February 2008

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Periodicals
6200 Aurora Avenue • Suite 200W
Des Moines, Iowa 50322-2864, USA

Food Protection Trends

Science and News from the International Association for Food Protection

Vacuum-packaged Fresh Blue Crab Meat

Music In Food Service Safety Curriculum

New England Gardeners to Assess Food Safety Knowledge

www.foodprotection.org

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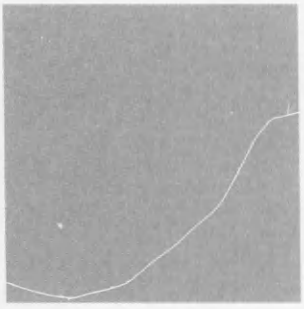

We live in a global economy and the way food is grown, processed, and handled can impact people around the world. Combine these issues with the complexity of protecting the food supply from food security threats and the challenges to food safety professionals seem overwhelming. However, with your support the IAFP 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, distribute *JFP* and *FPT* journals to developing countries through FAO in Rome, and supports the future of food scientists through scholarships for students or funding for students to attend IAFP Annual Meetings.

It is the goal of the Association to grow the IAFP Foundation to a self-sustaining level of greater than $1.0 million by 2010. With your generous support we can achieve that goal and provide additional programs in pursuit of our goal of *Advancing Food Safety Worldwide*®.

Contribute today by calling 515.276.3344 or visiting www.foodprotection.org

IAFP FOUNDATION

International Association for Food Protection

FOOD PROTECTION TRENDS

VOLUME 28, NO. 2

ARTICLES

ASSOCIATION NEWS

DEPARTMENTS

EXTRAS

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

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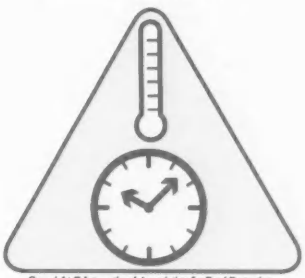
International Food Safety Icons

Available from International Association for Food Protection®

Handwashing

Potentially Hazardous Food



Cooking

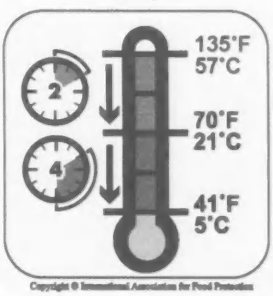
Do Not Work If Ill

Cross Contamination

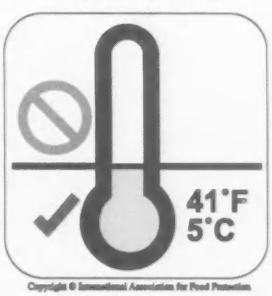
Wash, Rinse, and Sanitize

No Bare Hand Contact

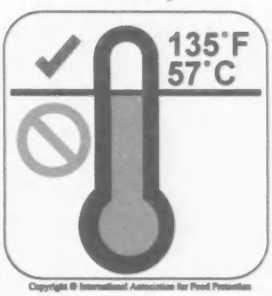
Cooling



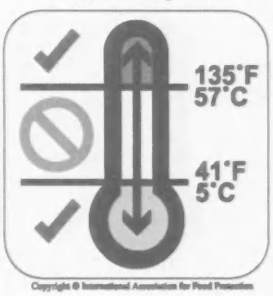
Refrigeration/Cold Holding



Hot Holding



Temperature Danger Zone



For additional information, go to our Web site: www.foodprotection.org or contact the IAFP office at 800.369.6337; 515.276.3344; E-mail: info@foodprotection.org

FUTURE ANNUAL MEETINGS

IAFP 2008

AUGUST 3-6

Hyatt Regency Columbus
Columbus, Ohio

IAFP 2009

JULY 12-15

Gaylord Texan Resort
Grapevine, Texas

IAFP 2010

AUGUST 1-4

Anaheim Convention Center
Anaheim, California

International Association for Food Protection

FOOD PROTECTION TRENDS

"The mission of the Association is to provide food safety professionals worldwide with a forum to exchange information on protecting the food supply."

Associations Make A Better World

FPT EDITORIAL BOARD

SUSTAINING MEMBERSHIP

Membership in the International Association for Food Protection will put you in charge of your career. From quick access to cutting-edge technical and scientific information, becoming a Member is your link to the food safety industry and a clearinghouse of resources. Increase the knowledge and ideas you can implement in your work environment.

Is your organization in pursuit of "Advancing Food Safety Worldwide®"? As a Sustaining Member of the International Association for Food Protection, your organization can help to ensure the safety of the world's food supply.

Sustaining Membership

Sustaining Membership provides organizations and corporations the opportunity to ally themselves with the International Association for Food Protection in pursuit of *Advancing Food Safety Worldwide*®. This partnership entitles companies to become Members of the leading food safety organization in the world while supporting various educational programs through the IAFP Foundation that might not otherwise be possible.

Organizations who lead the way in new technology and development join IAFP as Sustaining Members. Sustaining Members receive all the benefits of IAFP Membership, plus:

- Monthly listing of your organization in *Food Protection Trends* and *Journal of Food Protection*
- Discount on advertising
- Exhibit space discount at the Annual Meeting
- Organization name listed on the Association's Web site
- Link to your organization's Web site from the Association's Web site
- Alliance with the International Association for Food Protection

Gold Sustaining Membership $5,000

- Designation of three individuals from within the organization to receive Memberships with full benefits
- $750 exhibit booth discount at the IAFP Annual Meeting
- $2,000 dedicated to speaker support for educational sessions at the Annual Meeting
- Company profile printed annually in *Food Protection Trends*

Silver Sustaining Membership $2,500

- Designation of two individuals from within the organization to receive Memberships with full benefits
- $500 exhibit booth discount at the IAFP Annual Meeting
- $1,000 dedicated to speaker support for educational sessions at the Annual Meeting

Sustaining Membership $750

- Designation of an individual from within the organization to receive a Membership with full benefits
- $300 exhibit booth discount at the IAFP Annual Meeting

SUSTAINING MEMBERS

Sustaining Membership provides organizations the opportunity to ally themselves with IAFP in pursuit of *Advancing Food Safety Worldwide*. This partnership entitles companies to become Members of the leading food safety organization in the world while supporting various educational programs that might not otherwise be possible.

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(Continued on next page)

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FOSS North America, Inc., Eden Prairie, MN; 800.547.6275

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HiMedia Laboratories Pvt. Limited, Mumbai, Maharashtra, India; 91.22.2500.3747

IBA, Inc., Millbury, MA; 508.865.6911

Idaho Technology, Inc., Salt Lake City, UT; 801.736.6354

Institute for Environmental Health, Lake Forest Park, WA; 206.522.5432

International Dairy Foods Association, Washington, D.C.; 202.737.4332

Iowa State University Food Microbiology Group, Ames, IA; 515.294.4733

It's Clean USA, Inc., Chicago, IL; 312.994.2547

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Kellogg Company, Battle Creek, MI; 269.961.6235

The Kroger Co., Cincinnati, OH; 513.762.4209

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Michelson Laboratories, Inc., Commerce, CA; 562.928.0553

Michigan State University–ProMS in Food Safety, East Lansing, MI; 517.432.3100

MicroBioLogics, Inc., St. Cloud, MN; 320.253.1640

Micro-Smedt, Herentals, Belgium; 32.14230021

Nasco International, Inc., Fort Atkinson, WI; 920.568.5536

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Ross Products, Columbus, OH; 614.624.7040

rtech™ laboratories, St. Paul, MN; 800.328.9687

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The Steritech Group, Inc., San Diego, CA; 858.535.2040

Strategic Diagnostics Inc., Newark, DE; 302.456.6789

Texas Agricultural Experiment Station, College Station, TX; 979.862.4384

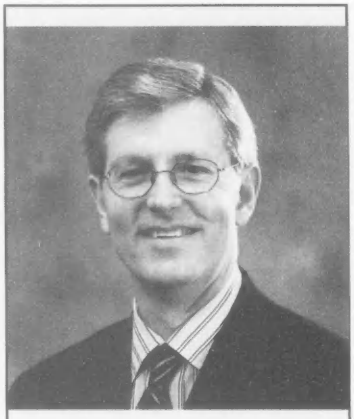
United Fresh Produce Association, Washington, D.C.; 202.303.3400

Walt Disney World Company, Lake Buena Vista, FL; 407.397.6060

WTI, Inc., Jefferson, GA; 706.387.5150

Zep Manufacturing Company, Atlanta, GA; 404.352.1680

"LONE STAR PERSPECTIVE"
FROM YOUR PRESIDENT



By GARY ACUFF
PRESIDENT

"The safety of our food supply depends heavily on the intelligence, resourcefulness, and investigative natures of many of the members of our Association"

Have you ever noticed that there are certain foods consumers typically regard as "dangerous" or "safe" in regard to foodborne illness risk, but that their risk assessment just doesn't match up with reality? For example, consumers will invariably tell you that mayonnaise and products containing it are inherently dangerous; never mind that the pH of commercial mayonnaise is probably low enough to be used as paint stripper on furniture. When I have read a newspaper report of foodborne illness associated with potato salad at a potluck to my undergraduate food microbiology class, at least one of the students will knowingly nod and state, "You have to be careful with that mayonnaise!" I suppose when students left home for college, loving moms around the world must have given them parting advice to be careful with their mayonnaise consumption.

The reverse situation exists for products like chocolate, peanut butter and salsa. We eat a lot of salsa in Texas, so maybe I hear this more than you do, but I can't tell you how many times someone has mentioned to me that they are absolutely sure the salsa is safe. How could those little germs possibly survive the heat of a hot sauce made with all those spicy jalapeños? Consumers often assume that because the sauce is spicy, bacteria or viruses cannot survive. Of course, that is where they would be wrong—bacteria laugh at hot salsa that you swear could take the lining off the inside of your mouth. Better check the pH of salsa before assuming it is safe!

The same situation is true for chocolate. Before the 1970s, nobody ever thought chocolate or cocoa powder could be a source of salmonellosis. But then there were a couple of big outbreaks that really got our attention, and we learned some fascinating things about chocolate: Who would have imagined that *Salmonella* could survive for years in chocolate? Also, research at the time showed that *Salmonella* displayed an unusually high heat resistance in chocolate, due to protection by the fat and the low water activity of the product. And no matter how many outbreaks of foodborne illness we have had associated with chocolate, informing the typical consumer that a small risk does exist is almost guaranteed to get a surprised response.

How many US consumers were shocked last summer to hear that peanut butter was contaminated with *Salmonella*? I would be willing to bet that the vast majority of consumers never thought anything could ever be wrong with their beloved peanut butter. The outbreak that occurred and the resulting recalls truly shook consumers' faith in the safety of our food supply. Nothing confuses consumers more than finding out something they thought was inherently safe is now dangerous. Of course, as food microbiologists, we all knew there is a small risk, but who wants to concern consumers with small risks? They have enough to worry about without adding that to their list. Unfortunately, peanut butter is on their list now. Probably right under mayonnaise.

The bottom line is, we can never take anything for granted in food safety. We cannot assume that we have all the answers, and we can never assume the consumer has an inherent ability to know which food is likely to be safe and which is likely to be dangerous. Unfortunately, with today's consumers, we would probably be better off assuming they have no clue what is safe and what is not.

I could give you hundreds of examples to discuss issues that have surprised consumers, but now I have gotten myself sidetracked. What

I really wanted to talk with you about in this column is something you already know—that food safety is often not obvious. The safety of our food supply depends heavily on the intelligence, resourcefulness, and investigative natures of many of the members of our Association. We have some extremely talented people in IAFP, but we may be the only people who really know that our members are extremely talented. The average consumer probably doesn't appreciate what we do—they are already past the latest food recall and likely couldn't care less about our role in food safety. But that doesn't lessen the importance of what we do, nor does it decrease the real impact of our actions. That is why it is so important for us to encourage each other and compliment colleagues when we have the chance, and that chance is now.

IAFP award nominations are due March 4, 2008. Please take a few minutes to think about how our field has impacted consumer safety and consider those individuals who have made a quiet, but important contribution. What would it mean to them to receive an award at the IAFP Annual Meeting? How many times, after one of our members has passed away, have we recalled all the things they did for our association and our field of food safety and wished we had taken the opportunity to recognize their contributions with an award. A posthumous award is a nice gesture, but we really do need to recognize our members before they are gone. This is such an essential practice, and we often take the opportunity for granted. I sure hate to see a year go by where we have an award available and there is no nomination. I am positive there is always someone out there who was busy advancing food safety worldwide, and we just didn't have time to get a nomination submitted.

So I am asking you take a few minutes, think about your colleagues and their contributions, and see if you don't come up with a name of someone that deserves to be recognized. If you need help submitting the award nomination, let the IAFP staff know and they will be glad to get you connected with someone who can help.

And, by the way, since Valentine's Day is approaching rapidly in the US, be sure and buy lots of chocolate for your sweetie. But be sure to write down and keep the lot number handy. You never know when you may need to retrieve your gift to save a relationship from *Salmonella*!

