educational materials focused on encouraging adoption of revised home food drying recommendations. Specifically, materials included information about *E. coli* O157:H7 infection and salmonellosis related to consumption of home made meat jerky and paprika-powdered potato chips to increase participant awareness of potential risks. Methods found to enhance destruction of pathogens in home dried foods were explained, and participants were encouraged to adopt these methods to reduce the risk of foodborne illness. Perceived threat and perceived benefits are important components of the Health Belief Model *(30)*. The ability of pathogens to survive the drying process and cause serious illness (perceived threat), and the ability of new preparation methods to minimize pathogen survival and the risk of illness (perceived benefit) were included in the workshop.

A 15-page bulletin, *Drying Foods (22)*, containing guidelines for the safe preparation and storage of dried foods was developed as a teaching tool. A rating form was developed to evaluate the bulletin's understandability, usefulness, believability, graphics and overall likeability. The two-hour workshop included background information on foodborne pathogens, general food safety information, and recommendations and demonstrations on the safe preparation, handling and storage of home-dried foods. Sensory evaluations of dehydrated carrot and potato slices left untreated (control) or blanched in a 0.105% or 0.210% citric acid solution (4 min, 88°C) provided an experiential component to the workshop.

Sample preparation for sensory evaluation

Samples were prepared in kitchens available in the Department of Food Science and Human Nutrition (Colorado State University, Fort Collins, CO). Fresh carrots and potatoes were obtained from a local supermarket in the fall of 2004, washed, peeled and sliced into circular discs (3 mm thickness), using a hand-operated slicer. Treatments and drying times used were derived from those found to enhance destruction of pathogens in dehydrated carrot and potato slices *(24, 25)* but not yet evaluated for their effects on sensory characteristics. Slices were left untreated (control) or blanched (88°C, 4 min) in 0.105% or 0.210% citric acid (Fisher Scientific, Fair Lawn, NJ), and dehydrated for 6 h at 60°C (140°F) in home-type dehydrators (American Harvest Gardenmaster, model FD-1000, Nesco, Chaska, MN).

After drying, dehydrators were turned off and left for 30 min to allow samples to cool. Vegetable slices were removed from the dehydrators with rubber gloves and placed in 1-quart Ziploc freezer bags (Nasco, Modesto, CA). Bags were left open, allowing samples to cool in the bags at 25°C for an additional 24 h. One sample, consisting of 12 carrot slices (approximately 10g) or 2 potato slices (approximately 10g), was selected randomly from each treatment. Each of these samples was placed in an individual Ziploc snack-

TABLE 4. Mean (n=53) ratings for sensory qualities of carrot slices and potato slices left untreated (control), blanched in 0.105% citric acid (88°C, 4 min) or blanched in 0.210% citric acid (88°C, 4 min), and dried for 6 h at 60°C (140°F)

Carrot Slices	Appearance[1]	Flavor Acceptability[1]	Flavor Description[2]	Color[3]	Texture[4]	Overall Acceptability[1]
Control	4.71^{A}	6.04^{A}	5.97^{A}	3.78^{A}	4.97^{A}	5.84^{A}
Citric Acid 0.105%	6.49^{B}	5.78^{A}	5.78^{A}	6.45^{B}	3.82^{B}	5.73^{A}
Citric Acid 0.21%	6.04^{B}	4.84^{A}	5.22^{A}	6.37^{B}	3.51^{B}	4.67^{A}
Potato Slices						
Control	2.82^{A}	3.02^{A}	4.06^{A}	4.51^{A}	3.51^{A}	2.92^{A}
Citric Acid 0.105%	6.51^{B}	5.12^{B}	5.00^{AB}	3.43^{A}	1.82^{B}	5.02^{B}
Citric Acid 0.21%	6.61^{B}	5.53^{B}	5.29^{B}	3.72^{A}	2.18^{B}	5.52^{B}

[1]Hedonic values are based on a nine-point scale (1 = "dislike extremely," 5 = "neither dislike nor like," 9 = "like extremely") for appearance, flavor acceptability and overall acceptability.

[2]Flavor description values based on a nine-point scale (1 = "extremely tart," 5 = "neither tart nor sweet," 9 = "extremely sweet").

[3]Color values based on a nine-point scale (1 = "extremely light," 5 = "neither light nor dark," 9 = "extremely dark").

[4]Texture values based on a nine-point scale (1 = "extremely brittle," 5 = "neither brittle nor rubbery," 9 = "extremely rubbery").

A–B means with different superscripts within a column are significantly different ($P < 0.05$).

size bag (Nasco, Modesto, CA) identified with a 3-digit code number. Samples were kept frozen (4°C) until the time of testing.

Sensory evaluation

As part of the training workshop, each participant received a tray containing coded samples, two unsalted crackers, a cup of tepid, distilled water for cleansing the palate, and corresponding surveys. Dried carrot and potato sensory evaluation surveys were developed in accordance with Institute of Food Technologist guidelines *(36)* and included six sensory characteristics (appearance, flavor description, flavor acceptability, color, texture, overall acceptability), along with corresponding description terms. Respondents rated dried vegetable slice appearance, flavor acceptability and overall acceptability by use of a nine-point hedonic scale (1 = "dislike extremely"; 5 = "neither like nor dislike"; 9 = "like extremely"). Samples were also evaluated for flavor description (1 = "extremely tart"; 9 = "extremely sweet/bland"), color (1 = "extremely light"; 9 = "extremely dark") and texture (1= "extremely brittle/hard"; 9 = "extremely soft/chewy"). Participants were allowed to retaste samples and change rating scores. Panelists were aware that some samples were blanched in citric acid, which may have influenced their responses. Demographic and behavioral questions were also included in the survey.

Physical analysis

Carrot and potato slices from each treatment were analyzed for pH and water activity. The pH of samples was measured with a digital pH meter with a glass pH electrode (Denver Instruments, Arvada, CO). A water activity meter (model AwQUICK, Rotronic Instrument Corp., Huntington, NY) was used to analyze samples for water activity according to AOAC International official method 978.18.

Statistical analysis

Data were analyzed with the Statistical Analysis System (SAS Institute version 9.1, Cary, NC). The McNemar's Test and t-tests were used to test for differences between pre- and post, pre- and follow up, and post and follow up survey responses. Sensory data for each vegetable were analyzed separately using a randomized block design. Comparisons between sample means were done using least significant differences (LSD). A significance level of $P < 0.05$ was used for all statistical analyses. Means and standard deviations for pH and water activity data were calculated.

RESULTS AND DISCUSSION

Demographics

Of the 75 consumers who participated in the workshop, 53 completed and returned the follow up survey. Participants (n = 53) were primarily female (88.7%), white (88.2%) and between the ages of 35 and 64 years (83%). With regard to affiliation, 45.3% of participants identified themselves as Master Food Preservers, 30.2% as Cooperative Extension Agents, 5.7% as 4H Leaders or volunteers and 18.9% as consumers. Sixty-six percent of the participants indicated that they had dried foods in the past five years, and 54.7% said that they had done so in the past year. Among those who had dried foods in the past 5 years, 77.1% indicated they had dried fruits/fruit leathers, 62.9% herbs, 60% vegetables and 54.3% meats.

Education outcomes

Knowledge items were scored on a scale of agree/disagree, and a percent correct score was calculated for each item (Table 1). McNemar's Test showed that the initial (pre-workshop) mean score for knowledge items (73.8% correct) had significantly ($P < 0.05$) improved immediately following (91.6% correct), and six weeks following (90.0% correct) participation in the training workshop (Table 1). Knowledge is factual information that a learner uses to perform a task in a desired manner, and must precede behavior change *(47,48)*.

Attitude items were scored on a scale of agree/disagree and presented on a scale of 0 to 100% agree, with 100% agreement being the most safe food drying attitude (Table 2). McNemar's Test showed that overall mean scores for attitude items significantly ($P < 0.05$) improved, from 86.7% before the workshop to 98% agreement with the most safe food drying attitude immediately following the workshop, and remained at that level through the 6 week follow up (Table 2). An attitude is learned through the environment and can be used to predict the likelihood that a person will be motivated to move to action *(27, 30, 43, 47)*.

According to pre-workshop survey scores, approximately 10–15% of participants were not concerned that dried foods may be contaminated with microorganisms and make them sick (Table 2). However, in New Mexico between 1966 and 1995, 250 illnesses were traced to consumption of meat jerky contaminated with *Salmonella* and *Staphylococcus aureus (26)*. In 1995, an outbreak of *E. coli* O157:H7 infection was traced to home made deer jerky *(39)* and approximately 1,000 cases of salmonellosis were linked to consumption of contaminated potato chips *(44)*. Immediately following and 6 weeks following the education intervention, > 98% of participants were concerned about the safety of dried foods.

As indicated by pre-workshop survey results, only 72 to 76% of participants were concerned about case hardening during dehydration of meats and/or produce (Table 2). Case hardening occurs when heat is applied too rapidly during drying, the outer layer of the food dries too quickly and further moisture release from the center of the food is prevented *(22, 52)*. Case hardening and moisture retention in dried foods leads to rapid spoilage and the potential survival of any harmful bacteria present *(8)*. Immediately following and 6 weeks following the workshop, 98 to 100% of participants reported that they were concerned about case hardening in dried foods (Table 2).