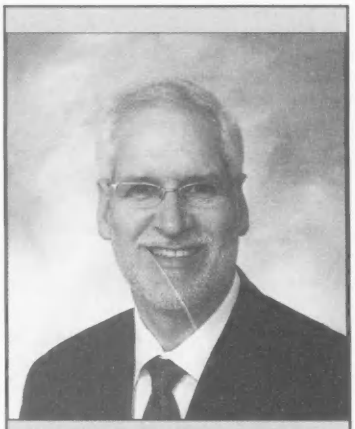
As always, I am all ears if you have comments, recommendations or just want to talk. E-mail me at gacuff@tamu.edu.

"COMMENTARY" FROM THE EXECUTIVE DIRECTOR

February is a very busy month for IAFP. The Secretary election is now begun; our Awards nominations are due just past the end of this month, and the Program Committee meets in mid-February along with the Executive Board. All of this in addition to continuing the planning for three major meetings in 2008! Those meetings include our Latin American and our European Symposia on Food Safety and our 95th Annual Meeting (IAFP 2008).

We should spend a little time reviewing and updating each of these projects and events. First off, let's discuss the Secretary election. By now, you should have received an E-mail notification regarding your vote for the next IAFP Secretary. This year, all of our ballots for the Secretary election will be cast via the Internet for the first time in Association history. You may recall that the IAFP Constitution and Bylaws were amended in 2006 to allow for an electronic election and now it is time to put the vote into action.

It is very simple to vote in the IAFP Secretary election. Just click on the link provided in your E-mail or visit the IAFP Web site for the link from our home page. Once on the voting Web site, you need to enter your user identification and the unique password provided in the E-mail sent to you in order to vote. If for some reason you didn't receive the E-mail, or even discarded it unknowingly, you may call directly to the voting center to obtain your identification number, thus allowing you to vote.



By DAVID W. THARP, CAE
EXECUTIVE DIRECTOR

"This year, all of our ballots for the Secretary election will be cast via the Internet for the first time in Association history"

Our office will not have access to the unique passwords, so your call for help will need to be placed to the voting center. This keeps the voting activity at "arms-length" from the IAFP Executive Board and staff. We want you to be comfortable knowing that the IAFP election process is tamper proof!

While talking about the election, it would be proper to recognize our two candidates this year. They are Emilio Esteban from USDA's Food Safety and Inspection Services in Alameda, California and Isabel Walls from USDA's Foreign Agricultural Service in Washington, D.C. We truly appreciate the willingness of both Isabel and Emilio to be considered for service on the IAFP Executive Board.

I want to also mention the Awards nominations for 2008 are due to the IAFP office by Tuesday, March 4. There is still plenty of time to nominate a deserving colleague for an IAFP Award. Don't let this opportunity pass you by – prepare a nomination today! The list of Awards is shown on page 135 of this issue and the criteria for each nomination is available at the IAFP Web site from our Home page and the Annual Meeting page. We look forward to receiving your nomination!

The Program Committee will meet in Columbus to review all submitted technical abstracts and decide which are worthy of including in this year's program. In addition, a final review of submitted symposia and workshop ideas takes place. By the time the Committee completes their work, the program for IAFP 2008 is ready to take shape! By the end of March, program details will be posted on the IAFP Web site for your review.

The IAFP Executive Board also meets in Columbus in February to discuss the business of the Association. This also allows a time for the Board to see the convention site and become familiar with the layout for our events next summer. Columbus will surprise most of our attendees with the number

of excellent restaurants and night spots available for entertainment. All of it very close to the convention site! We are looking forward to IAFP 2008 and our visit to Columbus. I can tell you that the Ohio Local Arrangements Committee is planning a great time for everyone who attends IAFP 2008!

One change you will notice as you sign up for Annual Meeting this year is in our online registration system. With the growth we have experienced over the past three or four years, we now have a need for a more advanced registration system. After you have registered, the new system will allow you to plan your schedule for IAFP 2008 and will also allow you to schedule appointments with exhibitors! We are looking forward to implementing this system and hope you will enjoy using it this year. Please let us know if you like it or if you see areas for improvement. We expect there may be some growing pains this year, but also expect that you will like the new system!

As I said in the beginning, it is a busy time for IAFP. Our efforts are pulled in many ways, but all are good. We enjoy moving the projects forward for our Members and feel good about the work we do. Working for the leading food safety organization in the world keeps our efforts focused on being the very best for you!

Is Your Program Crumbine Material? Put it to the Test!

The Samuel J. Crumbine Consumer Protection Award for Excellence in Food Protection at the Local Level is seeking submissions for its 2008 program. Achievement is measured by:

- Sustained improvements and excellence, as documented by specific outcomes and achievements, over the preceding four to six years, as evidenced by continual improvements in the basic components of a comprehensive program;
- Innovative and effective use of program methods and problem solving to identify and reduce risk factors that are known to cause foodborne illness;
- Demonstrated improvements in planning, managing, and evaluating a comprehensive program; and
- Providing targeted outreach; forming partnerships; and participating in forums that foster communication and information exchange among the regulators, industry and consumer representatives.

All local environmental health jurisdictions in the U.S. and Canada are encouraged to apply, regardless of size, whether "small," "medium" or "large."

The Award is sponsored by the Conference for Food Protection, in cooperation with the American Academy of Sanitarians, American Public Health Association, Association of Food and Drug Officials, Foodservice Packaging Institute, International Association for Food Protection, International Food Safety Council, National Association of County & City Health Officials, National Environmental Health Association, NSF International and Underwriters Laboratories, Inc.

For more information on the Crumbine Award program, and to download the 2008 guidelines and previous winning entries, please go to www.fpi.org or call the Foodservice Packaging Institute at (703) 538-2800. **Deadline for entries is March 14, 2008.**

ARTICLES

Food Protection Trends, Vol. 28, No. 2, Pages 96–106

International Association for Food Protection

Microbiology, Physical and Sensory Quality of Vacuum-packaged Fresh Blue Crab Meat (*Callinectes sapidus*) Treated with High Hydrostatic Pressure

KANNAPHA SUKLIM,[1] GEORGE J. FLICK,[1]* DIANNE WALL BOURNE,[1] LINDA ANKENMAN GRANATA,[1] JOSEPH EIFERT,[1] ROBERT WILLIAMS,[1] DAVID POPHAM[2] and ROBERT WITTMAN[3]

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SUMMARY

Vacuum-packaged fresh lump blue crab meat (*Callinectes sapidus*) was pressurized at 300 or 550 MPa for 5 min at 25°C and evaluated for changes in microbiological, physical, and sensory qualities after pressure treatments and during storage (4°C for 31 days). A pressure of 300 MPa caused a 1 log reduction in total aerobic plate count and a 3-day lag period, whereas 550 MPa inactivated 2 logs in total aerobic plate count and caused no evident lag phase. Physical and sensory qualities of pressurized crab meat were not statistically different from those of the untreated crab meat ($P > 0.05$). High hydrostatic pressure treatments killed or inactivated pressure-sensitive microflora in the fresh crab meat, resulting in the following surviving microorganisms: *Aerococcus* spp., *Brevibacillus* spp., *Brevibacterium* spp., *Enterococcus* spp., and *Macrococcus (Staphylococcus)* spp. Sensory evaluations, along with identification of predominant organisms in fresh and pressurized crab meat (550 MPa), under reduced-oxygen and low-temperature storage conditions, were conducted. A pressure of 300 MPa extended the shelf life of fresh crab meat from 17 to over 24 days and caused a predominance of *Carnobacterium piscicola*. Crab meat treated with 550 MPa was not rejected by sensory panels at day 31; *Enterococcus* spp. was identified as the predominant microorganism, suggesting that this organism could have an inhibitory effect on the other microflora.

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INTRODUCTION

Blue crab (*Callinectes sapidus*) is processed and marketed in a variety of forms, including frozen, canned, pasteurized, and fresh. Fresh lump crab meat, distributed under refrigerated conditions, is highly perishable, with a shelf life of 10–14 days or less depending on the microbiological quality during processing and subsequent storage *(29)*. The blue crab industry has used several post-processing procedures, including pasteurization, sterilization and freezing, to extend the shelf life. However, these processes cause undesirable changes in flavor, color and texture during processing and storage *(9, 10)*.

Fresh and minimally processed food products are in demand. Consumer preference is continually driving the food industry to generate new processing and preservation techniques that do not dramatically change the sensory and nutritional attributes of the products *(2)*. Among novel approaches, high hydrostatic pressure processing has gained considerable interest with its advantages over conventional thermal treatments due to inactivation of spoilage and pathogenic microorganisms as well as a shelf-life extension along with maintenance of nutritional value.

Quality and safety of several varieties of seafood processed with high pressure (e.g. bluefish, carp, cod, octopus, oysters, Pacific mackerel, prawn, and salmon) have been investigated *(16)*; however, fresh blue crab meat has not been sufficiently studied. The microflora and microbiological safety and quality of blue crab meat derived from current commercial processes have been studied *(7, 8, 20, 21, 22, 29)*, but, changes in the microflora content of hydrostatic pressure-treated products have not been adequately studied to determine how quality and safety may be affected.

The objectives of this study were (1) to investigate the effect of pressure treatments on the physical and sensory properties of fresh hand-picked blue crab meat; (2) to investigate microbiological changes, including identification of surviving microorganisms after pressure treatments and subsequent storage; and (3) to determine if shelf life is extended by high hydrostatic pressure processing (HPP).

MATERIALS AND METHODS

Crab meat

Crab meat used throughout this study was processed with a scheduled thermal method that consisted of cooking live crabs under pressure (10 min at 121°C) to facilitate the removal of meat from the bodies and claws, cooling to ambient temperature, and subsequent storing under refrigeration temperature overnight prior to hand picking. Hand-picked crab meat was packaged into containers for retail and institutional sale and then stored packed in ice. This hand-picked meat with no subsequent processing is referred to as fresh crab meat.

Fresh hand-picked blue crab lump meat (*Callinectes sapidus*) in 454 g containers was obtained from a commercial facility (Graham and Rollins Inc.) in Hampton, VA. Within 24 hours post-processing, the meat was transferred to the Virginia Polytechnic Institute and State campus, Blacksburg, VA in insulated containers with ice packs and stored on ice in a refrigerator at 0–4°C after arrival. All samples were used within 48 h, and the meat was mixed thoroughly prior to the high pressure treatments.

High hydrostatic pressure treatment

High hydrostatic pressure treatments were performed with commercial scale equipment (The Quintus Food Press QFP 35L-600, Avure Technologies, Kent, WA at the High Pressure Processing Laboratory Service Center at Virginia Tech). Pressure and temperature were controlled by a pressure transducer and a thermocouple interfaced with the pressure unit. Water was used as the pressure transmitting medium. Samples of 15 g lump blue crab meat were double-bagged and vacuum-packaged in 3-mm nylon/polyethylene vacuum pouches (Koch, North Kansas, MO) and then subjected to 300 or 550 MPa with an end temperature of 25°C for 5 min. Decompression occurred within 2–3 s. For testing purposes, an untreated sample was used as the control.

Product storage and sampling

After application of the pressure treatments, all samples and the control were stored at 4°C for 31 days, during which time they were sampled on days 0, 3, 7, 12, 17, 24, and 31 for aerobic and anaerobic microorganism enumeration, isolation, and identification; sensory analyses; physical analyses; and pH and color measurements.

Aerobic microorganism enumeration and isolation

A 10-g sample of crab meat was transferred to a 90 ml 0.1% peptone dilution blank and homogenized with a Stomacher (Stomacher Lab Blender 400, Tekmar Co., Cincinnati, OH). Subsequent dilutions were made with 9 ml peptone dilution blanks. Aliquots of 0.1 ml were spread on the surface of previously prepared Trypticase Soy Agar (TSA; Becton Dickinson and Company, Sparks, MD) plates. The plates were incubated at 30°C and enumerated after 48 h.

Predominant well-isolated colonies were picked, quadrant streaked on TSA plates, and incubated at 30°C for 24 h. After 24 h, the cultures on TSA plates were examined for purity under a dissecting microscope. For mixed cultures, the microorganisms were restreaked until pure cultures were obtained.

Anaerobic microorganism enumeration and isolation

Anaerobic culture and isolation methods have been described by Holdeman et al. *(11)*. A 10-g sample of crab meat was diluted with 90 ml 0.1% peptone and homogenized by use of a Stomacher. Subsequent dilutions were made with pre-reduced 9.9 ml 0.1% peptone anaerobe dilution blanks. Inoculations from the appropriate blanks were placed into molten pre-reduced Brain Heart Infusion Agar (BHIA; Becton Dickinson and Company, Sparks, MD) tubes. All serial dilutions and inoculations were performed under a stream of oxygen-free CO_2. The BHIA tubes were then placed on horizontal spinners until the medium had solidified. The tubes were then removed and incubated at 30°C for 5 days. After incubation, the tubes were spirally marked with the pen on the streaker unit of the VPI Anaerobic Culture System. Colonies were counted by use of a dissecting microscope.

Predominant well-isolated colonies were picked from countable tubes,

TABLE 1. Microorganisms isolated from vacuum-packaged unpressurized (control) and pressurized (550 MPa at 25°C for 5 min) crab meat stored at refrigeration temperature for 31 days

Microorganisms	Days of storage and treatment													
	Control							550 MPa						
	0	3	7	12	17	24	31	0	3	7	12	17	24	31
Acinetobacter	•													
Aerococcus								•						
Aeromonas							•							
Arthrobacter	•		•											
Bacillus		•												
Brevibacillus	•							•						
Brevibacterium	•							•	•					
Carnobacterium piscicola	• *	• *	• *	• *	• *	• *	• *				*		• *	
Chryseobacterium			•											
Corynebacterium										•	•			
Enterococcus								*	• *	• *	• *	• *	*	• *
Exiguobacterium	•	•		•										
Macrococcus		•						•	•	*				
Moraxella											•			
Providencia							•							
Pseudomonas		•	•	•		•								
Psychrobacter										•	•	•		
Staphylococcus	•													

• = isolated from aerobic plates * = isolated from anaerobic roll tubes

transferred to pre-reduced Cooked Meat (CM; Becton Dickinson and Company, Sparks, MD) medium, and incubated at 30°C for 24 h. The isolates were then anaerobically streaked onto BHIA roll tubes and examined for purity after 24 h incubation at 30°C. Because a preliminary study had shown that no strict anaerobic microorganisms were present, all cultures in anaerobic CM medium were also grown on Trypticase Soy Agar (TSA) plates for identification purposes. Tubes with one morphological type were streaked onto TSA plates and the third quadrant harvested after 24 h incubation at 30°C into tubes, which were capped with Teflon-lined screw caps for subsequent identification of microorganisms.

Aerobic and anaerobic microorganism identification: cellular fatty acid analyses

Identification of all aerobic and anaerobic microorganisms was performed with the Sherlock Microbial Identification System (MIS, Microbial ID Inc., Newark, DE), in which whole cell fatty acid profiles are used for identification. The procedure used for sample preparation was adapted from the MIS protocol. Cells that had been frozen were thawed prior to cellular fatty acid analysis. The cells were lysed and saponified with 1.0 ml of basic methanol (45 g of NaOH, 150 ml of methanol, 150 ml of deionized water), heated in a boiling water bath for 5 min, mixed by use of a vortex mixer, and heated in the boiling water bath for an additional 25 min. To methylate cell constituents of anaerobes, 1 ml of HCl-methanol (325 ml of 6.0 N HCl, 275 ml of methanol [certified grade]) and 1 ml of sulfuric acid-methanol (162.5 ml of H_2SO_4 [American Chemical Society reagent grade]) added to 162.5 ml deioized water, 275 ml of methanol [certified grade] were added, and the solution was heated at 80°C for 10 min. For aerobes, 2 ml of HCl-methanol was used instead of both HCl and H_2SO_4. After rapid cooling, the methylated components were extracted by adding 1.25 ml of hexane-ether (200 ml of hexane, 200 ml of methyl-tert-butyl ether) and turning the tube end over end for 10 min. Each extract was washed once with 3 ml of a solution containing 5.4 g of NaOH in 450 ml of deionized distilled water saturated with NaCl.

A 2 µl portion of the washed extract was analyzed on an Ultra 2 column, a 25 m × 0.2 mm ID × 0.33 µm film thickness phenyl methyl silicone fused silica capillary column (Agilent, Newark, DE) by use of a model HP-5890A gas chromatograph (Hewlett-Packard Co., Palo Alto, CA) equipped with a model HP 6763 autosampler (Hewlett-Packard), a flame ionization detector and a model HP-3392A integrator (Hewlett-Packard). The gas flow rates were 400 ml/min for air, 30 ml/min for hydrogen, and 30 ml/min for nitrogen. The temperatures used were 250°C for the injection port and 300°C for the detector. After injection, the oven temperature was ramped from 170 to 270°C at a rate of 5°C/min and then from 270 to 310°C at a rate of 30°C/min, held at 310°C for 2 min, and then returned to 170°C before the next sample was injected. A standard mixture containing known fatty acids was chromatographed at the beginning of each day and after each set of 10 samples.

The MIS software package was used to identify the peaks and to determine the area, the ratio of area to height, the equivalent chain length, the total area, and the total area for named or listed compounds. The MIS software package was also used to calculate the percentage of area for each named or listed compound compared with the total area of the compound detected. Compounds were identified by use of the TSBA Version 4.0 Library for aerobic and VPI broth grown library version 3.9 for anaerobes.

Objective measurements/ physical analyses

The objective measurements of texture were obtained by analysis of resistance to shear force conducted on an Instron Universal Testing Machine Model 3365 (Instron Corp., Canton, MA) equipped with a Kramer shear cell. The cell traveled at the crosshead speed of 100 mm/min for the 44 mm distance. The constant distance of 44 mm was predetermined as the point at which the blades reached the bottom slots and the sample was sheared.

Weighed portions (15–20 g) of blue crab meat were mounted in the holding compartment of the cell, with muscle fibers aligned perpendicular to the plane of shear plates. As the blades of the Kramer shear cell moved down, the sample was compressed, deformed and sheared. The force-deformation curve between compressive load (force, N) and compressive extension (distance, mm) was generated by use of Bluehill® software (Instron Corp., Canton, MA). Also, the compressive load at maximum compression load (the maximum peak force, N), compressive load at break (force at break, N), and energy at break (total energy, which is area under the curve, J) was recorded. The peak force (N), force at break (N), and energy at break (J) were normalized by dividing these values by the corresponding weight, which resulted in units of peak force per gram ($N\ g^{-1}$), force at break per gram ($N\ g^{-1}$), and energy at break per gram ($J\ g^{-1}$). Results are reported as a mean of 10 samples per replication and triplicate analyses.

Subjective measurement/ sensory analyses

A triangle test was selected to determine whether an overall difference existed as the result of using HHP to process the crab meat. Crab meat pressure processed at 300 or 550 MPa was compared with non-high pressure processed crab meat. The subjective measurements were performed by 23 experienced panel members consisting of faculty, staff, and graduate and undergraduate students from the Department of Food Science and Technology at Virginia Tech. Three sets of triangle tests were performed by each panelist; they were 300 MPa and control, 550 MPa and control, and 300 MPa and 550 MPa.

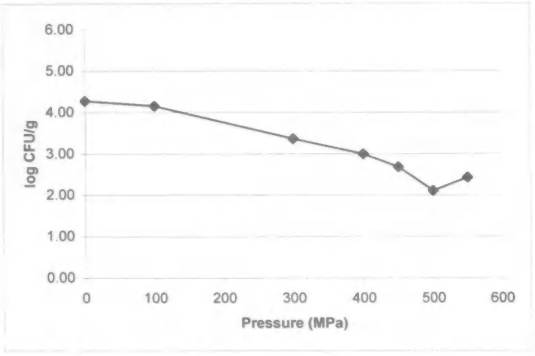
Colorimetric measurements

Colorimetric measurements on the absolute CIE L^*, a^*, and b^* values were obtained with a Minolta Chroma Meter Model CR-200 (Minolta, Ramsey, NJ) by use of CIE illuminant C and D65 as a light source. A 15-g crab meat sample packaged in a polyethylene bag was measured with the chroma meter calibrated with a standard white plate CR-A43 (Minolta). L^*, a^*, and b^*values (L^* = lightness, a^* = redness, and b^* = yellowness) were recorded. All analyses were performed in triplicate.

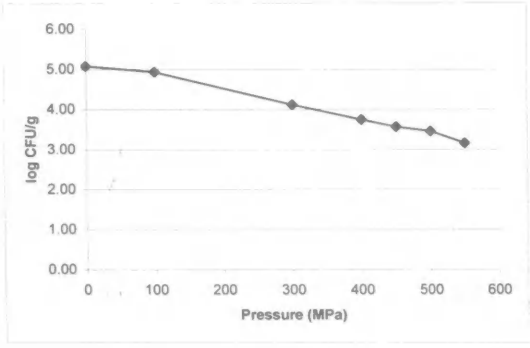
Statistical analyses

Data were analyzed using the General Linear Model (GLM) procedure of SAS (V. 8.02, Statistical Analysis Systems Institute, Inc. 2002). The complete ran-

FIGURE 1. Effects of end-processing temperatures of 25°C (a) and 40°C (b) at different pressure levels for 15 min treatment on total aerobic plate counts



a. Aerobic counts at 25°C



b. Aerobic counts at 40°C

domized factorial design was utilized to test the effects of two variables (pressure treatments and storage days) and their interactions on color characteristics (CIE L*, a*, and b*) and pH. The same experimental design was also used to test the effect of pressure treatments on textural parameters (compressive load at break, compressive load at maximum compression load, and energy at break). All tests used 10 samples for each treatment, except tests for pH (4 samples). If significant differences were found, means were separated by a Least Significant Difference test.

RESULTS

Microbiological changes

Preliminary studies were performed to identify the effects of different pressure levels, processing temperatures, and processing times on Aerobic Plate Counts (APC) and Anaerobic Counts. Pressures of 100 and 300 MPa were chosen, with starting temperatures of 25 and 50°C for 15 min and a storage temperature of 4°C for 31 days. The results showed that, at both temperatures, a low pressure of 100 MPa did not significantly reduce the total aerobic and anaerobic plate counts compared to the control.

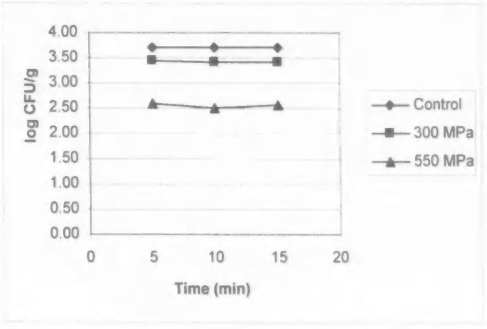
The 50°C process temperature was later found to be unacceptable on the basis of potential metal fatigue of the pressure chamber and the process was therefore eliminated from the study. The processing temperature was then decreased from 50 to 40°C and the starting temperatures at different pressures were calculated to account for the adiabatic temperature rises during compression in order to achieve the same end temperatures for all treatments. Fresh crab meat was processed with two end temperatures (25 and 40°C) at six different pressures for 15 min (Fig. 1). The end temperatures did not significantly reduce the aerobic plate counts. Again, a low pressure of 100 MPa produced a relatively minor effect on aerobic plate counts, whereas medium pressures (200 and 300 MPa) and high pressures (400 to 550 MPa) resulted in a reduction of approximately 1 and 2 log units in aerobic microorganisms, respectively. These results influenced the last study on the effects of processing or holding times. The processing time was 5, 10, or 15 min at medium and high pressures (300 and 550 MPa) at 25°C (Fig. 2). The results showed that a 5-min pressurization process was as effective as 10 or 15 min in reducing microorganisms. From these preliminary results, pressures of 300 and 550 MPa, a processing time of 5 min, and an end temperature of 25°C were used throughout the study.

Microbiological quality of fresh blue crab meat after the cooking process should approach sterility; however, the reintroduction of bacteria into the meat by subsequent processes can result in high initial levels of aerobic organisms. When fresh crab meat was treated with high hydrostatic pressures of 300 or 550 MPa for 5 min at 25°C, the aerobic and anaerobic plate counts on day 0 (the day of pressure treatment) decreased, as shown in Fig. 3a and b. A pressure of 300 MPa decreased the aerobic plate counts by approximately 1 log unit, and a treatment of 550 MPa resulted in a reduction of approximately 2 log units on aerobic plate counts. It was observed that at the same processing temperature, higher pressures (above 300 MPa) inactivated more aerobic organisms than the lower pressure treatments (200 MPa and lower).

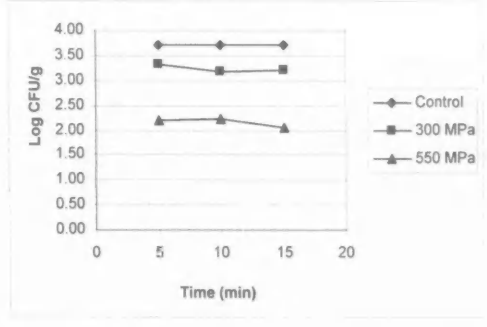
Anaerobic bacteria on pressurized samples were enumerated in order to identify surviving organisms and to determine whether the crab meat contained anaerobic pathogens. No strict anaerobes were found in either control or treated samples. For example, in the control sample on day 0, the aerobic plate counts were ~5 logs, whereas the anaerobic plate counts were slightly more than 3 logs. The effect of hydrostatic pressures on anaerobic plate counts are shown in Fig. 3b. Crab meat treated with 300 MPa did not show any reduction in anaerobic organisms, whereas at 550 MPa a slight reduction was observed.