To better understand how participants viewed the safety of their own food drying practices, they were asked on the pre-test to rate their food drying practices on a scale of 1 = unsafe to 5 = extremely safe. At the six-week follow up, they were asked to reflectively judge the safety of their food drying practices before the workshop and now as a direct result of attending the workshop. At the 6-week follow up, participants indicated that their pre-workshop food drying practices were not as safe as they had thought prior to taking the workshop ($P < 0.05$) but that they had improved as a direct result of attending the workshop (3.7 ± 1.1 pre- vs. 4.8 ± 0.7 follow up) (Table 3).

A five point scale (1 = "I don't usually do this", 3 = "I sometimes do this", 5 = "I have always done this") was used to further evaluate participants' typical food drying behaviors at the pre-test and six weeks following the workshop. Compared to pre-workshop survey responses, follow up survey responses suggested that participants were more likely ($P < 0.05$) to monitor oven temperature with a thermometer (4.1 ± 1.8 pre- vs. 4.8 ± 0.9 follow up) and more likely to immerse fruit slices/pieces in a citric acid solution before drying (2.6 ± 1.6 pre- vs. 3.5 ± 1.4 follow up) (data not shown) as desired. Research showed that immersion in a 1.7% citric acid solution before drying enhanced destruction of pathogens during home-type dehydration and storage of apple and peach slices *(11, 18, 20, 21)*.

Workshop participants rated the *Drying Foods* bulletin for understandability, usefulness, willingness to follow and overall likeability. Mean scores ranged from 6.2 to 6.7 on a seven-point scale (1 = "not very easy to understand", "not very useful", "not very willing to follow" or "dislike extremely" to 7 = "very easy to understand", "very useful", "very willing to follow" or "like extremely"). These favorable scores indicated that participants liked the *Drying Foods* bulletin, found it somewhat useful and easy to understand, and were willing to follow the recommendations. It is essential that health educators develop interesting, personalized, science-based messages to help increase consumer knowledge and awareness about safe food handling *(10)*. Feedback was used to guide the modifications of content and format of the bulletin.

Sensory evaluation

Carrot slices blanched in 0.105% or 0.210% citric acid prior to dehydration had significantly ($P < 0.05$) higher scores for appearance than did slices left untreated before drying (Table 4). Consumer comments revealed that untreated carrot slices had a shriveled/crumpled appearance compared to acid blanched samples. Pectins, a main structural component of the plant cell wall, are susceptible to enzymatic degradation *(45)*. Enzyme-induced changes in pectins affect the structural characteristics of plant tissue and may influence the overall appearance of dehydrated vegetables *(35, 45, 51, 54)*. In the current study, blanching prior to dehydration helped maintain the appearance of dried carrots, perhaps because of the inactivation of enzymes and stabilization of pectins *(45, 51)*. Citric acid blanched carrot slices were considered significantly ($P < 0.05$) more brittle/hard than controls. Textural effects may have been due to the acidification of pectin enzymes during treatment with heat and acid, resulting in increased free carboxyl groups of cell wall pectin and subsequent cross-linking by endogenous calcium, as proposed by Sapers and Miller *(57)* and Bartolome and Hoff *(7)*. Nevertheless, all carrot samples received similar scores for flavor acceptability, flavor description and overall acceptability, regardless of treatment (Table 4).

Mean scores for potato slices blanched in 0.105% or 0.210% citric acid before dehydration were rated significantly higher ($P < 0.05$) for appearance, flavor acceptability and overall acceptability compared to untreated samples (Table 4). Further-

more, consumers considered acid blanched potato slices somewhat lighter in color than untreated samples. Citric acid has been used for decades to inhibit browning in home-dried fruit *(62)* and may have had an enhancing effect on the blanching treatment used on potato slices. In a related study, Sapers and Miller *(57)* determined that immersion (15–20 min) of pre-peeled potatoes in a heated (45–55°C) citric/ascorbic acid solution (2% and 1%, respectively) prevented discoloration of the peeled surface for up to 14 d at 4°C. In the present study, consumers considered acid blanched potato slices significantly ($P < 0.05$) more brittle/hard than slices dried without a treatment. Similarly, toughening was found to be associated with the presence of citric acid in heated solutions used to control discoloration in peeled potatoes and may be related to pectin degradation *(57)*. Nevertheless, blanching in 0.105% or 0.210% citric acid prior to dehydration maintained or improved the appearance, flavor acceptability and overall acceptability of dried carrot and potato slices.

Physical analysis

The pH values of untreated (control) carrot (5.35 ± 0.28) and potato slices (5.66 ± 0.23) remained near or within the normal range for carrots and potatoes (5.40–5.80 and 5.40–5.90, respectively) *(28, 60)* throughout 6 h of dehydration and 30 days of storage (data not shown). Carrot slices blanched in 0.105% citric acid (pH 3.08 ± 0.07) or 0.210% citric acid (pH 2.48 ± 0.2) had pH values (4.28–4.47 and 3.87–4.12, respectively) that were significantly ($P < 0.05$) lower than the pH values of untreated samples throughout dehydration and storage. Potato slices blanched in 0.105% or 0.210% citric acid had pH values (4.95 ± 0.55 and 4.90 ± 0.63, respectively) that were generally lower than those of untreated samples throughout dehydration, and significantly ($P < 0.05$) lower than those of untreated samples throughout storage. Treatment had no effect ($P > 0.05$) on the water activity of carrot and potato slices, which ranged from 0.98 to 0.99 at 0 h of dehydration (data not shown). After 6 h of dehydration, carrot and potato slices, had water activity values of 0.26 to 0.31 and 0.12 to 0.17, respectively.

CONCLUSIONS

An increasing association between low moisture foods and foodborne infection has led to concerns about the safety of home dried foods *(15, 16, 17, 26, 42, 44)*. Research has shown that traditional treatments for drying foods at home may allow survival of pathogens and that minor modifications in preparation methods reduced survival of bacteria during drying and storage *(1, 2, 12-14, 20, 21, 23-25, 63)*. Outcomes of educational workshops indicate improved knowledge and attitude concerning safe food drying methods, which may reinforce adoption of new food drying guidelines by home food preservers. Participants were more likely to practice some safe food drying behaviors, and believed their food drying practices improved as a direct result of attending the training workshop. Modified treatments, including blanching in a 0.105% or 0.210% citric acid solution before drying, maintained or improved the appearance, flavor and overall acceptability of dehydrated carrot and potato slices. Methods and educational materials are currently being publicized through Colorado State University Cooperative Extension and are available to consumers through educational activities, bulletins, fact sheets and the internet. It is important to note that drying procedures, educational materials and workshops were developed and tested in Colorado and, therefore, may be less relevant to other areas of the country.

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Jones-Hamilton Co.
Walbridge

Roger Roeth
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OKLAHOMA

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Philip Morris
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WISCONSIN

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Christine M. Aleski
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Gale Prince
The Kroger Co.
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Dennis Bogart
Randolph Associates
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UPDATES

Dr. Paul A. Hall Joins MATRIX MicroScience as VP of Global Business Development

MATRIX MicroScience Inc., has announced that Dr. Paul A. Hall has joined the company as vice president of global business development. Dr. Hall comes to MATRIX with over 30 years food safety leadership experience in the industry. Prior to joining MATRIX, Dr. Hall held the position of chief microbiology and food safety officer for Kraft Foods Global. At Kraft, Dr. Hall was responsible for the microbiological safety and stability of some of the most well-known food and beverage brands in North America and in the world.

Dr. Hall holds his bachelors degree from the University of Missouri-St. Louis, his masters degree in management of technology from Washington University in St. Louis, MO, and his Ph.D. degree in quality management from Lasalle University.

Dr. Hall is a world-renowned expert in the microbiological safety and stability of foods and beverages. He is past president of the International Association for Food Protection and has been actively involved with various professional organizations and institutes, including the International Life Sciences Institute, the University of Georgia Center for Food Safety, the National Center for Food Safety and Toxicology, the Institute of Food Technologists, the American Society for Microbiology, the Food Products Association, and the International Dairy Foods Association among others.

Dr. Hall has published and lectured extensively in many areas including rapid detection and characterization of foodborne pathogens and spoilage organisms, HACCP, food preservation, food hygiene, and employee training.

Dr. Hall commented, "I am extremely excited to bring my background and experience to the MATRIX team. The PATHATRIX system is the only commercially available system successfully addressing the up-front selection and concentration of target organisms. The PATHATRIX system is extremely flexible in that it is compatible with a number of existing rapid microbiological methods, and, when applied in a sample pooling format, can literally save a company thousands of dollars in testing costs. I believe that my experience as a practicing industry food microbiologist will help the industry embrace this technology as an integral part of their environmental, ingredient, and finished product testing programs."

Dr. Adrian Parton, C.E.O. of MATRIX MicroScience commented, "We are delighted that someone of Dr. Hall's integrity and world-class reputation has joined the MATRIX team. His intimate knowledge of the food industry will provide MATRIX with another dimension to satisfy his customers' needs."

FMC FoodTech Introduces New Executive Leadership

FMC FoodTech has introduced the newest member of its leadership team.

Toby Arvidsson has been appointed the new manager for FMC FoodTech's Food Solutions and Services Division (FSSD) and will play an integral role in strengthening the company's position as a knowledge supplier for the industry. Mr. Arvidsson steps into this position following the recent retirement of Jeff Simoneau as FSSD division manager after 29 years of service to the company. Mr. Arvidsson has more than 30 years of food processing industry experience and has been with FMC FoodTech since the company's acquisition of Frigoscandia Equipment in 1996. Prior to his new position, he was manager of FSSD in Europe for five years and spent two years as general manager for North America.