After pressure treatments, all samples as well as the controls were stored at 4°C for the 31-day shelf-life extension study. During storage, microbiological changes in aerobic and anaerobic organisms were observed. For the control (unpressurized) crab meat, the aerobic count increased

FIGURE 2. Effects of processing times of 5, 10, and 15 min at 25°C (a) and 40°C (b) at 300 and 550 MPa for 15 min treatment on total aerobic plate counts



a. Aerobic counts at 25°C



b. Aerobic counts at 40°C

from 5 logs to ~7 logs during the first 7 days of storage. From day 7 to day 17, the APC gradually increased from ~ 7 logs to ~8 logs. At day 31, the APC was > 8 logs.

In addition to reducing aerobic counts, high pressures may have caused a lag period in which the multiplication of organisms was inhibited because of cell injuries or adaptation of cells to a new environment. A pressure of 300 MPa caused a 3-day lag period, after which growth resumed and increased more than 3 logs before gradually increasing to the final APC of ~ 9 logs at day 31. A lag phase was not observed in the samples treated at 550 MPa.

The behavior of organisms grown under anaerobic conditions in unpressurized and pressurized crab meat is similar to the behavior of those grown aerobically. Anaerobically grown organisms in the control sharply increased from 3 logs to 7 logs during the first 17 days of storage. After day 17, the organism population remained constant until day 31. Crab meat treated with 300 MPa exhibited no reduction in anaerobic counts on day 0 and only slow growth to day 7. During these 7 days, the anaerobic counts increased slightly, from 3 logs to 4 logs, and continually increased with a higher growth rate to 8 logs at day 31.

In the 550 MPa samples, a reduction of 2 log cycles was observed, with no lag period. A starting level of 2 logs in 550 MPa-treated samples increased to 7 logs by the end of the storage period. To summarize the results, high hydrostatic pressures did not appreciably reduce the number of aerobic and facultatively anaerobic bacteria; the 300 MPa process reduced or inactivated aerobic organisms approximately 1 log, and the 550 MPa treatment inactivated about 2 logs of aerobically and anaerobically grown organisms.

Microflora of fresh crab meat and surviving microorganisms after pressure treatments

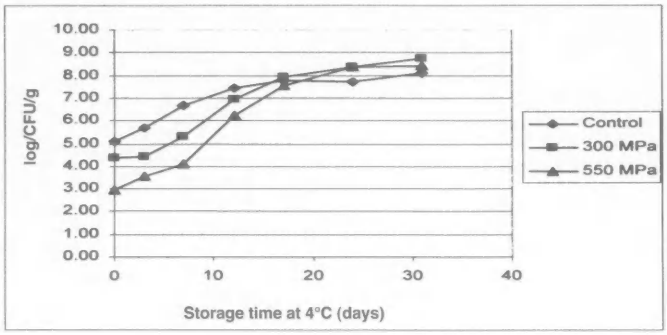
Representative aerobic and anaerobic pressure-resistant organisms surviving the highest pressure applied in this study (550 MPa) were identified and compared to microflora in the fresh crab meat. Fresh and pressurized meat samples were stored at 4°C for 0, 3, 7, 12, 17, 24, and 31 days. Microorganisms isolated from the samples are listed in Table 1. The predominant aerobic microorganisms isolated from the crab samples are listed in Table 2. The facultative anaerobic microorganisms were *Carnobacterium piscicola* for the control crab meat and *Carnobacterium piscicola* and *Enterococcus* spp. for the 550 MPa crab samples.

The microorganisms of fresh meat isolated from aerobic plates were *Acinetobacter* spp., *Arthrobacter* spp., *Brevibacillus* spp., *Brevibacterium* spp., *Exiguobacterium* spp., and *Staphylococcus* spp. The most prominent isolates were identified as *Exiguobacterium* spp. and *Acinetobacter* (Table 2). Pressure treatment of 550 MPa inactivated many of the microorganisms in the fresh meat. Microorganisms present immediately after 550 MPa pressurization (Day 0) in crab meat were *Aerococcus* spp., *Brevibacillus* spp., *Brevibacterium* spp., and *Macrococcus (Staphylococcus)* spp. (Table 1). The predominant aerobic organism that tolerated 550 MPa pressure was identified as *Brevibacterium*.

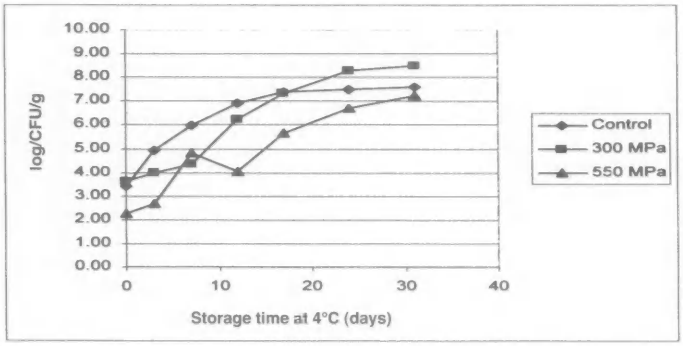
The types of organisms isolated under anaerobic growth conditions were different from those isolated under the aerobic growth condition, as expected. *Carnobacterium piscicola* was the only organism identified from fresh crab meat on day 0. On the same day, only *Enterococcus* spp. was identified from pressurized meat. Although *Carnobacterium piscicola* and *Enterococcus* spp. were identified from anaerobic roll tubes, these two organisms are not strict anaerobes; they are in fact facultatively anaerobic organisms. No obligate anaerobes were isolated in this study.

During the 31-day storage period, the amount of residual oxygen in the vacuum packages was decreased through the growth of aerobic organisms, until the environment became microaerophilic or anaerobic. The diminished oxygen had an adverse effect on aerobes but favored the growth of anaerobic or facultatively anaerobic organisms. Because of the anaerobic

FIGURE 3. Aerobic plate counts (a) and anaerobic counts (b) of control and pressurized crab meat at 300 and 550 MPa at 25°C for 5 min



a. Aerobic count at 25°C



b. Anaerobic count at 25°C

conditions that occurred during storage, fewer species of organisms were identified than under the aerobic condition. Only *Carnobacterium piscicola* was isolated from fresh crab meat from day 0 to day 31, whereas *Carnobacterium piscicola* and *Enterococcus* spp. were isolated from the pressurized samples, with predominance of *Enterococcus* spp.

Sensory analyses

Sensory analyses were conducted to evaluate overall differences between the control and the meat treated with pressures of 300 and 550 MPa. Overall differences between the control and pressurized samples at 300 MPa were analyzed using triangle tests by sensory panels and were not statistically different ($P > 0.05$). Pressure-treated samples at 550 MPa were also not statistically different from the control ($P > 0.05$). Pressurized samples at two different levels (300 and 550 MPa) were not statistically significance ($P > 0.05$).

When the sensory panelists judged and described the meat characteristics, especially odor of the stored meat, a very pungent and strong odor was reported for the control samples when the APC reached about 10^7 CFU/g (Fig. 3), resulting in rejection by panel members on day 17 (Table 3). In contrast, sensory evaluations based upon the smell or odor of the pressurized samples differed from the evaluations of the fresh meat. The higher plate count level did not result in rejection by sensory panelists. If the meat was unacceptable, the aerobic plate counts could not serve as a criterion of quality.

Panelists accepted and described the 300 MPa-treated products as fresh (Table 3) even at the time the aerobic counts had reached 10^7 CFU/g at day 12 (Fig. 3). The 300 MPa-treated samples eventually became spoiled and unacceptable to sensory judges at day 31, when the APC reached 5.6×10^8 CFU/g. For the 550 MPa samples, the APC of pressurized crab meat reached 10^7 CFU/g at day 17 and the meat was still considered acceptable. On the last day of storage (day 31), when the APC was 2.9×10^8 CFU/g, the meat was still acceptable; however, a slight stale odor was detected (Fig. 3).

Color measurement

L^*, a^*, and b^* color values, representing lightness, redness, and yellowness, respectively, of unpressurized and pressurized crab meat were obtained on day 0, 3, 7, 12, 17, 24, and 31. After pressurization (day 0), the crab meat had become slightly darker, as indicated by lower values of lightness. There was more green ($-a^*$) color in the 550 MPa-treated meat, but less green color in the 300 MPa pressure-treated meat, compared to the control. The b^* value, indicating yellowness, was lower in the 550 MPa samples but higher in the 300 MPa samples, compared to the control (Table 4).

The effects of storage day and the interaction between treatment and day of storage were not statistically significant ($P > 0.05$); the treatment of 300 and 550 MPa had significant effects on the L^*, a^*, and b^* values of meat sampled on each day.

In meat sampled immediately after pressurization (day 0), the pressure level of 300 MPa had a statistically significant effect on lightness and yellowness when compared to the control, i.e., pressurized meat was darker and more yellow. A pressure of 550 MPa had no significant effect on lightness and yellowness, but redness was different; the color was more green ($-a^*$) than the control. During the storage period, the color of unpressurized and pressurized crab meat changed over time.

Texture measurement

All three parameters, compressive load at break, compressive load at maximum compression load, and energy at break, of the untreated and pressure-treated crab meat at 300 and 550 MPa measured immediately after pressure treatment (day 0) showed no statistically significant differences ($P > 0.05$), Table 5. The compressive load at break varied from 8.1 (control) to 8.7 N/g (550 MPa). The compressive load at maximum compression load ranged from 18.7 (550 MPa) to 19.7 N/g (control). Energy at break for both untreated and treated samples occurred at the same value of 0.2 J/g. These results demonstrate that high-pressure treatments did not affect meat texture.

TABLE 2. Predominant microorganisms isolated from aerobic plates

Day	Control	550 MPa
0	*Exiguobacterium* spp. *Acinetobacter*	*Brevibacterium*
3	*Pseudomonas* spp.	*Brevibacterium*
7	*Pseudomonas* spp.	*Psychrobacter* spp.
12	*Carnobacterium piscicola* *Pseudomonas* spp.	*Psychrobacter* spp.
17	*Carnobacterium piscicola*	*Enterococcus* spp.
24	*Carnobacterium piscicola*	*Enterococcus* spp.
31	*Carnobacterium piscicola*	*Enterococcus* spp.

TABLE 3. Sensory characteristics of unpressurized (control) and pressurized crab meat stored at 4°C for 31 days

Day	Control	300 MPa	550 MPa
0	Fresh	Fresh	Fresh
3	Fresh	Fresh	Fresh
7	Pungent, strong odor	Fresh	Fresh
12	Pungent, strong odor	Fresh	Fresh
17	Pungent, strong odor, spoiled	Fresh	Fresh
24	Strong odor, spoiled	Stale	Fresh, acceptable
31	Strong odor, spoiled	Pungent, sweet flavor, cabbage flavor, smoky flavor, unacceptable	Little stale, acceptable

pH measurement

High-pressure processing had no effect on the pH of crab meat; the pH of pressurized crab meat on day 0 was constant at a pH of about 7.7, which is identical to the control. In contrast, the pH of untreated (control) and pressurized crab meat changed during storage at refrigeration temperatures for 31 days. pH of the control decreased gradually from 7.7 on day 0 to 7.2 on day 31. Crab meat treated at 300 MPa showed a decrease in pH from 7.7 on day 0 to the lowest pH (7.4) on day 12 and then an increase to 7.8 by the end of the storage period. The treatment of 550 MPa showed similar results to those of the control, in which pH decreased over the storage time, from 7.7 on the first day to 7.4 on the last day of storage.

DISCUSSION

An extension of seafood shelf life, including fresh crab meat, is always financially significant; seafood is highly perishable, with a shelf life of 10–14 days under proper refrigeration conditions. Post-processing methods such as pasteurization, sterilization and freezing have been applied to fresh crab meat; however, these processes always impair the sensory quality characteristics of the meat *(9, 10)*. Recently, an alternative process using high hydrostatic pressure treatment has been used to improve the safety of various foods, including seafood, by inactivating pathogenic and spoilage microorganisms as well as maintaining quality through causing only minor changes in sensory characteristics *(13, 16, 18)*. In this study, the overall differences in sensory attributes of the untreated and pressure-treated crab meat were not statistically significant ($P > 0.05$). Pressure treatments extended the shelf life of crab meat processed at 300 or 550 MPa from 17 to over 24 days and over 31 days, respectively, based on organoleptic evaluations from sensory panels.

Pressure treatments resulted in a different odor in the pressurized meat compared to the fresh product (Table 3). This difference was due to changes in the types and numbers of microorganisms associated with the crab meat as well as intrinsic and extrinsic factors influencing the growth of the surviving microorganisms after high pressure treatments.

The microorganism content in fresh crab meat changed as a result of high hydrostatic pressure inactivation of certain pressure-sensitive microorganisms. The microflora of fresh crab meat consisted primarily of 5 genera of Gram-positive bacteria (*Exiguobacterium, Arthrobacter, Brevibacillus, Staphylococcus* and *Brevibacterium*) and 1 Gram-negative bacterium (*Acinetobacter*). The microflora of pressurized crab meat contained solely Gram-positive bacteria *Brevibacterium, Brevibacillus, Aerococcus, Enterococcus* spp., and *Macrococcus* spp.) in pressurized crab meat. This change demonstrates that Gram-negative bacteria present in fresh crab meat were more sensitive to pressurization treatment than Gram-positive bacteria, which is in agreement with the general statement about pressure sensitivities of bacteria *(12, 28)*. However, the sensitivity of each organism among groups of Gram-positive bacteria varies; i.e., *Brevibacterium* and *Brevibacillus* tolerated a pressure of 550 MPa, whereas *Exiguobacterium, Arthrobacter, Acinetobacter* were inactivated. The presence of *Aerococcus, Enterococcus* spp., and *Macrococcus* after pressurization, despite not having been identified in fresh crab meat, might occur because of suppression by the presence and growth of the other organisms.

As previously mentioned, intrinsic and extrinsic factors (temperature and packaging) also influence the growth of surviving microorganisms during storage. Under an aerobic refrigeration condition, spoilage in fish and other seafood

TABLE 4. L* (lightness), a* (redness), and b* (yellowness) values of unpressurized (control) and pressurized (300 and 550 MPa, 25°C for 5 min) crab meat stored at 4°C for 31 days

Day		Control[1]	300 MPa[2]	550 MPa[3]
0	L	80.0 ± 0.97[a]	78.1 ± 0.75[b]	79.2 ± 0.86[a]
	a	-2.1 ± 0.17[a]	-1.9 ± 0.26[a]	-2.4 ± 0.23[b]
	b	8.6 ± 0.83[b]	9.9 ± 0.89[a]	8.3 ± 0.77[b]
3	L	79.4 ± 1.40[a]	78.6 ± 1.04[ab]	78.3 ± 1.05[b]
	a	-1.9 ± 0.40[a]	-2.4 ± 0.33[b]	-2.3 ± 0.40[b]
	b	7.4 ± 0.93c	9.2 ± 0.58[a]	8.4 ± 0.73[b]
7	L	78.4 ± 1.50[a]	77.4 ± 1.24[a]	78.1 ± 1.10[a]
	a	-1.3 ± 0.30[a]	-2.1 ± 0.24[b]	-2.2 ± 0.29[b]
	b	6.7 ± 1.03[b]	9.0 ± 1.10[a]	8.2 ± 0.88[a]
12	L	78.6 ± 0.77[a]	78.4 ± 0.68[ab]	77.6 ± 1.43[b]
	a	-1.0 ± 0.25[a]	-2.3 ± 0.41[c]	-1.8 ± 0.28[b]
	b	7.6 ± 0.84[b]	8.2 ± 0.83[b]	9.1 ± 0.88[a]
17	L	78.4 ± 1.28[a]	78.3 ± 1.43[a]	78.7 ± 1.23[a]
	a	-1.0 ± 0.30[a]	-2.4 ± 0.40[b]	-2.1 ± 0.52[b]
	b	7.4 ± 0.75[a]	7.4 ± 0.75[a]	8.1 ± 0.95[a]
24	L	79.3 ± 0.68[a]	79.0 ± 1.33[a]	78.1 ± 0.63[b]
	a	-1.0 ± 0.28[a]	-1.9 ± 0.26[b]	-2.0 ± 0.30[b]
	b	7.4 ± 1.15[a]	7.6 ± 1.02[a]	8.2 ± 0.79[a]
31	L	79.0 ± 1.26[a]	78.2 ± 1.50[a]	78.4 ± 1.15[a]
	a	-1.1 ± 0.32[a]	-1.9 ± 0.32[b]	-1.9 ± 0.29[b]
	b	7.3 ± 0.89[a]	7.0 ± 1.18[a]	7.6 ± 0.80[a]

[1,2,3]Each value under the same treatment represents a mean of 10 measurements with standard deviation.

[a,b]Means in same row with same letter are not significantly different ($P > 0.05$).

typically occurs because of growth of psychrotrophic bacteria such as *Pseudomonas* spp. Cockey and Chai *(5)* stated that *Pseudomonas* is one of the predominant organisms during refrigerated storage of dungeness as well as blue crab meat. *Pseudomonas* and *Achromobacter* (which later were identified as *Moraxella* and *Acinetobacter*) accounted for 23.4% of the total microflora in fresh meat and increased to 96.3% by day 11–15 of storage. However, in this study, the spoilage organism isolated from rejected fresh crab meat at day 17 was *Carnobacterium piscicola*, rather than *Pseudomonas*. This change in microflora could result from vacuum packaging that inhibited the growth of aerobic organisms (e.g., *Pseudomonas*) and promoted the growth of anaerobic or facultative anaerobic organisms (e.g., *Carnobacterium piscicola*). Residual oxygen in the vacuum-packaged during storage could have been depleted by the growth of aerobic organisms until microaerophilic or anaerobic conditions were achieved.

Under anaerobic or reduced oxygen conditions and low storage temperatures, psychrotrophic lactic acid bacteria (LAB) can successfully compete with other psychrotrophic bacteria. Lactic acid bacteria consist of genera of *Carnobacterium*, *Enterococcus*, *Lactobacillus*, *Lactococcus*, *Leuconostoc*, *Pediococcus*, *Streptococcus* and *Weissella (26)*. Although lactic acid bacteria are not indigenous to marine environments, they have been isolated from aquatic environments and various seafoods. The occurrence of lactic acid bacteria may be caused by post process contamination, during the picking and packaging stages. Mauguin and Novel *(15)* isolated 86 strains of lactic acid bacteria from fresh pollock, brine shrimp, gravid fish, vacuum-packed seafood (surimi, smoked tuna, salted cod), and fish stored under 100% CO_2 at 5°C (smoked tuna, fresh and salted cod, salmon). Eighty-six isolates were characterized and identified as the genus *Lactococcus* (54 isolates), *Lactobacillus plantarum* (4 isolates), the genus *Leuconostoc* (8

TABLE 5. Compressive load at break, compressive load at maximum compression load, and energy at break of unpressurized (control) and pressurized (300 and 550 MPa, 25°C for 5 min) crab meat

	Control[1]	300 MPa[2]	550 MPa[3]
Compressive load at break (N/g)	8.1 ± 1.08[a]	8.6 ± 1.83[a]	8.7 ± 1.57[a]
Compressive load at maximum compression load (N/g)	19.7 ± 1.61[a]	18.9 ± 1.21[a]	18.7 ± 0.26[a]
Energy at break (J/g)	0.2 ± 0.02[a]	0.2 ± 0.02[a]	0.2 ± 0.01[a]

[1,2,3]Each value under the same treatment represents a mean of 30 measurements from 3 replications with standard deviations.

[a]Means in same row with same letter are not significantly different ($P > 0.05$).

isolates), the genus *Carnobacterium* (16 isolates), facultative heterofermentative *Lactobacillus* (1 isolate), and unidentified (3 isolates).

Lactic acid bacteria are predominant spoilage organisms in packaged and processed meat products *(24)*, fish and fish products, and vacuum-packed seafood products, e.g., vacuum-packaged cold-smoked salmon *(14)*. The lactic acid bacteria isolated from vacuum-packed cold-smoked salmon were dominated by *Carnobacterium piscicola*, which accounted for 87% of the lactic acid bacteria isolates *(19)*. Similarly, in this study two lactic acid bacteria, *Carnobacterium piscicola* and *Enterococcus* spp., were identified as dominant organisms at the time of spoilage, in vacuum-packaged untreated and 550 MPa-treated crab meat, respectively.

Interestingly, despite the high numbers of lactic acid bacteria in vacuum- and modified-atmosphere-packed products, sensory rejection does not always occur. For example, sensory rejection of vacuum- and modified-atmosphere-packed cold-smoked salmon was caused by autolytic changes rather than high levels (> 10^7 CFU/g) of *Carnobacterium piscicola*. The role of lactic acid bacteria on sensory changes in vacuum- or modified packaged foods is also shown in this study when pressurized crab meat (550 MPa), dominated by *Enterococcus* spp., did not spoil. However, in the control samples, sensory panelists described "strong odor" even though *Carnobacterium piscicola* was predominantly found at the time of sensory spoilage (day 17), possibly due to the *Pseudomonas* spp. growth prior to day 17 (Table 2).

The inhibitory effect of *Carnobacterium piscicola* and *Enterococcus* spp. to other microflora in vacuum-packaged crab meat is probably due to production of lactic and acetic acids. Lactic acid bacteria produce either homo- or heterolactic acid from metabolism of carbohydrates, resulting in a pH decrease. The pH of crab meat measured during the storage period decreased from 7.7 on day 0 to 7.2 in control samples and to 7.3 in treated samples by the end of the 31-day storage period. Some lactic acid bacteria are capable of producing antimicrobial proteins or peptides known as bacteriocins, e.g., nisin (*Lactococcus lactis*), and pediocins (*Pediococcus acidilactici* and *Pediococcus cerevisiae*), along with acids.

Among the bacteriocin-producing lactic acid bacteria, *Carnobacterium* is a newly recognized genus, most strains of which have been isolated from vacuum-packaged meat or fish *(27)*. Schillinger and Holzapfel *(25)* were the first to report on the production by the genus *Carnobacterium*, of bacteriocin, which has antibacterial activity against other microorganisms, including enterotoxigenic and pathogenic bacteria such as *Staphylococcus aureus* and *Listeria monocytogenes*. Bacteriocins from the genus *Carnobacterium* are heat-resistant and stable over a wide range of pH *(27)*. *Carnobacterium piscicola* is used as a starter culture, and its purified bacteriocins have been used in the biopreservation of refrigerated meat and fish products, mainly to control the growth of *Listeria monocytogenes (3, 4, 6, 17, 27)*. These studies showed an antagonistic activity of bacteriocins against *Listeria monocytogenes* and other closely related Gram-positive bacteria, which might resemble results obtained in the present study, in which growth of some pressure-resistant Gram-positive bacteria was inhibited. *Enterococcus* spp. isolated from pressurized crab meat (550 MPa) may be capable of producing bacteriocins that can inhibit the growth of other pressure-resistant Gram-positive bacteria that survive pressure treatments. *Enterococcus faecium* has been reported as capable of producing bacteriocins called enterocin *(1)*.

Application of pressure treatments to fresh crab meat not only resulted in a shelf-life extension by inactivating spoilage microorganisms, as previously discussed, but also maintained product quality (color and texture). Of all three color values (L^*, a^*, and b^*), L^* (lightness) is likely to be the most important factor determining consumer acceptance, as loss of the natural glistening white to off-whitish color in fresh meat could lower acceptance and thereby generate economic loss *(23)*. The color measurements of treated crab meat showed no significant difference ($P > 0.05$) from those of untreated crab meat after pressurization and during the storage period, except for minor changes in L^* (lightness) values after high pressure treatments, discolorations so slight they were not visually detected by sensory panelists. The texture of pressurized crab meat was also not affected by high pressures and was identical to the texture of fresh crab meat.

In summary, high hydrostatic pressure treatment of vacuum-packaged fresh crab meat has been shown to increase shelf

life without impairing the original texture and sensory properties.

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Incorporation of Music in a Food Service Food Safety Curriculum for High School Students

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SUMMARY

Food safety music parodies were incorporated into a nine-lesson foodservice food safety curriculum for high school students. Nine song parodies were chosen from those developed by Dr. Carl Winter (available at the University of California Food Safety Music webpage, http://foodsafe.ucdavis.edu/) and were inserted into nine lessons to reinforce the subject matter. The curriculum was taught both with the addition of music (Music-added, 9 classes) and without it (Control, 8 classes) in 17 high school family and consumer sciences foods classes in Idaho. Student response was measured. Students in the Music-added group, who were also in classes taught by teachers with more experience with this curriculum or who were also in classes with fewer students, had a significantly higher food safety knowledge score than students in the Control group. Students in the Music-added group who were males or students who were also in classes taught by the teachers with more experience with the curriculum scored significantly higher on one of the food safety attitude instruments used in the study. Teachers using the Music-added curriculum were positive about the addition of the songs and reported that it increased the enjoyment of teaching the subject for both themselves and students.

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INTRODUCTION

Food safety education of food service workers is an important and challenging task. To protect public health, many states mandate some type of food safety training for these workers *(1)*, and a wide variety of training options exist. The goal of food safety education is that food handlers will implement the lessons learned and thereby reduce the risk of foodborne illness in their food service establishments. Many studies have been conducted to assess the effect of food safety training on knowledge, attitudes and behaviors of food service workers *(5, 6, 13)*, and means for improving educational success are continually sought. Addition of relevant musical interludes to food safety educational programs is one novel approach.

Educational research indicates that music provides a powerful, yet often overlooked, medium for learning and memory. Music and rhythm-based mnemonics presumably allow audiences to easily link new information to their existing knowledge base *(9)*. Recall of textual information is improved when the information is presented as a lyric *(4, 19)*, and music is associated with greater retention of the information *(16)*. Studies indicate that simple repetitive melodies and consistent rhythmic structure across the verses are most effective, as are lyrics containing strong end-rhymes, imagery, internal rhymes and poetic devices *(9)*.