California Restaurant Association Announces New Senior Vice President

The California Restaurant Association (CRA) has hired Sally Howard as senior vice president of marketing and development.

Because this year represents CRA's 100th anniversary, Ms. Howard's role will include advancing current statewide strategic marketing and development objectives to integrate the Association's tradition with its future potential to increase awareness and visibility.

Ms. Howard joined CRA from the California Exposition and State Fair, where she had been for the past ten years. After 18 months as a facilities marketing representative, she was appointed as the interim assistant general manager of marketing, receiving full appointment by Governor Wilson shortly after.

In 1988 she received an A.A. degree with honors in food service management from American River Junior College in Sacramento. She graduated Cum Laude from Cal Poly Pomona with a B.S. degree in hotel and restaurant management in 1991. In 1996, she received her MBA degree with an emphisis in marketing from California State University, Sacramento.

International Association for Food Protection® NEWS

Food Safety Magazine Awards John Butts and Don Zink with Distinguished Service Honors

The publishers of the trade publication *Food Safety* Magazine will present the prestigious 2006 Food Safety Distinguished Service Awards to food safety pioneers John N. Butts, Ph.D. and Don L. Zink, Ph.D., at the food safety conference March 9, in Washington, D.C.

The *Food Safety* Magazine Distinguished Service Award honors individuals who best exemplify the characteristics of the dedicated food safety professional. Those honored are recognized by members of the profession for their collective works in promoting or advancing science-based solutions for food safety issues.

Dr. John N. Butts is vice president, Research, with Land O'Frost, Inc. This award recognizes John's pivotal work and leadership in the development of Land O'Frost's Seek & Destroy program of sanitation, equipment and maintenance; his leadership in the implementation of one of the first food processing plant HACCP programs in the US; and as part of the Land O'Frost Design Team, his leadership in the company's application of the AMI Principles of Sanitary Equipment and Facilities Design guidelines in the construction and design of Land O'Frost's new greenfield processing facility opening in 2006.

Dr. Don L. Zink is senior food scientist, Office of Plant and Dairy Foods and Beverages, Center for Food Safety and Applied Nutrition, US Food and Drug Administration. This award recognizes Don's nearly 30 years of contributions that have advanced sound food safety science in all three stakeholder groups—academia, industry and government. Among his accomplishments, Don founded the Microbiology Round Table; was instrumental in advancing the use of HACCP in his work with industry, trade associations and government committees; developed and implemented harmonized food safety policies and procedures for Nestlé USA, where he was responsible for all aspects of product safety, including thermal processing, microbiological food safety, toxicology and regulatory affairs; and most recently, is leading efforts to advance food safety through current Good Manufacturing Practices (cGMP) modernization and allergen control guidelines.

"Their outstanding individual efforts have helped to establish a solid foundation in the US for the development of science-based food safety policies, real-world management strategies and innovative technology and systems applications," stated Stacy Atchison, publisher of *Food Safety* Magazine and Food Safety World executive director.

USDA Continues Efforts to Safeguard the Nation's Food Supply

The US Department of Agriculture has announced additional efforts in collaboration with states and private industry to protect the nation's food supply from terrorist threats. "Ensuring the safety of our nation's food supply remains a top priority for President Bush and USDA. We remain steadfast in our commitment to work with our federal, state and private sector partners so that we can keep our agricultural commodities safe," said Dr. Richard Raymond, USDA under secretary for food safety.

USDA's Food Safety and Inspection Service (FSIS) will conduct five critical food defense exercises this year. The first exercise took place in Alameda, CA on Jan. 18 and 19. These exercises are designed to practice reporting a non-routine incident while coordinating with all levels of government, non-governmental agencies and the private sector in an incident command system structure. These exercises will challenge all participants to collaborate more closely and become better prepared to keep the food supply safe.

The first day of the exercise will focus on non-routine incident reporting and how program offices would manage an emergency and the second day will focus on product recall and public health and communication issues. Additionally, FSIS will test its ability to coordinate with organizations outside of USDA, such as the local and state departments of health and agriculture, the Federal Bureau of Investigation, the US Department of Homeland Security, the US Department of Health and Human Services' Food and Drug Administration (FDA) as well as the affected industries.

Additional food defense exercises will be conducted in Raleigh,

NC, March 22–23; Chicago, IL May 17–18; Minneapolis, MN July 19–20; and Albany, NY, Sept. 20–21. FSIS will eventually conduct similar exercises in all 15 FSIS regional district offices.

In July 2005, USDA announced the Strategic Partnership Program Agroterrorism (SPPA) Initiative, which supports President Bush's requirements directing the government to work closely with states and industry to secure the nation's food supply. In December, the first pilot visit was conducted by USDA's Farm Service Agency and Grain Inspection, Packers and Stockyards Administration in cooperation with FDA and the grain export elevator industry in New Orleans, LA. The purpose of these visits is to assess and identify vulnerabilities in the agriculture and food sectors. In March, USDA and FDA will jointly assess frozen foods in Wisconsin and Florida. Also in March, USDA will conduct an assessment on swine with the Iowa Department of Agriculture and the National and Iowa Pork Producers. Currently, the results of grain export elevator industry assessment are being evaluated.

In order to "respond quickly and effectively to a terrorist attack, a major disease outbreak, or other disaster affecting national agriculture and food infrastructure," the White House issued Homeland Security Presidential Directive (HSPD) 9. HSPD-8 requires that all federal, state and local response capabilities are adequate. The Incident Command System was established in response to HSPD 5, which requires that the federal government and states have a comprehensive approach to emergency management and coordinate the efforts of individual agencies as they work toward the common goal of stabilizing the incident and protecting both public health and food supply.

Additional information about agrosecurity can be found on USDA's Web site at www.USDA.gov/homelandsecurity.

Food Authority Develops International Safe Mercury Message

The NSW Food Authority has been asked by the leading health body to help devise communication solutions so other countries can show people how to safely eat fish while reducing the risk from mercury.

The World Health Organization (WHO) invited the Food Authority to participate in a Geneva workshop following the success of the Authority's Mercury in Fish campaign, which recently won a national award for excellence.

Executive director of corporate and consumer services, Samara Kitchener, will outline how the innovative campaign dispelled misunderstanding about mercury in fish.

Acting director-general Terry Outtrim said many countries were struggling to inform consumers how to balance the healthy benefits of fish while reducing the risk from mercury.

"The Food Authority's Mercury in Fish campaign has been recognized as an international benchmark and that's exactly the type of expertise WHO wants to tap into," Mr. Outtrim said.

"Ms. Kitchener has been invited to provide a summary of our work on risk communication and help prepare resource materials for use by countries around the world. The Food Authority is recognized internationally as being at the forefront of risk communication and we're more than happy to share our expertise in this area," said Mr. Outtrim.

Mr. Outtrim said the Mercury Campaign, which was launched in May, showed pregnant and breast-feeding women how to enjoy the healthy benefits of fish, such as Omega 3, while reducing mercury.

"Unfortunately there was a great deal of fear and misunderstanding and our research showed many women stopped eating fish altogether and sacrificed all the great health benefits. Our campaign provided science-based advice that was easy to follow, so women could make healthy choices. Mercury in fish is not an issue for the general population, and the campaign addressed this from the beginning. Key to its success was the support of a broad coalition of industry, consumer and medical groups, who joined the Food Authority to drive an important public health message. The Food Authority produced 500,000 wallet cards featuring the dietary advice, and these have been distributed across NSW by our partners, fish retailers and Coles Supermarkets," Mr. Outtrim said.

Revised Guidance for Food Businesses

The Agency is issuing revised guidance for the Regulation on Microbiological Criteria for Foodstuffs, which applies from January 11, 2006. The aim of the guidance is to help UK food business operators understand the requirements of new European legislation.

The Agency's consultations on this regulation, the UK Regulatory Impact Assessment and associated guidance, generated extensive comments from many key stakeholders and those concerning the clarity of the text are reflected in the final guidance. We also received requests for detailed guidance relating to the practical application of the regulation in a number of areas such as: enforcement, primary production, small businesses, durability studies, sampling plans and frequency, the relationship between the regulation and food safety management practices, transitional derogation for minced meat, meat preparations and meat products, and training for food business operators and enforcement officers.

We plan to work with relevant stakeholders to ensure the additional guidance requested is provided and will arrange a meeting within the next two months to take this work forward.

The Agency also proposes to review the guidance document after 12 months to take account of experience gained in applying the regulation. We would therefore like to invite comments on the practical application of the regulation and the guidance up to December 31, 2006.

In the meantime, the Agency is happy to provide advice direct to food businesses, and food businesses should be aware that some trades organizations, such as the British Retail Consortium and Chilled Food Association, have produced guidance on complying with the regulation that may also be helpful.

Guidance on EC Regulation 2073/2005 on Microbiological Criteria for Foodstuffs. General guidance for food business operators (pdf 92 kb) available at http://www.foodstandards.gov.uk/multimedia/pdfs/ecregguidmicrobiolcriteria.pdf.

New Food Law to Enhance Consumer Protection – FSAI Publishes Information Pack

The Food Safety Authority of Ireland (FSAI) has published an information pack containing a range of leaflets to assist compliance by food businesses with the requirements of new EU food hygiene regulations which came into force on January 1st. The new EU food law aims to optimise the protection of public health through improving and expanding current legislation. It is applicable to over 40,000 food businesses in Ireland and the farming community.

The new food law brings together 17 previous EU Hygiene Directives into five new pieces of legislation. The legislation introduces a "farm to fork" approach to food safety. Primary production (farming) is now an integral part of food hygiene legislation for the first time. It also puts the legal obligation on the food businesses to bear the full responsibility for the safety of food produced.

The five leaflets included in the information pack produced by the FSAI, which are freely available to interested parties, are entitled Key Principles and Obligations for Food Businesses; General Food Law; Regulation on Microbiological Criteria; Regulation for Restaurants, Caterers, Retail and Wholesale Operators; and Regulation for Premises Handling Products of Animal Origin. The leaflets outline in simple terms the legal obligations of food businesses. In addition, the FSAI has a section on its Web site that provides further advice and will be continually updated as more information becomes available from the EU and Irish Government departments. The Web site and leaflets will be of interest to all food businesses in Ireland, enforcement officers and interested parties.

According to Dr. John O'Brien, chief executive, FSAI the new comprehensive food law encompasses 17 pieces of old legislation, some dating back over 40 years which led to some inconsistencies and difficulties of understanding. "The new legislation brings together all the various regulations and assembles them out more clearly for food businesses to understand. The underlying premise of the law now very clearly states that it is the legal duty of food business operators to produce food safely. This is a requirement that is contained in current legislation and is underpinned in general food law. The FSAI's role in relation to this new food law is to assist the enforcement officers in its application. This series of leaflets for food business operators is to present the legislation in simple terms and enable them to better understand the comprehensive range of legislation impacting on their businesses," says Dr. O'Brien.

Dr. O'Brien confirmed that the new legislation requires all food business operators, except primary producers, to implement and maintain procedures based on the principles of HACCP which will ensure the production of safe food and help to protect consumer health. "The legislation is structured so that it can be applied flexibly in all food businesses regardless of their type or size. The new more risk-based and flexible procedures will better match the needs both of individual businesses and enforcement authorities. For the vast

majority of food businesses, the law's insistence on the application of procedures based on HACCP principles is not a new requirement. In most areas of food production this legal requirement is already in place. The application of HACCP-based principles in food manufacturing and preparation is widely regarded throughout the EU and in most developed countries as crucial to the management of food safety and, in turn, consumer protection," Dr. O'Brien states.

What is Epidemic Intelligence, and How is It Being Improved in Europe?

Epidemic intelligence can be defined as all the activities related to early identification of potential health threats, their verification, assessment and investigation in order to recommend public health measures to control them.

Epidemic intelligence is being seen as increasingly important because of the need to rapidly recognize emerging international health threats such as SARS, or any clusters of human-to-human transmission of a new influenza virus with pandemic potential. The term "epidemic intelligence" is not used in all European countries, and may cause confusion when translated into some languages. However, this term will be used until alternatives can be defined in each country and language.

National and regional disease surveillance systems provide information on potential threats by identifying abnormal events within the temporal distribution of known disease indicators routinely collected (number of cases, rates), and changes in laboratory characteristics of pathogens. New approaches are being used to improve the capacity of surveillance systems in detecting previously unknown threats, such as monitoring of syndromes (syndromic surveillance), death rates, health service use (such as emergency hospital admissions and drug prescriptions), behaviors, and exposure to risks related to the environment, food or animals.

More recently, surveillance institutions have been actively searching for information about health threats using internet scanning tools, email distribution lists or networks that complement the early warning function of routine surveillance systems.

Primary information can be reported by individuals, the media or information scanning tools (such as GPHIN (the Global Public Health Intelligence Network), and the European Commission's Medical Information System, MedISys), and may be further processed and summarised by specific distribution lists or networks (such as ProMED-mail and the World Health Organization (WHO) Outbreak Verification List). While this approach has been successful in complementing surveillance systems for the detection of emerging threats at international level, few countries have developed standard operating procedures for epidemic intelligence or integrated these processes into their early warning activities.

The revised international health regulations (IHR), once adopted, will also have an impact on epidemic intelligence activities because they require countries to strengthen and maintain capacity to detect, assess, notify and report events that may constitute a public health emergency of international concern. The European Centre for Disease Prevention and Control (ECDC) is collaborating closely with the WHO Regional Office for Europe on the integration of the revised IHR requirements into the alert notification process.

The ECDC is working with European national experts, the European Commission and the WHO to agree on a common Europe-wide terminology for epidemic intelligence needed for collaboration and harmonization of methods, and a basic framework for the epidemic intelligence process that can be applied in all European countries. The ECDC will support European countries by producing a weekly confidential communicable disease threat bulletin.

This framework, proposed by the ECDC and broadly accepted by the European experts, separates the evolving methods to identify previously unknown or emerging health threats from more traditional routine surveillance systems. Although there is generally overlap of these activities, it provides a useful reference for the general terms used in the epidemic intelligence process. All components of the framework, including the Europe-wide surveillance networks, are important contributors to the epidemic intelligence process.

Strengthening human and communication networks will help to build a culture of timely reporting of potential health threats. An integrated response will require multidisciplinary involvement at local, regional and national levels. Sensitivities have to be addressed with regard to a potential negative understanding of the terms "epidemic intelligence" and "reporting culture."

There is a need for guidelines for epidemic intelligence to be developed by the ECDC together

with national authorities in Europe. This should assist countries in strengthening their own national epidemic intelligence activities.

Study Identifies *Campylobacter* in Poultry as Risk Factor for Gastroenteritis in Humans

"Recent research, funded by safefood, has indicated a high occurrence of the food poisoning bacterium, *Campylobacter* in raw poultry, particularly chicken, with 49.9% of retail samples of raw chicken testing positive for the bacterium," said Dr. Paul Whyte from UCD, lead researcher.

"The study was carried out to provide all island public health data on *Campylobacter*. Our research showed that a high proportion of human *Campylobacter* cases are linked with the handling and consumption of contaminated foodstuffs of animal origin, particularly poultry. *Campylobacter* is a common cause of bacterial foodborne infection in many countries including the island of Ireland. Scientists have detected the pathogen in raw poultry produced worldwide."

Dr. Thomas Quigley, director of food science, safefood said, "The poultry industry has been working closely in partnership with the authorities on the island of Ireland to reduce the levels of *Campylobacter*. This study shows that the prevalence of the bacterium on raw poultry remains high. We know that during the handling and preparation of foods in the domestic kitchen *Campylobacter* is easily spread, readily contaminating other foods and surfaces."

Traditionally it has been common practice to wash raw poultry under the tap, prior to cooking. But this has been identified as a major risk factor because it increases the potential for the spread of *Campylobacter* and other bacteria throughout the kitchen, as they are easily transferred through splashes and drips.

"These research findings further support the advice not to wash poultry before cooking. The presence of *Campylobacter* is a compelling reason why consumers should place raw chicken straight into the oven and ensure that the meat is cooked thoroughly, until it is piping hot all the way through, the juices run clear and there is no pink meat left. By correctly following this simple advice to ensure proper cooking, consumers can be reassured that the process will destroy any harmful bacteria present, leaving the meat perfectly safe to eat," he continued.

Campylobacter is recognized to be the most common cause of bacterial foodborne illness in humans in many countries, including the island of Ireland. There were over 2,600 cases notified on the island of Ireland in 2004, which was over 3 times the number of *Salmonella* cases. However, many of those affected do not report it to medical practitioners and as a result, it is widely accepted that significant underreporting occurs. The symptoms of campylobacteriosis, which generally last 2–5 days, include diarrhea, abdominal cramps and sometimes fever and vomiting.

European scientific experts met on February 8th at a conference in Dublin, organized by Teagasc and funded by the European Commission to discuss the issue of *Campylobacter* in the food and water chain.

The study using genetic fingerprinting investigated the role of foods and companion animals in the epidemiology of *Campylobacter* infection in humans on the island of Ireland.

A full copy of "A Comparative Study of Thermophilic *Campylobacter* Isolates of Clinical, Food and Pet Origin Using Genotypic and Antimicrobial Characterization Techniques" can be found at www.safefoodonline.com/safefood/uploads/campylobacterreport.pdf.

INDUSTRY PRODUCTS

Harvard Apparatus, Inc.

Multifunction Waterproof pH Meter from Harvard Apparatus

This new pH meter from Harvard Apparatus is microprocessor controlled and housed in a rugged, waterproof casing – this pH meter can withstand the elements!

The auto-instruction feature guides the user through a simple calibration procedure – including NIST buffer calibration at 6.86 and 9.18 in addition to the standard 4.01, 7.01, and 10.01.

The powerful software allows 1 or 2-point calibration with any of the memorized buffers. The ready symbol appears when the unit has stabilized, and an automatic shut-off conserves the battery.

The meter features a dual level display with graphic symbols that show pH or mV as well as temperature to 0.1°C.

Harvard Apparatus, Inc.
800.272.2775
Holliston, MA
www.harvardapparatus.com

Northland Laboratories Utilizes AOAC-approved IMS from MATRIX MicroScience for Pathogen Testing

Northland Laboratories of Northbrook, IL and Green Bay, WI has announced the adoption of the PATHATRIX system from MATRIX MicroScience, Golden, CO for their routine pathogen testing. Northland Laboratories is the first independent testing lab to use this technology in routine pathogen testing for the food industry.