Dr. Carl Winter, Extension Food Toxicology Specialist at the University of California-Davis, has developed a unique musical approach to food safety education and outreach over the past ten years. Dozens of popular songs, representing a wide range of styles, have had their lyrics modified into humorous, yet informative, musical parodies appropriate for food safety education. As examples, the Beatles' "I Wanna Hold Your Hand" has been amended to "You'd Better Wash Your Hands," the Eagles' "Heartache Tonight" becomes "Stomachache Tonight," and Will Smith's rap song, "Gettin' Jiggy Wit It" is changed to "Don't Get Sicky Wit It." Many of the food safety songs incorporate the simple repetitive melodies, consistent rhythmic structure, and lyrics with strong end-rhymes, imagery, internal rhymes and poetic devices that have been identified as effective for information retention.

These food safety music parodies have been disseminated through a number of channels, and the response has been very favorable. Dr. Winter has hundreds of live performances of the music at national and local meetings of food professionals, teachers, dietitians, environmental/public health specialists, childcare providers, foodservice workers, students from K-12 through college age, and the general public. More than 20,000 of the self-produced audio CDs have been distributed throughout the world and have been particularly popular with school teachers, food safety instructors in the food service industry, and Extension educators. The food safety music has also been the focus of hundreds of media reports, including television, radio, newspapers, magazines and online media. The Food Safety Music Web site *(17)* contains downloadable streaming audio files for several songs available in Flash™ format, as well as lyrics that may be downloaded as PowerPoint presentations containing clip art. Video clips of live performances and animated videos are also available in Flash™ format. The site has received more than 80,000 individual visits in the past three years.

The availability and popularity of these food safety songs suggested that incorporating them into a food safety curriculum could result in improved learning and retention by students. Liang and Frank *(11)* have used nutrition songs to enhance nutrition knowledge among fourth-grade students. Other studies have shown that music serves effectively as an educational aid for such diverse audiences as children *(4, 18)*, young adults *(12, 14, 15, 16)*, older adults *(15)*, and the learning disabled *(3)*.

We undertook this project to determine whether adding food safety songs to an existing food service food safety curriculum for high school students would enhance student knowledge, attitudes and behaviors.

METHOD

University of Idaho Extension added music to its 9-lesson curriculum, *Ready, Set, Food Safe,* which it uses for teaching food service food safety to high school students. When students pass the *Ready, Set, Food Safe* certification test with a score of 80% or better, they receive an Idaho Department of Health and Welfare-approved food safety and sanitation certificate. Use of the curriculum in Idaho has been increasing annually. Since it was introduced in 2002, *Ready, Set, Food Safe* has been taught by 60 teachers or extension educator-teacher teams in 312 Idaho classrooms to 6,984 students; 5,131 students received the food safety and sanitation certificate.

Nine food safety songs that reinforced the curriculum subject matter were selected (from 18 available) by a team of a senior student and a graduate student enrolled in the University of Idaho foods and nutrition program and author SMM. Table 1 identifies the song chosen for each lesson and the rationale for including that song. The songs were inserted in the curriculum at points appropriate to the subject matter. The song lyrics were included in the PowerPoint slide set (on 3–6 slides) for each lesson. A mouse-click on the first lyric slide started the song playing. A handout of the song lyrics was also provided for distribution to students.

Three instruments were used to assess student food safety knowledge, attitudes and behaviors after completion of the *Ready, Set, Food Safe* curriculum, either with or without added food safety songs.

Student knowledge of food service food safety concepts was measured by use of the 50-item true-false and multiple choice certification test for the *Ready, Set Food Safe* curriculum. A team of three foods and nutrition faculty identified the test items (20 of the 50 questions) that were related to song content. For example, the use of proper temperatures for cooking or holding is mentioned in six of the nine songs, and 11 of 20 related test items address these concepts.

Student attitudes about food safety were measured by having them read a case study, then rate 16 behaviors for safe and unsafe food handing practices. A brief vignette (275 words) describing specific behaviors of two high school students preparing and serving hamburgers, French fries, drinks and cookies in a fast food restaurant was followed by a list of sixteen food safety behaviors from the story. The students rated eight behaviors on their importance to providing safe food (on a 4-item scale: 'Very important to safe food' to 'Not important to providing safe food') and eight behaviors on their likelihood to lead to unsafe food (on a 4-item scale:

TABLE 1. Lesson topic and food safety parody song chosen for that lesson

Lesson Title	Song (and song/artist parodied) and song length (minutes:seconds)	Explanation for teacher about rationale for including song in curriculum
Lesson 1: Why is Food Safety Important? Where Do the Rules Come From?	USDA (from "YMCA" by the Village People) 4:19	This song works well as an introduction to government agencies and the regulation of the food supply. Emphasize to the students that food service is not regulated by USDA. USDA handles aspects of food safety described in the song, but food service food safety is regulated by individual state goverments.
Lesson 2: What are Hazards to Safe Food?	STAYIN' ALIVE ("Stayin' Alive" by the Bee Gees) 3:36	This song introduces many hazards which affect the safety of the food supply. It includes some symptoms of food-borne illness and how to "stay alive" by preventing foodborne illness. The potentially hazardous foods hamburger, raw oysters and raw vegetables are mentioned in the song. Please note the underlined lyrics vary a little from the recording because they were changed to comply with the Idaho Food Code.
Lesson 3: What are Some Important Foodborne Pathogens?	A CASE OF NORWALK ("Under the Boardwalk" by the Drifters) 2:43	This song discusses norovirus, which is one of the microorganisms this lesson focuses on. The song includes symptoms and sources of this virus. Note that the name of this pathogen has recently changed to norovirus, although many references to it as Norwalk-virus still exist.
Lesson 4: Food Flow: Keeping Food Safe from Gate to Plate	DON'T BE A GAMBLER ("The Gambler" by Kenny Rogers) 2:45	This epic-style song talks about how to properly cook a hamburger including hand washing and taking the temperature before serving. This is an excellent introduction to the "Let's Fry a Hamburger!" Activity. Point out to students that the food service regulations require ground beef be cooked to 155°F for 15 seconds and the ground beef cooking recommendation for consumers is 160°F (no time requirement).
Lesson 5: Clean: Do You Want to Eliminate a Million… Bacteria?	YOU'D BETTER WASH YOUR HANDS ("I Want to Hold Your Hand" by The Beatles) 2:20	This song stresses the importance of handwashing to reduce contamination and includes a description of proper handwashing techniques. This reinforces the handwashing demonstration.
Lesson 6: Keep It Straight, Don't Cross Contaminate	THEY MIGHT KILL YOU/WE ARE THE MICROBES ("We Will Rock You/We Are The Champions" by Queen) 4:37	This song discusses cross contamination and the importance of thorough cooking. It is a good summary song because it includes concepts from previous lessons such as potentially hazardous foods, specific microorganisms, and symptoms of foodborne illness.

TABLE 1. *(Continued)* Lesson topic and food safety parody song chosen for that lesson

Lesson Title	Song (and song/artist parodied) and song length (minutes:seconds)	Explanation for teacher about rationale for including song in curriculum
Lesson 7: Hot Tips: Cooking, Hot Holding and Reheating	STOMACHACHE TONIGHT ("Heartache Tonight" by The Eagles) 4:20	This song discusses the importance of thoroughly cooking food before serving it to the public. The song is based on the songwriter's own experence. It also reinforces the importance of *Salmonella*, one of the pathogens studied in previous lessons.
Lesson 8: Chill Out: The Importance of Cold Temperatures in Food Safety	DON'T GET SICKY WIT IT ("Gettin' Jiggy Wit It" by Will Smith) 3:05	This song gives tips to use when cooking and chilling food as well as sanitizing. The song is about the general consequence of improper cooling—getting sick. The song also mentions the prevalence of foodborne illnesses in the United States. Note: This song mentions the consumer recommendation of no more than 2 hours in the Danger Zone; the food service rule is no more than 4 hours.
Lesson 9: Managing Food Safety	I WILL SURVIVE ("I Will Survive" by Gloria Gaynor) 3:42	This song is an excellent summary of the course. It mentions cooking food thoroughly, using a food thermometer, defrosting food safely and the importance of refrigeration. It also mentions specific pathogens, which were discussed in previous lessons. The "take home" message from this song is that foodborne illness can be prevented if the necessary precautions are taken.

'Very unsafe food handling behavior' to 'This behavior does not affect safe food safety'). For example, the statements that were rated with positive wording (safe food handling practices) included items such as "Putting on a clean apron before starting work," "Washing hands before starting work," and "Slicing tomatoes within 15 minutes of serving." The statements that were rated with negative wording (unsafe handling practices) included items such as "Starting to work without cleaning and sanitizing the work surfaces," "Slicing tomatoes directly after handling frozen hamburger patties," and "Placing hamburgers, fries, cookies and drinks on the same serving tray." The vignette and behaviors for assessment were improved after review by three food safety specialists, a nutrition education professor, and a family development professor. The instrument was pilot-tested in two high school family and consumer sciences classes, one in a large urban area and the other in a small rural high school. A focus group of 6 or 8 students from each class discussed the instrument to verify that students understood the vignette and the rating of the 16 food handling behaviors.

An observation checklist was developed for use by high school teachers in observing student food safety practices in the foods laboratory. Nineteen specific food safety behaviors generally expected of high school students were identified in five categories: hand hygiene (7 items), general cleaning and sanitizing (4 items), handling raw meat, poultry or fish (3 items), use of a food thermometer (2 items), and food storage (3 items). For each behavior, the checklist had a place for the teacher to record "yes" or "no" as to whether the student performed the behavior (for example, "Washes hands before beginning food preparation") or "not applicable" if the situation did not apply in that classroom. The checklist was reviewed by a food safety extension specialist not on the research team and pilot-tested by two high school family and consumer sciences teachers; it was revised based on their comments.

Idaho high school family and consumer sciences teachers or extension educators who use the University of Idaho extension curriculum *Ready, Set, Food Safe* were recruited for the study at their Professional-Technical Education Summer Conference on July 28, 2004 (teachers) or via email (Extension educators). Twenty teachers/educators agreed to participate. Teachers/educators were blocked into groups for experience with the curriculum and by classroom size. They were either 'Less Experienced' (having taught the curriculum 1–2 times) or 'More Experienced'

TABLE 2. Food safety knowledge scores of Control and Music-added group students from classrooms grouped by teacher/educator experience and grouped by classroom size[1] (highest possible score = 10)

Treatment	Teacher/educator experience		Classroom size	
	More	Less	Large	Small
Control	7.0 a (76)[2]	7.9 a (50)	8.3 a (86)	6.6 a (40)
Music-added	8.7 b (82)	7.2 a (71)	8.1 a (97)	7.9 b (56)

[1]Scores within a column followed by different letters are significantly different $P < 0.05$.

[2]Numbers in parentheses are the numbers of students contributing to the score.

(having taught the curriculum 3 or more times). Classroom size was either 'Small,' less than 18 students, or 'Large,' more than eighteen students. After blocking, ten teachers/educators were randomly assigned to teach the curriculum with added food safety songs ('Music-added group') and ten were assigned to teach the curriculum as usual, without songs ('Control group'). Seventeen teachers/educators completed the teaching and evaluations.

Participating teachers/educators were sent a packet of materials explaining the experimental protocol and containing the evaluation instruments. Teachers who had been randomized into the Music-added group also received a new copy of the *Ready, Set, Food Safe* curriculum, with one food safety song added to each of the nine lessons. They were also provided with a CD containing the nine songs, in case they were unable to play the songs via the computer PowerPoint program, for which external speakers were required. Each teacher from both the Control and Music-added groups participated in a separate, approximately 1-hour, training conference call to familiarize them with the project and particularly with the instruments for measuring student attitudes and behavior.

Each teacher taught *Ready, Set, Food Safe* as usual, or as usual with the addition of the food safety song parodies, and recorded the amount of classroom time used to teach the curriculum. The 50-item certification test was administered as usual. In addition, teachers had their students read the case study and rate the food safety handling behaviors described. Teachers rated the food safety behavior (19 items) of four randomly selected students (randomization protocol was provided) during a food laboratory session in which meat, poultry, fish or eggs was prepared. Students and teachers in the Music-added group were also asked to complete a brief opinion questionnaire about whether they liked the songs. Seventeen of the recruited teacher/educator classrooms completed evaluation instruments and returned them to the investigators via mail; 8 of the 17 were from the Control group (5 were 'More experienced' and 3 were 'Less experienced'; 4 classrooms were 'Large' and 4 were 'Small') and 9 of the 17 were from the Music-added group (5 were 'More experienced' and 4 were 'Less experienced'; 4 classrooms were 'Large' and 5 were 'Small'). Teachers/educators received a $50 gift certificate for participating in the study. The project had been reviewed and approved by the University of Idaho Human Assurances Committee.

Data analysis

From the 50-item certification test, 20 multiple-choice questions that dealt with food safety topics covered by the nine songs were selected to assess student knowledge. Questions on which both the Control and Music-added groups scored 90% or higher were eliminated from the data analysis, leaving 10 questions. For the remaining 10 questions, each correct answer was assigned 1 point; averages for food safety knowledge were computed for each classroom (possible scores therefore ranged from 0 to 10).