Northland Laboratories is constantly striving to stay at the forefront of technology providing "state-of-the-art" solutions for their client base. After a period of research for new technologies, Northland identified the PATHATRIX system from MATRIX as a significant breakthrough in sample preparation and capture technology. The *Salmonella*, *Listeria* and *E. coli* O157:H7 products are AOAC-RI approved for a variety of food types, including difficult sample matrices.

Northland conducted an extensive evaluation study of the *Salmonella*, *Listeria* and *E. coli* O157 PATHATRIX products over a 6-month period to verify the performance of the AOAC-RI approved products in their own laboratories. After reviewing the data, Northland's Dr. Susan Abraham, technical director and D. J. Alwattar, vice president of business development said, "We are confident that the PATHATRIX system provides Northland Laboratories with the cutting-edge technology that guarantees we provide the best possible service, utilizing the best recognized science available, to our customers." When used in combination with polymerase chain reaction (PCR), both IMS and PCR provide an unprecedented level of specificity for pathogen detection in addition to speed and sensitivity. Northland is also the first independent testing laboratory in North America to introduce this combined technology to the food industry.

Northland Laboratories
847.942.4136
Northbrook, IL
www.northlandlabs.com

Alconox, Inc. Expands Product Line of Scientific Cleaners for FDA-regulated Pharmaceutical, Biotechnology, and Medical Device Cleaning

Alconox, Inc. the developer and manufacturer of detergent specifically designed for cleaning laboratory glassware in healthcare settings, has grown its product line to offer 12 custom-formulated, environmentally friendly cleaner products that are now distributed worldwide for medical, laboratory, pharmaceutical manufacturing and medical device applications.

Pharmaceutical and biotechnology applications are highly critical due to the many tough residues that are used such as insoluble coatings and slow-release active ingredients. Both Citranox (enhanced acid for insoluble residues) and Citrajet (low-foaming acid cleaners for insoluble residues) were specifically designed to handle the critical cleaning jobs required in process equipment, from tablet presses to mixing tanks.

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

From spinner flasks to production fermentation tanks, Alconox detergents can eliminate cross contamination and assure reliably clean equipment. Even difficult accumulated biomaterial residues on fermentation vessel agitation shafts, thermowells, harvest tubes, sparger tubes and the bevel tips of addition ports easily come clean to Alconox detergents.

When you scale up to production, Alconox can provide cleaning validation support, quality control and regulatory compliance documentation. Tergazyme (circulation cleaning of filtration systems) and Citrajet (nonfoaming, acid cleaner for amphoteric protein cleaning) are ideal products for the FDA-regulated pharmaceutical and biotechnology industries.

Alconox, Inc.
914.948.4040
White Plains, NY
www.alconox.com

Maxi Contact Plates Available from International pbi S.p.A.

The hygienic conditions of hands are a key point to avoid microbiological cross contamination during production in the pharmaceutical, food, dairy sectors and in the hospital-clinical field. The personnel should be educated to the importance of hand cleaning and trained how to perform a correct washing and disinfection.

The adoption of the Maxi Contact Plates from International pbi is one of the basic and simplest system to reach this goal. The fingers of the hands are pressed on the agar surface of the Maxi Contact Plate and after 24/48 hours of incubation the colonies of the agar will show the microbiological contamination and the skill of the operator in hand washing. A real live picture is definitely better than a lot of words.

The Maxi Contact Plates are available with different nutrient media: Tryptone Soy Agar for a total bacterial count, Sabouraud Dextrose Agar for yeasts and molds.

International pbi S.p.A.
39.02.48779245
Milano, Italy
www.internationalpbi.it/

Torrey Pines Scientific, Inc.

Torrey Pines New Hot Plates/Stirrers Offer Digital Control

Torrey Pines Scientific, Inc. announces its new DigiLog™ line of hot plates, stirrers, and stirring hot plates.

These units feature digital display of temperature power settings and two memory keys for storing and recalling favorite settings.

In the interest of safety, there is a plate hot indicator that stays activated even after the unit is turned off if the plate remains above 50°C.

The Digilog™ line provides membrane keypad operation, with temperature settings as low as 30°C to as high as 450°C, stirring ranges from 100 to 1,500 rpm and all at a price comparable to standard analog-controlled units.

The Models HS20 stirring hot plate, HP20 hot plate, and ST20 stirrer are compact units measuring 10"(25.4cm) deep by 7"(17.78cm) wide by 4.5"(11.43cm) tall.

The heating surface is 6" by 6" (15.24cm) constructed of solid white ceramic glass for quick heating and excellent spill resistance. Ruggedly built, they can withstand at least 30 pounds (13.5kg) on the plate surface without damage.

They feature scrolling buttons for setting stirrer, heater, or memory functions. Heating models have a digital display that shows heater power applied as a percentage of overall range for easily reproducing settings.

The units are available in 100, 115 and 230VAC models for use anywhere in the world and come complete with 3-wire AC line cord for the country of use, user's manual and full 12-month warranty. All units are CE compliant.

Torrey Pines Scientific, Inc.
760.471.9100
San Marcos, CA
www.torreypinesscientific.com

Wire Belt's C-CureEdge™ Belting, EZSplice™ System and CarrySmart™ Conveyors

Wire Belt, a developer of advanced belting solutions, will feature its patented C-CureEdge™, unique open-mesh, stainless steel wire belting; the EZSplice™ belt splicing system; and the new CarrySmart™ line of conveyors at the SNAXPO 2006 Show in Mandalay Bay, Las Vegas, NV, from March 19–22, 2006.

C-CureEdge's closed-loop-ends offer faster installation and repair time, while continuously minimizing the risk of accidents caused by sharp open

ends. C-CureEdge eliminates the possibility of snags and tangles, and the belts are sanitary safe, and easy to clean. Wire Belt's cost-effective C-CureEdge belts reduce downtime by minimizing conveyor-to-conveyor snags and tangling during shipping, storage, installation, repair and day-to-day operation.

When EZSplice is used to make the splice-joint on a newly installed replacement belt, the life of the belt will be increased dramatically, simply because of the strength of the EZSplice strand. It eliminates the weak points caused by bending and weaving a traditional splice into the belt. Additionally, EZSplice requires less installation time, allowing minimal downtime.

CarrySmart is a unique, made-to-order line of conveyors. CarrySmart belts are constructed from stainless steel, which makes it ideal for the food processing industry. The CarrySmart line includes flex-turn, flat-flex straight, flat-flex huttle conveyors, and CarrySmart spreader or converger specialty conveyors. CarrySmart conveyors offer a stable conveying surface that is easy to clean and maintain. The conveyors are able to maintain product orientation around turns and offer full product support for delicate products.

Wire Belt Company
603.644.2500
Londonderry, NH
www.wirebelt.com

Nilfisk-Advance America Introduces New Safety Vac Series

Manufacturing and industrial companies today face increasingly complex plant maintenance and cleaning needs driven by consumer demands, regulatory requirements, and sanitation best practices. Nilfisk-Advance America is helping companies meet those challenges with the launch of its newest line of industrial vacuum cleaners — the Safety Vac series.

This innovative group of machines is designed to meet the twin customer concerns of cost and performance. Simultaneously addressing the cleanliness standards of organizations and tackling the health and safety concerns of employees, the Safety Vac series also effectively reduces the overall cost of cleaning.

The three vacuums in the Safety Vac series offer distinct attributes with clear benefits for a range of industrial users:

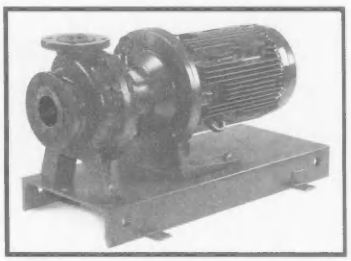
The Nilfisk GD 930 is a canister vacuum built for solid performance in abusive environments with the added benefit of noise reduction. Designed with optimized air-flow patterns to maximize suction and minimize noise, multi-stage filtration, and sturdy steel, the GD 930 also features quick and easy access to internal parts for efficient servicing.

The Nilfisk UZ 964 is a hip-mounted vacuum worn like a belt around the waist, designed for operator comfort and reduction of back strain. The versatility needed to clean narrow spaces and cramped work areas combined with tremendous suction power and durability make the UZ 964 ideal for demanding applications such as mold or asbestos remediation.

The NilfiskUZ 934 is a durable canister vacuum cleaner combining reliability and performance at a low price. Quiet operation, lightweight design and easy access to internal parts combined with the rugged construction and durability required for industrial-strength cleaning make the UZ 934 one of the best in its class.

Delivering maximum portability within a wide range of plant and facility environments, the Safety Vac series vacuums feature rugged design for long-term use, quiet operation, and a host of optional extras. Able to effectively collect and retain contaminants such as dust, bacteria and food scraps, the three vacuum Safety Vac series continues Nilfisk-Advance America's tradition of product excellence, combining attention to detail, careful ergonomic design, and the availability of a wide range of accessories.

Nilfisk-Advance America
877.215.8322 ext. 131
Malvern, PA
www.nilfisk-advance.com



Iwaki America Inc.

Iwaki America Offers Risk-free Pump Program on MDM Chemical Process Pumps

Iwaki America Inc. announces a free trial pump program for their MDM magnet drive chemical process pump line.

The MDM product line has proven itself as a rugged quality design with truly innovative engineered features allowing users to recognize it as the leader in non-metallic magnetic drive technology. With patented features such as dry run capability, the MDM provides users with a value packed solution to their chemical process pump needs.

The MDM is a wide-ranging line of chemical process pumps with models that exceed ANSI hydraulics with flows to 360 gpm and heads to 350 ft. Capable of handling temperatures to 302°F. The MDM design features standard construction materials of ETFE for cost-effective handling of most aggressive chemistries, and PFA for added temperature capabilities and high purity applications. Available bearing systems of carbon and high purity alumina ceramic, or alpha sintered silicon carbide, ensure process integrity.

MDM is a compact close-coupled design with modular construction and individually replaceable parts, allowing simple maintenance and lower cost of ownership. The convenient mounting configuration and dual back pull-out design provides user the ability to maintain line pressure while removing the motor, or if necessary, access to the pump internals from the foot mounted front casing design to avoid disturbing the piping.

Applications for the MDM include bulk chemical transfer, chlorination, water treatment, refineries, plating, fume scrubbers, paper production, desalination, and metal pickling.

Iwaki America Inc.
508.429.1440
Holliston, MA
www.iwakiamerica.com

Eagle Offers Machine-washable Undershelves for Dishtables

Eagle Foodservice Equipment offers Lifestor® high-density polymer undershelves for stainless steel tubular-based dishtables and worktables. Eagle's Lifestor undershelves are machine-washable and non-corrosive.

Designed to optimize worker efficiency and sanitation, the adjustable undershelves feature Microgard® antimicrobial protection. Microgard® provides protection from a broad range of bacteria, molds and mildew that can cause stains, odors and product degradation. The antimicrobial protection never washes out, even with dishwasher cleaning of polymer shelf sections.

Eagle's dishtables and worktables feature stainless steel tubular base construction for superior stability and strength. The NSF-listed shelf sections are removable for ease of mopping underneath the table. Four-sided stainless steel bracing ensures optimum sturdiness and eliminates table wobble. Choose from three grades of steel in a wide selection of sizes and styles.

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

FKI Logistex S-3000CB Cross-belt Sorter Provides Accurate, High-Speed Sortation of Difficult-to-Sort Items

FKI Logistex® introduces the S-3000CB cross-belt sorter. The S-3000CB cross-belt sorter provides accurate, high-speed transportation and sortation of items that present difficulties during traditional sortation, such as fragile products and hard-to-grip packages.

A provider of more than 900 sortation systems installed worldwide, FKI Logistex is the industry leader in high-speed sortation. S-3000CB sortation systems are used in a wide range of applications, from post and parcel to distribution and manufacturing. The S-3000CB's scalable design and sortation process can be tailored to any size facility and any type of product or package.

With individual, motor-driven belted carriers, the S-3000CB features gentle, horizontal item discharge and induction to ensure precise positioning and orientation throughout the sortation process. Because of its horizontal induction and discharge, the S-3000CB accommodates a diverse mix of products and package types within an individual batch of sorted items.

Carriers on the S-3000CB accelerate to match induction speeds. Sort discharge can be optimized to a specific product rather than averaged across a range of product. Discharge from S-3000CB carriers is extremely accurate, allowing for closer discharge chute centers and selective positioning of sorted items within a chute.

S-3000CB cross-belt sorters operate at speeds up to 472 ft/min (2.4 m/s) at just 65 dB(A). Versatile and dependable, the S-3000CB uses a non-proprietary control system for maximum flexibility.

The FKI Logistex S-3000CB offers many induction options, from multiple small items to longer, heavier items. It features the ability to sort heavy items to one side of a discharge and smaller, fragile items to the other.

Standard S-3000CB cross-belt sorters are designed with a single cross-belt cart per carrier. An optional double-cart version is available to meet specific sortation requirements.

The S-3000CB's modular frame and cart designs reduce the amount of time required for commissioning. Its streamlined assembly features a minimum of moving parts, reducing wear-and-tear and increasing system life.

FKI Logistex
877.935.4564
Frederick, MD
www.fkilogistex.com

Proposed Symposia Topics for IAFP 2006

- Refrigerated Ready-to-Eat (RTE) Foods: Microbiological Concerns and Control Measures
- International Food Law – An Overview
- How Risk Managers Decide on Risk from Different National Perspectives
- Surrogate Microorganisms: Selection, Use and Validation
- The New Frontier in Emerging Methods – How to Make the New Technologies Practical for You
- Issues Regarding Raw Milk Sales and Consumption
- Verification of Sanitary Design of Food Equipment
- Making Foods Safer: Factors That Influence Change
- Water Safety Quality Roundtable: Global Water, HACCP Issues
- "A New Crack at Egg Safety: Egg Safety from the Hen House to Your House"
- Chicken and Eggs – *Campylobacter* from Gate to Plate
- Assuring Safety of Animal-based Organic Products
- Who Spoiled My Beverage?
- Biosecurity at Retail
- Symposium on *Salmonella*
- Symposium on Foodborne Viruses
- Symposium on *Enterobacter sakazakii*
- Laboratory Quality Programs – A Global Perspective
- Identification of Risks Associated with *Vibrios* in Raw Molluscan Shellfish
- The Evolution of Environmental Food Safety Risks in Manufacturing Plants
- Bacterial Resistance to Antimicrobials: Current Trends and Future Perspectives
- Innovations in the Canadian Approach to Food Safety Along the Supply Chain
- Cleaning and Sanitation for Retail Food Safety Part 1: Identifying the Issues
- Foodborne Disease Update
- Developing and Improving Your Food Microbiology Laboratory
- Methods, Methods Everywhere but Which is Right for Me? Selection and Verification of Methods
- Food Safety/Food Standards Auditing

Subject to change

IAFP 2006 Networking Opportunities

IAFP FUNCTIONS

WELCOME RECEPTION–*Hyatt Regency Calgary*
Saturday, August 12 • 4:30 p.m. – 5:30 p.m.

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

AFFILIATE RECEPTION–*Hyatt Regency Calgary*
Saturday, August 12 • 5:30 p.m. – 7:00 p.m.

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

COMMITTEE MEETINGS–*Hyatt Regency Calgary*
Saturday, August 12 • 1:00 p.m. – 5:00 p.m.
Sunday, August 13 • 7:00 a.m. – 5:00 p.m.
Refreshments Sponsored by Springer New York LLC

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

STUDENT LUNCHEON–*Hyatt Regency Calgary*
Sunday, August 13 • 12:00 p.m. – 1:30 p.m.

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

EDITORIAL BOARD RECEPTION–*Hyatt Regency Calgary*
Sunday, August 13 • 4:30 p.m. – 5:30 p.m.

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

OPENING SESSION AND IVAN PARKIN LECTURE–*Hyatt Regency Calgary*
Sunday, August 13 • 6:00 p.m. – 7:00 p.m.

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

CHEESE AND WINE RECEPTION–*Telus Convention Centre*
Sunday, August 13 • 7:00 p.m. – 9:00 p.m.
Sponsored by Kraft Foods

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

IAFP JOB FAIR–*Telus Convention Centre*
Sunday, August 13 through Wednesday, August 16

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

COMMITTEE AND PDG CHAIRPERSON BREAKFAST
(By invitation)–*Hyatt Regency Calgary*
Monday, August 14 • 7:00 a.m. – 9:00 a.m.

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

EXHIBIT HALL LUNCH – *NEW!*–*Telus Convention Centre*
Monday, August 14 • 12:00 p.m. – 1:00 p.m.
Tuesday, August 15 • 12:00 p.m. – 1:00 p.m.

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

EXHIBIT HALL RECEPTIONS–*Telus Convention Centre*
Monday, August 14 • 5:00 p.m. – 6:30 p.m.
Sponsored by DuPont Qualicon
Tuesday, August 15 • 5:00 p.m. – 6:00 p.m.– ***NEW!***

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

PRESIDENT'S RECEPTION (By invitation)–*Hyatt Regency Calgary*
Monday, August 14 • 6:30 p.m. – 7:30 p.m.
Sponsored by Fisher Scientific

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

PAST PRESIDENTS' DINNER (By invitation)–*Hyatt Regency Calgary*
Monday, August 14 • 7:30 p.m. – 10:00 p.m.

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

BUSINESS MEETING–*Telus Convention Centre*
Tuesday, August 15 • 12:15 p.m. – 1:00 p.m.

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

JOHN H. SILLIKER LECTURE–*Telus Convention Centre*
Wednesday, August 16 • 3:45 p.m. – 4:30 p.m.

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

AWARDS BANQUET–*Hyatt Regency Calgary*
Wednesday, August 16 • 7:00 p.m. – 9:30 p.m.

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

IAFP 2006 Event Information

EVENING EVENTS

NEW – IAFP Foundation Fundraisers

Murder Mystery Dinner at the Deane House
Tuesday, August 15 • 6:30 p.m. – 10:00 p.m.

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

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

Dinner at The Ranche
Tuesday, August 15 • 6:30 p.m. – 10:00 p.m.

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

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

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

GOLF TOURNAMENT

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

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

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

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

DAYTIME TOURS

The Best of Lake Louise and Banff
Saturday, August 12 • 8:00 a.m. – 5:00 p.m.