For the assessment of students' food safety attitudes from their behavior ratings in the case study, one point was assigned to each correct answer in the 8-item safe food handling list and the 8-item unsafe food handling list. A classroom average for attitude was computed for safe food handling and for unsafe food handling behaviors by averaging the correct responses (possible scores ranged from 0 to 8).

The teacher/educator observations of student behavior in the foods laboratory was not analyzed statistically because the teachers/educators in the Music-added group reported a much higher percentage of 'Not Observed' for the 4 students per classroom they observed. The differences made a comparison of the two groups impossible.

The response of teachers/educators and students to the opinion questionnaire were tabulated.

The classroom knowledge scores and safe and unsafe food handling attitude scores were analyzed as a Generalized Randomized Complete Block using SAS 9.1 for Windows, with blocks for treatment (Control or Music-added), teacher/educator experience with the curriculum (2 levels), and class size (large or small). Data was also analyzed separately by gender. The assumptions of the model were checked, and no violations were found.

RESULTS

Effect of music addition on knowledge scores

Although the Music-added treatment group tended to score better than the Control group, 0.80 versus 0.74, on the 10 knowledge questions that were supported by the lyric content of the food safety songs, the difference was not significant. Interactions were observed within the treatment blocks for teacher/educator experience and classroom size. In classrooms where the teacher was more experienced with the *Ready, Set Food Safe* curriculum, students in the Music-added group scored significantly higher in food safety knowledge than Control students (Table 2). In small classrooms, students in the Music-added group also scored

TABLE 3. Safe and unsafe food-handling attitude scores of Control and Music-added group students[1] (highest possible score = 8)

Treatment	Safe Food-Handling Attitude Score			Unsafe Food-Handling Attitude Score		
	All Students (n = 287)	Males (n = 118)	Females (n = 169)	All Students (n = 287)	Males (n = 118)	Females (n = 169)
Control	4.5 a	4.5 a	4.6 a	4.6 a	4.5 a	4.7 a
Music-added	4.8 a	4.8 a	4.8 a	4.9 a	5.1 b	4.9 a

[1]Scores within a column followed by different letters are significantly different $P < 0.05$.

TABLE 4. Safe and unsafe food-handling attitude scores of Control and Music-added group students from classrooms grouped by teacher/educator experience[1] (highest possible score = 8)

Treatment	Safe Food-Handling Attitude Score		Unsafe Food-Handling Attitude Score	
	Teacher/educator experience		Teacher/educator experience	
	More	Less	More	Less
Control	4.4 a (73)[2]	4.7 a (41)	4.4 a	5.0 a
Music-added	4.7 a (88)	4.9 a (84)	5.0 b	4.8 a

[1]Scores within a column followed by different letters are significantly different $P < 0.05$.

[2]Number in parentheses are the numbers of students contributing to score.

significantly higher in food safety knowledge than Control students (Table 2). Analyzing the data by gender produced the same results, except that for males the significantly higher score in small classrooms was lost (data not shown).

Effect of music addition on food safety attitude scores

The mean food safety attitude score of high school students was measured by their ratings of behaviors described in a food service story. For the students' ratings of safe food handling behaviors (positively worded statements), no significant differences occurred between groups for main effects or interactions. The scores were higher for the students in the Music-added group than for the Control group, but no statistical significance was achieved for the 8-item safe food handling list (Table 3). For the 8-item unsafe food handling behaviors instrument (negatively worded statements), males in the Music-added group scored higher than males in the Control group ($P > 0.05$) (Table 3), and in classrooms in which the teacher was more experienced with the curriculum, students in the Music-added group scored higher than the Control students ($P > 0.05$) (Table 4).

Student and teacher opinion of added music

Students (n = 176) in the Music-added group were asked if they liked the songs that were played during the food safety lessons. Forty-seven percent answered 'Yes,' 28% said 'No' and 26% marked the 'No opinion' box. On a classroom basis, the majority of students in 2 classrooms did not like the songs, students in two classrooms were split in their opinions and students in 5 classrooms mostly liked the songs. When asked if there were any particular songs they remembered or liked, 92 students identified 113 songs (students could choose more than one song). Songs were listed as few as 4 times or as frequently as 23 times; the most popular song was *Don't Get Sicky Wit It*, a parody of the rap song *Gettin' Jiggy Wit It*, by Will Smith.

The opinion of the nine teachers/educators was universally positive about the addition of food safety songs to the *Ready, Set Food Safe* curriculum, but of course these individuals had volunteered to participate in the project. The teachers commented that their students liked the songs, even in the two classes where a majority of students indicated otherwise. One teacher commented that her students "groaned" when she played the songs, but "they got into it." The teachers noted that the songs made a positive contribution to the teaching of the food safety lessons, particularly in making it more enjoyable.

Time used to teach curriculum

The amount of time teachers reported they used to teach the *Ready, Set Food Safe* curriculum in the high school classrooms varied greatly, from 3.5 h to 15 h, but the variation occurred similarly in both the Control and Music-added groups. The average time used was 8.4 h for the Control group and 8.6 h for Music-added group, which was not significantly different. Analysis of time to

teach by teacher experience or classroom size also did not reveal significant differences.

DISCUSSION

In this study of 17 classrooms, the addition of food safety songs to a nine-lesson food service food safety curriculum for high school students positively affected student learning in classrooms that had teachers with more experience with the curriculum and smaller class size. In classrooms that had teachers with less experience and more than eighteen students, there was no difference between the measured knowledge of students in the Control and Music-added groups. Teaching food service food safety information to high school students can be a challenging task, and it may be that teachers who were more comfortable with the curriculum were better able to incorporate the songs in their lessons. Smaller classrooms may permit more rapport with students and allow students to feel more comfortable with an innovative change in instructional style. Certainly research has shown that smaller classrooms permit teachers to spend more time on task-related interactions *(8, 10)* and appear to be more supportive environments for student learning, with a relaxed atmosphere and a student-teacher familiarity that extends beyond the classroom *(8)*. Positive effects of smaller classroom size on student learning have been observed from elementary to post-secondary levels *(2, 7, 10)*.

It is also possible that the differences observed were due to a 'teacher effect.' The authors have noted in working with teachers on delivery of this curriculum since 2002, that some are consistently able to produce higher percentages of students who pass the certification test. Teacher records of students' pass rates were not used to block the classrooms when the treatment group was assigned, as it was not consistently available.

It is interesting that no differences between the Music-added and Control groups were observed for student ratings of the behaviors that 'keep/make food safe,' while some significant differences were observed for student ratings of behaviors that lead to unsafe food. The higher attitude score of males in the Music-added group is difficult to explain. The higher attitude score of students in classrooms in which teachers had more experience with the curriculum may be due to improved delivery of food safety information by these teachers.

The large differences between the Control and Music-added groups in the number of observations of student behavior in the foods laboratory prevented a comparison of food safety behaviors for the two groups. A follow-up conversation with some of the teachers in the Music-added group did not identify a reason for the smaller number of observations made by this group of teachers.

The opinions of the students about the inclusion of songs were mixed, with almost one-half of the students liking the added food safety song parodies. The teacher opinions indicated that many students who professed not to like the music, did appear to enjoy it. A few (11 of 176) commented that they would prefer a professional singer.

Measuring the effect of music in this project differed from that reported by research studies interested in the effect of music as a mnemonic aid *(4, 14, 19)*, as the songs did not directly reflect the certification test material or the case study behaviors rated in the attitude instrument. However, the songs convey general and specific information about food safety topics as well as an attitude that food safety is an important topic.

It may be possible to make music more effective as an educational tool by aligning the topics covered in the lyrics more closely with specific subjects in each lesson and by writing songs with strong rhythm, rhymes, imagery that emphasize topics in which memorization is required, such as temperatures, microbe names, or sanitizer concentrations. Selection of songs for parody that are familiar to the target audience may also increase effectiveness.

The results of this project indicate that adding food safety parodies to a food safety food service curriculum for high school students may improve knowledge scores and food safety attitudes scores for some students.

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On-site Interview of New England Gardeners to Assess Food Safety Knowledge and Practices Related to Growing and Handling of Home Grown Fresh Fruits and Vegetables

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SUMMARY

The objective was to develop and implement an on-site interview as a follow-up, in-depth probe to a regional mail survey that had been used to assess food safety knowledge of home gardeners with regard to fresh fruits and vegetables. The interview was used by investigators to enhance the understanding of the original survey data by probing topics associated with documented low knowledge scores. Ninety-four home gardeners of fruits and vegetables from 5 New England states volunteered to participate in the interview. A structured, on-site questionnaire was developed and carefully scripted. Master Gardeners from each state were recruited and trained to conduct the on-site interviews and were instructed to gather information only. Respondents answered 19 questions in the following categories: safety of organically grown produce, bacterial contamination (human and garden sources), water safety, safe use of compost/manure, health and hygiene, and post-harvest handling. Qualitative data and descriptive assessments were obtained through written text responses, and Chi-square statistical analysis was used to assess the demographic variables. Home gardeners, although they acknowledged that they could get sick from consuming produce, did not seem to be aware that contamination could come from a variety of sources such as soil, compost, fresh manure and/or the water supply. Results indicated that there was a "disconnect," or lack of understanding, of the sources and mechanisms of pathogenic bacterial contamination as related to its homegrown produce.

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INTRODUCTION

The hazards of microbial contamination associated with commercially grown fresh produce have been well-documented *(5)*. During the past three decades, the consumption of fresh fruits and vegetables has increased in the United States *(11, 30)*. Along with this increase, public health officials and the Centers for Disease Control and Prevention (CDC) have documented an increase in produce-related foodborne illnesses *(13, 30, 34)*. Most recently in the United States, a nationwide *E. coli* O157:H7 outbreak associated with the consumption of fresh spinach caused 204 cases of foodborne illness, including 31 cases involving a type of kidney failure, 104 hospitalizations, and three deaths *(15)*. Between 1990 and 2003, foodborne illness outbreaks linked to fresh produce and/or produce dishes made up 12% of all outbreaks and constituted 20% of all foodborne illness cases *(14, 31)*. Furthermore, surveillance data for foodborne illnesses reported by the CDC also indicated that deaths attributed to contaminated fruits and vegetables accounted for 7% and 8% between 1993 and 1997 and between 1998 and 2002, respectively *(21, 22)*. Since 2000, the US Food and Drug Administration (FDA) has investigated 57 foodborne illness outbreaks, 47 of which involved fresh produce *(23)*.

In an effort to ensure the safety of produce, the FDA has developed guidelines that outline Good Agricultural Practices (GAP) for commercial growers/producers of fresh and, more recently, fresh -cut produce *(11, 16)*. These strategies were designed to minimize the microbial contamination safety hazards associated with fresh and minimally processed fruits and vegetables. The guidance document addresses common good agricultural and good manufacturing practices associated with the production of fruits and vegetables, such as safety of the water source, manure application, worker hygiene/sanitation, and post-harvest handling. The new guidance document focused on application of GMPs, production, process controls and transportation, as well as documentation and records. However, contamination, growth and survival of enteric pathogens in produce are complex and can be impacted by plant environment, plant-bacteria interactions, and plant microflora-bacteria interactions *(6)*. Once fresh produce has been contaminated, with microbial pathogens, removing or killing them can be difficult. Prevention of microbial contamination at all steps, from farm to table, would most effectively reduce foodborne illness associated with fresh produce contamination.

However, the potential for microbial contamination of fresh produce should not be assumed to be confined to the farm. On the contrary, home gardeners, because of limited educational resources and intervention available to them, should be considered as sources of microbial contamination *(26)*. Although considerable effort has been made in recent years to integrate GAP food safety practices on commercial farms, the guidance and educational efforts have not been directed at home fruit and vegetable gardeners. Retrospective analysis of food poisoning provides relatively little information, because consumers often find it difficult to recall their food intake and handling practices and fail to assess and link home food handling practices with foodborne illness *(28)*. Therefore, consumers may not associate their growing/handling practices of home grown produce with illness. Assessment of home gardening practices is necessary to develop the most effective outreach strategy of GAP for home food production.

Many of the same food safety issues associated with commercial agriculture could easily apply to home grown products. A recent study by Pivarnik et al. *(26)* assessed the knowledge of and attitudes toward Good Agricultural Practices of home gardeners of fruits and vegetables in New England. This regional questionnaire was distributed to 5,000 randomly selected households of gardeners in five New England states, and respondents answered questions on food safety topics for all aspects of gardening and post-harvest handling. Knowledge questions were assessed by using five gardening timeline/categories (general fruit/vegetable food safety, prior to planting/soil preparation, during planting/growing, harvesting and post-harvest handling) and four content categories (foodborne illness, sanitation/hygiene, composting/manure application and water). Attitudes were assessed regarding the importance of home gardening practices to food safety. Although respondents appeared to have positive attitudes toward their responsibility for the safety of the produce they grow, results indicated that knowledge of food safety of fruits and vegetables by New England home gardeners fell below an 80% subject mastery standard. More than 50% of the survey questions addressing aspects of general fruit/vegetable safety, gardening practices and post-harvest handling either were answered incorrectly or were answered by an indication that the respondent did not know the answer. The results of the survey strongly indicated a lack of food safety knowledge among New England home gardeners and supported the need for outreach programming and training.