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

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

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

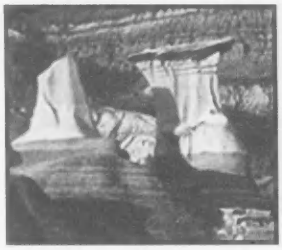
The Complete Calgary Tour

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

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

Drumheller and the Badlands

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



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

Art Walk

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

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

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

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

Yoga and Cooking Class

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

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

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

POST MEETING ACTIVITY

Outdoor Adventure in Kananaskis

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

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

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

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

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

MEETING INFORMATION

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

Full Registration includes:

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

4 EASY WAYS TO REGISTER

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

Online: www.foodprotection.org

Fax: 515.276.8655

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

Phone: 800.369.6337; 515.276.3344

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

REFUND/CANCELLATION POLICY

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

International Association for Food Protection®

EXHIBIT HOURS

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

DAYTIME EVENTS – Lunch included

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

EVENING EVENTS

Sunday, August 13, 2006

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

Monday, August 14, 2006

Exhibit Hall Reception *Sponsored by DuPont Qualicon*	5:00 p.m. – 6:30 p.m.

Tuesday, August 15, 2006

Exhibit Hall Reception	5:00 p.m. – 6:00 p.m.
NEW – IAFP Foundation Fundraisers	
Murder Mystery Dinner at the Deane House	6:30 p.m. – 10:00 p.m.
Dinner at The Ranche	6:30 p.m. – 10:00 p.m.

Wednesday, August 16, 2006

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

POST MEETING ACTIVITY

Outdoor Adventure in Kananaskis	8:30 a.m. – 2:30 p.m.

GOLF TOURNAMENT

Saturday, August 12, 2006

Golf Tournament at The Links of GlenEagles	7:30 a.m. – 4:00 p.m.

HOTEL INFORMATION

Hotel reservations can be made online at www.foodprotection.org.

IAFP 2006 Registration Form

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

Member Number: _____

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

Employer Title

Mailing Address (Please specify: ❒ Home ❒ Work)

City State/Province Country Postal/Zip Code

Telephone Fax E-mail

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

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

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

REGISTRATION FEES:	MEMBERS	NONMEMBERS	TOTAL
Registration	$ 395 ($ 445 late)	$ 597 ($647 late)	
Association Student Member	$ 80 ($ 90 late)	Not Available	
Retired Association Member	$ 80 ($ 90 late)	Not Available	
One Day Registration* ❒ Mon. ❒ Tues. ❒ Wed.	$ 215 ($ 240 late)	$ 330 ($355 late)	
Spouse/Companion* (Name): _____	$ 55 ($ 55 late)	$ 55 ($ 55 late)	
Children 15 & Over* (Names): _____	$ 25 ($ 25 late)	$ 25 ($ 25 late)	
Children 14 & Under* (Names): _____	FREE	FREE	
*Awards Banquet not included			
Additional Awards Banquet Ticket (Wednesday, 8/16)	$ 50 ($ 60 late)	$ 50 ($ 60 late)	
Student Luncheon (Sunday, 8/13)	$ 5 ($ 15 late)		
NEW IAFP FOUNDATION FUNDRAISERS:		# OF TICKETS	
Tuesday, 8/15			
Murder Mystery Dinner at the Deane House	$ 130 ($140 late)		
Dinner at The Ranche	$ 145 ($155 late)		
DAYTIME EVENTS – Lunch included			
Golf Tournament (Saturday, 8/12)	$ 135 ($145 late)		
The Best of Lake Louise and Banff (Saturday, 8/12)	$ 130 ($140 late)		
The Complete Calgary Tour (Sunday, 8/13)	$ 105 ($115 late)		
Drumheller and the Badlands (Monday, 8/14)	$ 115 ($125 late)		
Art Walk – Lunch not included (Tuesday, 8/15)	$ 42 ($ 52 late)		
Yoga and Cooking Class (Wednesday, 8/16)	$ 90 ($100 late)		
Outdoor Adventure in Kananaskis (Thursday, 8/17)	$ 82 ($ 92 late)		
Optional: Select one activity per person		Qty.	
❒ Biking	$ 93 ($103 late)		
❒ Canoe Ride	$ 56 ($ 66 late)		
❒ Hiking	$ 51 ($ 61 late)		
❒ Horseback Riding	$ 57 ($ 67 late)		
❒ Rafting	$ 61 ($ 71 late)		

PAYMENT OPTIONS: ❒ VISA ❒ MasterCard ❒

TOTAL AMOUNT ENCLOSED $_____
US FUNDS on US BANK

❒ Check Enclosed

Credit Card #_____

Expiration Date _____

Name on Card_____

Signature_____

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

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

EXHIBITORS DO NOT USE THIS FORM

REQUEST FOR ACCOMMODATIONS

INTERNATIONAL ASSOCIATION FOR FOOD PROTECTION
93rd ANNUAL MEETING
August 13 - 16, 2006
Calgary, Alberta, Canada

INSTRUCTIONS

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

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

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

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

IMPORTANT

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

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

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

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

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

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

6. All room rates are quoted in Canadian funds.

GUEST INFORMATION

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

Arrival Date _____ Departure Date _____

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

❑ Mr. ❑ Ms. ❑ Mrs.

First Name: _____
Last Name: _____
Address: _____
_____
City/State/Province: _____
Zip/Postal Code: _____ Country: _____
Email address: _____
Daytime Ph: ( ) _____ Fax: ( ) _____

HOTEL SELECTION

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

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

All rooms are standard rooms with one or two beds.

# of Occupants in room _____ List Occupants Names: _____

# of Beds Requested _____ _____

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

Special Room Requirements:

❑ ♿ Disability requiring special services ❑ Non-smoking ❑ Smoking

DEPOSIT INFORMATION

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

❑ VISA ❑ American Express ❑ Diner's Club ❑ Mastercard

Card Number: _____ Expiry Date: _____

Name on Credit Card: _____

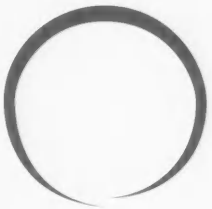
Cardholder's Signature*: _____

**Necessary to process reservations*

Complete and return this form by fax or mail to:
Tourism Calgary - Calgary Convention & Visitors Bureau
200, 238 11 Ave. S.E., Calgary, AB Canada T2G 0X8
Tel: (403) 263-8510 • Fax: (403)262-3809
For more information on Calgary visit:
www.tourismcalgary.com

Tourism CALGARY
CALGARY CONVENTION & VISITORS BUREAU

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



IAFP FOUNDATION

Advancing Food Safety Worldwide®

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

The Foundation is currently funded through contributions from corporations and individuals. A large portion of the support is provided from the Sustaining Members of IAFP. The Sustaining Membership program is a unique way for organizations to partner with the Association. Contact the Association office if you are interested in this program.

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

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

Donate Today!

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

International Association for Food Protection

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

COMING EVENTS

APRIL

- **5, Upper Midwest Dairy Industry Association,** Bombo's Family Dining, Albert Lea, MN. For more information, contact Gene Watnaas at 218.769.4334; E-mail: saantaw@prtel.com.
- **7–12, Conference for Food Protection,** Hyatt on Capitol Square, Columbus, OH. For more information, contact Trevor Hayes at 408.848.2255; E-mail: TWHgilroy@starband.net.
- **12–13, ISO 22000 Food Safety Management System Internal Auditor,** Mississauga, Ontario, Canada. For more information, call Canadian Standards Association at 800.463.6727; E-mail: seminars@csa.ca.
- **13, Ontario Food Protection Association Meeting,** Mississauga Convention Center, Mississauga, Ontario, Canada. For more information, contact Gail Seed at 519.463.5674; E-mail: seed@golden.net.
- **17–20, Better Process Control Schools,** Purdue University, West Lafayette, IN. For more information, call Thomas Robertson at 765.494.7220; Fax: 765.494.0567.
- **28, Tenth Annual Symposium on Industrial and Fermentation Microbiology,** Radisson Center, LaCrosse, WI. For more information, contact Dr. S. N. Rajagopal at 608.785.6976; E-mail: rajagopa.s@uwlax.edu.

MAY

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

JUNE

- **5–6, Brazil Association for Food Protection Meeting,** Anfiteatro do Conselho Regional de Quimica. For more information, call Maria Teresa Destro at 55.113.091.2199; E-mail: mtdestro.usp.br.
- **6–8, Penn State Food Microbiology Short Course,** Penn State Berks Campus, Reading, PA. For more information, contact Hassan Gourama at 610.396.6121; E-mail: hxg7@psu.edu.
- **13, Ontario Food Protection Association Meeting,** Springfield Golf Course, Guelph, Ontario, Canada. For more information, contact Gail Seed at 519.463.5674; E-mail: seed@golden.net.
- **26–28, New Zealand Association for Food Protection Meeting,** SkyCity Convention Centre, Auckland, New Zealand. For more information, contact Roger Cook at 64.4.463.2523; E-mail: roger.cook@nzfsa.govt.nz.

JULY

- **3–6, SFAM Summer Conference —"Living Together" Polymicrobial Communities,** Apex International Hotel, Edinburgh, United Kingdom. For more information, E-mail: meetings@sfam.org.uk; or go to www.sfam.org.uk.
- **10–13, Better Process Control Schools,** Louisiana State University, Baton Rouge, LA. For more information, call Dr. Michael Moody at 225.578.5207; Fax: 225.578.5300.
- **14–21, XXVI International Workshop/Symposium on Rapid Methods and Automation in Microbiology,** Manhattan, KS. For more information, contact Daniel Y.C. Fung at 785.532.1208; E-mail: dfung@ksu.edu.
- **18, United Kingdom Association for Food Protection Second Annual Meeting,** J Sainsbury plc, 33 Holborn, London. For more information, contact Gordon Hayburn at 02920.416456; E-mail: ghayburn@uwic.ac.uk.
- **24–26, Microbiology and Engineering of Sterilization Processes,** University of Minnesota, St. Paul, MN. For more information, contact Ann Rath at 612.626.1278.

AUGUST

- **13–16, IAFP 2006 Annual Meeting,** Calgary, Alberta, Canada. For more information, contact Julie Cattanach at 800.369.6337 or E-mail: jcattanach@foodprotection.org.

IAFP UPCOMING MEETINGS

AUGUST 13-16, 2006
Calgary, Alberta, Canada

JULY 8-11, 2007
Lake Buena Vista, Florida

AUGUST 3-6, 2008
Columbus, Ohio

JULY 12-15, 2009
Grapevine, Texas

CAREER SERVICES SECTION

Postdoctoral Research Fellow

DESCRIPTION:

The Department of Veterinary & Microbiological Sciences, North Dakota State University, is seeking applicants for a post-doctoral research fellow to work on a USDA sponsored research project □Food Safety and Security Risk Assessment□. The project is part of a multidisciplinary food safety research program involving collaboration among several departments at NDSU. Responsibilities include: Participate in planning and conducting Food Safety Research. Prepare publications in refereed journals. Generate data that may be used in the preparation of grant proposals. There may be opportunities to participate in teaching courses (including online courses) in epidemiology; Assist in the coordination of research activities of graduate (both M.S. and Ph.D.) students, technician, and collaborators.

MINIMUM QUALIFICATIONS:

¥ Ph.D. in any allied medical profession with emphasis in Epidemiology/Biostatistics
¥ Evidence of recent research accomplishments
¥ Ability to work with other investigators, good interpersonal skills and strong written and oral communication skills

PREFERRED QUALIFICATIONS:

¥ Ph.D. in Veterinary Preventive Medicine or Microbiology with a demonstrated expertise in data analysis
¥ Interest in Food Safety and Risk Assessment
¥ Expertise in grantsmanship

For information on the university and Fargo community and how to apply please go to NDSU website at:

http://www.ndsu.edu/ndsu/jobs/non_broadbanded/positions/00024380.shtml

Retail Quality Assurance Manager

Department: Retail QA
Location: Toronto
Posting: January 30, 2006
Application Process: **Please send your resume & cover letter to the e-mail addresses shown below.**

mmaddox@starbucks.com
Michele Maddox
Retail Quality Assurance, Starbucks North America

Job Summary and Mission

This job contributes to Starbucks success by providing subject matter expertise and implementation support for retail food safety, store cleanliness and store conditions standards. Assures an uncompromising experience for all customers by assessing retail stores, educating field partners and resolving quality issues. Models and acts in accordance with Starbucks guiding principles.

Summary of Key Responsibilities

Responsibilities and essential job functions include but are not limited to the following:

- Consults with operations and facilities teams to implement solutions to ensure that store practices and store designs meet local health regulations governing retail food establishments throughout Canada.
- Develops working relationships with regulatory agencies. Resolves critical issues with health jurisdictions so that regulators perceive Starbucks' commitment to consistently exceeding health department requirements.
- Implements and monitors quality assurance programs to assure that food safety, store cleanliness and store conditions are maintained to Starbucks standards.
- Manages audit data, pest control report information and health department inspections to identify risks and improvement opportunities.
- May supervise retail quality assurance specialist(s) in local markets.
- Participates in activities supporting the departments' mission, strategy and operating budget.
- Teaches food safety classes. Ensures field operations partners meet local codes for food safety training and certification.

Summary of Experience

- Food service establishment inspections, retail food service establishment plan review, retail food establishment pre-operational inspection, code enforcement hearings 5 years
- Monitoring food safety programs 2 years
- Restaurant or retail working experience
- Experience in regulatory code or jurisdictional resolution drafting

Required Knowledge, Skills and Abilities

- Ability to work as part of a team
- Ability to analyze complex data, draw conclusions and make recommendations
- Ability to assimilate new information quickly and react positively to new and challenging opportunities
- Ability to make progress in spite of setbacks or lack of clarity
- Ability to manage and resolve conflicts
- Ability to operate effectively in a fast-changing environment
- Ability to influence and lead others

Desired Education:

High school degree or GED required; Environmental Health, Biology, and Biochemistry, organic chemistry. BS required.

CAREER SERVICES SECTION

THE UNIVERSITY *of* TENNESSEE

Department of Food Science and Technology (http://foodscience@utk.edu)
Agricultural Experiment Station & College of Agricultural Sciences and Natural Resources

Assistant/Associate Professor
Molecular Food Microbiology

Position: Assistant/Associate Professor of Food Science and Technology in Molecular Food Microbiology; 12-month, tenure-track position; 85% Research, 15% Teaching

Responsibilities: Develop a competitive and independent research program in food microbiology focusing on microbial detection, gene expression, molecular characterization, virulence and/or microbial ecology of foods. Teach undergraduate and graduate courses in the Department related to the candidate's background, interests, and expertise. Must have a desire to effectively collaborate with existing research and educational programs. Advise and supervise undergraduate and graduate students.

Qualifications: An earned doctorate in Food Science, Microbiology or related field with emphasis on molecular biology related to microbiology and its application in foods and/or food components is required. The applicant must demonstrate excellence in effective oral communication and have demonstrated effective written communication. A demonstrated ability or potential for excellence in teaching is required. The applicant must have the ability to develop successful research proposals.

Application Deadline: Applications will be reviewed beginning **March 1, 2006** and will continue until a suitable candidate is identified. Interested applicants should submit: (1) a letter of application, (2) a one-page statement of research plans and goals, (3) a one-page statement of teaching ability and philosophy, (4) transcripts of all college course work, (5) a curriculum vitae detailing education background qualifications, experience, publications, and (6) names and contact information of three individuals whom the applicant has asked to submit letters of recommendation. Send all materials to:

Dr. Ann Draughon, Search Chair
The University of Tennessee
Department of Food Science and Technology
2605 River Drive, 105 Food Safety & Proc. Bldg., Knoxville, TN 37996-4591
Ph: 865-974-8400; Fax: 865-974-2750; E-mail: draughon@utk.edu

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

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Journal of Food Protection®

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Vol. 69 | February 2006 | No. 2

Research Notes

Review

* Asterisk indicates author for correspondence.

DON'T LET THE BUZZ ABOUT "BIRD FLU" BUG YOU!

You may have heard about "Bird Flu" or Avian Influenza in the news...but is it in our food? No.

The H5N1 highly pathogenic avian influenza strain does not exist today in the United States. One reason is that the U.S. government and poultry industry have safeguards in place to keep it out.

As a food safety advocate, it is important for you to know that there are no reported cases of avian influenza attributed to the consumption of cooked poultry products. Safe cooking of poultry and eggs would inactivate the virus if it were present in poultry meat or eggs. As with other foodborne pathogens (like *Salmonella* and *E.coli O157:H7*) it is important, always, to follow safe handling practices to reduce the risk of foodborne illness caused by bacteria and viruses. Using a food thermometer is the only way to know whether food has reached a high enough internal temperature to destroy foodborne pathogens.

The Partnership reminds consumers to always:

CLEAN: wash hands with warm water and soap for twenty seconds before and after handling food.

SEPARATE: keep raw meat, poultry, seafood and their juices away from other foods.

COOK: cook eggs and poultry products thoroughly and use a food thermometer to measure internal temperature: whole birds, drumsticks, thighs and wings should be cooked to 180°F, breasts to 170°F, ground turkey and ground chicken to 165°F. Cook eggs until both the yolk and the white are firm.

CHILL: refrigerate or freeze meat, poultry, eggs and other perishables as soon as you get them home from the store.

Want to receive E-cards from the Partnership? Sign up to be a BAC Fighter!

BAC Fighters teach that clean, separate, cook and chill are the first line of defense in fighting foodborne illness at home, work and school. Sign up to be a BAC Fighter TODAY and receive important information on food safety education research, tools, events and program developments. Go to the Fight BAC! Web site and click on "Register to be a BAC Fighter!®"

http://www.fightbac.org

Visit ***www.fightbac.org*** TODAY for additional food safety tips.

2006 Partnership for Food Safety Education
Contact Shelley Feist, 202-220-0651

Learn more at:
www.avianinfluenzainfo.org
www.pandemicflu.gov
www.foodsafety.gov

This information was developed by the Partnership for Food Safety Education which unites industry associations, consumer and public health groups and the United States Department of Agriculture, the Environmental Protection Agency and from the Department of Health and Human Services, the Centers for Disease Control and Prevention and the Food and Drug Administration, to educate the public about safe food handling and preparation.

With thanks to Partnership members Egg Safety Center, National Chicken Council, and National Turkey Federation. Printing of this ad made possible by the International Association for Food Protection.

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The use of the Audiovisual Library is a benefit for **Association Members only.** Limit your requests to five videos. Material from the Audiovisual Library can be checked out for 2 weeks only so that all Members can benefit from its use.

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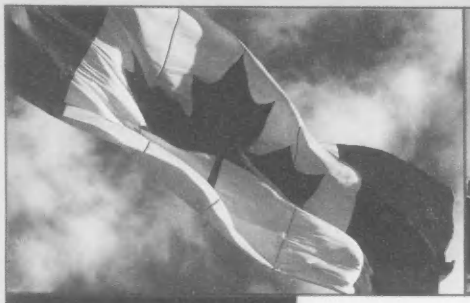

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