Although the study by Pivarnik et al. *(26)* evaluated knowledge and attitudes, the use of a self-reported survey as the sole effort to relate this information to respondents' behavior may not be reliable *(28)*. Although other researchers have shown a strong relationship between attitude and practice *(19)*, simply using a self-reported survey to develop educational programs may not impact behavior as desired. Studies have shown lack of agreement between self-reported and observed food handling practices *(9)*. Redmond and Griffith *(28)* found that problems associated with correlation of knowledge, attitudes and intentions with actual practice can be minimized by using on-site, face-to-face structured interviews along with any observational information. Although quantitative survey data identify areas of focus, qualitative interview data would give substance and enhanced understanding to those areas of focus. This qualitative descriptive analysis builds the foundation for interpretation, when meaning and comparisons are made from the data and patterns are revealed *(25)*. Interpretation of quantitative statistical assessment has been found to be clearer and more meaningful when presented in the context of respondents' comments to directed, open-ended questions with thematic analysis of common issues *(7, 25)*. Therefore, by probing the low-knowledge food safety topics from the survey by use of an on-site, structured interview, researchers could inform the quantitative data (i.e., add meaning and depth to the quantitative data) to develop appropriate educational/outreach materials *(17)*.

The objective of this research was to develop and implement an on-site interview as a follow-up, in-depth probe to the regional survey in an effort to gain additional information about knowledge and attitudes of home gardeners toward growth and handling of home-grown fruits and vegetables. The interview sought to inform the survey data by probing topics associated with low knowledge scores and consequently enhance *meaning* in the areas of misunderstanding. Thus, by a more comprehensive understanding of respondents' beliefs, educators can develop educational/outreach materials that can more effectively affect food safety practices from garden to table.

METHODOLOGY

Sampling and data collection

Utilizing the 762 respondents from the original mail survey administered to assess New England home gardener food safety knowledge of fresh fruits and vegetables as the initial pool for potential on-site interview subjects, volunteers interested in participating were asked to provide their name and contact information on a form attached to the mail-in survey *(26)*. Of 104 respondents who indicated they would consider involvement in this follow-up interview, only thirty-nine (N = 39) agreed to participate. Therefore, other home gardeners in five New England states (CT, MA, NH, RI and ME) were solicited via Cooperative Extension and/or Agricultural Resources Educator contacts, on-site solicitation using fliers at fairs/festivals, acquaintances, and/or people who called state-wide toll-free gardening/food safety hotlines. Those participants (N = 55) who did not complete the original mail-in survey were asked to complete a form containing demographic information on age, gender, household income, educational completion level, locality type (e.g., rural, suburban) and state of residence. These demographic items and corresponding choices were the same as those queried on the original survey. Demographic information forms, which were sealed in an envelope by the participant, contained no identifiers, and they were returned separately from the answers to the on-site interview. A total of 94 home gardeners of fruits and/or vegetables were interviewed for this study: CT, 18; NH, 19; ME, 20; RI, 18l and VT, 19.

Data analysis

For qualitative data, descriptive assessments (percentages) were obtained for the written text responses to open-ended questions. The project directors from the participating states reviewed answers to all questions from the interviewees (N = 94) and identified overriding "themes" for each question as well as documented evidence to support the themes from recorded comments. Content analysis for qualitative data required the project team to decipher core meanings or patterns/themes *(25)*. An issue and question analytical framework approach was used to organize, categorize and report the qualitative data *(25)*. This method allowed the researchers to explore the food safety issues related to home-grown fruits and vegetables, garden to table, that were elicited by the mail-in survey *(26)*. Typescripts were created for the text comments of respondents so that thematic or category analyses of the common issues could be described and tabulated. In this manner, the text comments helped to elaborate on or extend the numerical rating data from the mail-in survey described by Pivarnik, et al. *(26)*. The interpretations of the data were found to be clearer and more meaningful when presented in the context of the respondents' comments. Chi-square statistical analysis of the demographic variables was carried out using the SPSS statistical program, version 14.0 *(32)*.

Training of interviewers

The structured interview tool was carefully scripted. Master Gardeners were recruited from each state to conduct the on-site interviews (CT, 17; ME, 19; NH, 11; RI, 20; VT, 12) in May/June, 2005. A PowerPoint training program, developed by the project directors and an evaluation expert, was used by the participating states to train the Master Gardener volunteers on how to use the interview tool. The 3-hour training addressed interviewing techniques for the project, what to expect during an on-site interview and several role-playing scenarios for practice. Master Gardeners conducted the interviews in pairs (interviewer and recorder). Interviews were pre-arranged and conducted at the gardener's home. Master Gardener volunteers were instructed to gather information *only*, and not to dispense information. Interviewers were instructed to guide the interview and keep respondents on track, and recorders were instructed to record exactly what the home gardener said, completely and accurately, with no interpretations. Interviewers were also trained how to ask non-directive or follow-up questions such as, "Is there anything else?" or "Can you explain that?" or "Would you tell me what you have in mind?" Such follow-up questions would allow the interviewee to answer more fully, if desired, without leading the respondent to a desired answer. All volunteers were encouraged to be thoroughly familiar with the question content and to practice their questions. Master Gardener interviewers were also trained how to take the temperature of the refrigerators properly (middle shelf) and how to take compost temperature. Only growers of fruits and vegetables were interviewed. No Master Gardeners were interviewed. Interviews were conducted from June through October of 2005.

Structured interview questionnaire

A structured, on-site interview questionnaire was developed as the sequel to a mail survey conducted by Pivarnik et al. *(26)*, which assessed knowledge and attitudes regarding food safety practices of home gardeners relating to all aspects of gardening and post-harvest handling of home-grown fruits and vegetables. The interview focused on those items that had low knowledge scores, as determined by the quantitative survey assessment: safety of organically grown produce, association of produce with pathogenic bacteria, use of manure and compost, issues associated with water safety, washing produce and preservation or postharvest handling. The home gardeners were asked to provide general information concerning the garden size, what kind of fruits and/or vegetables were grown, who worked in the garden, who harvested the produce and how many years of gardening experience the gardeners had. Respondents answered 19 questions related to the following categories: safety of organically grown produce, bacterial contamination (human and garden sources), water safety, safe use of compost/manure, health and hygiene and post-harvest handling. Topics chosen also reflected the five gardening/timeline categories identified in the original mail-in survey. Direct questions, such as "what does something mean" or "do you think" and situation questions that set up a "scenario" requiring the respondents to reflect on their practice or behavior, were asked during the interview.

Most questions were followed by carefully scripted "probe" questions, which were asked when incomplete answers were given or when key food safety concepts were not included in the interviewees' initial answers to the questions. These were used to help guide the gardener to talk about specific knowledge or practices they may have forgotten. Follow-up questions were asked to obtain a thorough understanding of the gardener's beliefs and/or behavior. At the end of the interview, interviewers recorded the temperature of the gardener's refrigerator by use of a refrigerator/freezer thermometer (Model B9122, Miljoco Corp., Warren MI) and, when applicable, the compost pile(s) by use of a 20 in. RioTemp compost thermometer with a ¼ in. shaft (Biocontrol Network, Brentwood, TN). Upon completion of the interview, gardeners were given refrigerator and digital food thermometers (Miljoco Corp., Warren MI) as a token of thanks.

TABLE 1. Demographic characteristics of interviewees (N = 94)

	Frequency	Percent
Years Gardening		
1–10	17	20
11–20	16	19
21–30	15	18
31–40	17	20
40+	20	23
No answer	9	10
Size of Garden(s)(ft^2)*		
1–100	44	33
101–500	36	27
501–1,000	23	17
1,001–5,000	27	20
5,001–10,000	2	1
10,000 +	2	1
No answer	3	-
Water Sources (Chose all that applied)		
Rain	55	59
Well – garden only	8	9
Well – shared with household	43	46
Municipal or City	31	33
Stream	7	7

*N = 135 since some of those interviewed had more then one garden

Mean garden size = 1274 ft^2

Median garden = 300 ft^2

Mode = 32 ft^2

The protocol and questionnaire were approved by the University of Rhode Island Institutional Subjects Review Board. Food safety experts from the New England State/Land Grant Universities reviewed the structured interview for content validity and clarity.

RESULTS AND DISCUSSION

Demographics

A total of 94 home gardeners of fruits and/or vegetables were interviewed for this study: CT, 18; NH, 19; ME, 20; RI,18; and VT, 19. These volunteers were either recruited from the mail-in survey *(26)* or solicited directly as outlined in the methodology section. The total pool of potential volunteers that provided contact information and/or were directly solicited was 159 (104, mail-in survey; 55, other contacts). Survey respondents for the mail-in survey totaled 762, with a documented demographic profile for age, gender, income, education, living area (e.g., rural, suburban) and state of residence *(26)*. The demographic profile of the potential subject interview group (N = 159) was compared to the remaining respondents of the mail-in survey (N = 658). There were statistical differences for age and living area, with the onsite subject interview pool being slightly younger ($P < .05$, at 60 and older), and more likely to be rural than suburban ($P < .05$) (data not shown). However, the mail-in survey indicated no significant food safety knowledge differences, from garden to table, in these demographic categories. Furthermore, those interviewed (N = 85 out of 94) had slightly more gardening experience (Table 1) than expected ($P < 0.05$), with more individuals gardening for 11–29 years and fewer than expected in the 1–10 year category. Again, the knowledge survey conducted by Pivarnik et al. (2006) showed that only those who had no fruit or vegetable gardening experience had significantly lower food safety knowledge than the rest of respondents. With the exception of income and Master Gardener training (none used for the on-site study), no demographic characteristic impacted knowledge scores significantly. Therefore, the interviewee group (N=94) could be considered a good reflection of the larger population that responded to the randomized, mail-in survey.

Gardens ranged widely in size from 10 ft^2 to 40,000 ft^2, with a typical garden at 4 ft × 8 ft, or 32 ft^2 (Table 1), and with some gardeners having multiple gardens. A variety of fruits and vegetables were reported grown by those interviewed for this study: beans, corn, tomatoes, cucumbers, squash, leafy greens, root vegetables,

peaches, apples, pears, plums, apricots, cherries, berries, broccoli, cauliflower, eggplant, peas, peppers, herbs, asparagus, melons, grapes, gourds, celery, horseradish, rhubarb, zucchini, brussel sprouts, parsnips, red clover, alfalfa sprouts and hops. Although the main person who worked in and harvested the garden was the interviewee, various individuals were also reported by some people to be involved at some point during the gardening process, including spouses and children, other family members, friends, housemates, other children, friends and neighbors. However, in most cases, the interviewee was the principal person responsible for all aspects of gardening from "garden to table."

Interviewee responses

The interview focused on six content areas: safety of organically grown produce, association of produce with pathogenic bacteria (human and gardens sources), use of manure and compost, water safety, washing and preserving produce (post-harvest handling) and personal hygiene.

Organic gardening

In the initial mail-in survey *(26)*, the respondents' knowledge of organic gardening was low. Organically grown produce was considered less likely to cause foodborne illness than conventionally grown products, with the majority of the respondents considering homegrown produce safer if organic gardening practices were used. The interview found the same results, with the majority (66%) feeling that organically grown fruits and vegetables were safer, 79% citing "chemicals" and 11% mentioning "healthier" and "better taste." Of those interviewed, 79% considered themselves fully or "partially" organic growers, using no chemical pesticides/insecticides, but using synthetic fertilizers. Most (87%) felt that organically grown produce meant that there were *no* chemicals used (e.g., pesticides, insecticides, synthetic fertilizers). Additionally, some (27%) regarded organic produce as fruits/vegetables grown in organic or "natural" soil or soil on which natural or composted fertilizer was used.

When this study was conducted, home gardeners based safety opinions of organic produce on chemical rather than bacterial issues. However, research comparing organic and conventionally grown produce has not yielded evidence to conclude that either practice is superior to the other with respect to safety nutrient composition *(37)*. Furthermore, consumers appear to have beliefs about organically grown fruits and vegetables that are not fully correct. The results of this interview agree with the results of investigation by Zhao et al. *(38)*, in which consumer panelists stated that they believed that organic produce was more healthful and more environmentally friendly and had better taste. However, their study demonstrated that consumer sensory analysis of a variety of organically and conventionally grown produce detected no significant differences, except for tomatoes, in perceived sensory quality, and all produce evaluated had the same overall sensory acceptance — like or dislike *(38)*. Organic regulations in the United States do require organic foods to be grown without synthetic pesticides, growth hormones, antibiotics, genetic engineering techniques or chemical fertilizers. However, synthetic materials may, in fact, be used, on a limited basis, for organic farming if they are on the list of the National List of Allowed and Prohibited Substances *(1)*. Although pesticide residues have been found at a lower frequency in organically farmed versus conventionally farmed produce, the benefits of reducing human exposure of chemicals by increasing consumption of organic produce appear to be insignificant. Occupational exposure to pesticides has been shown to be a far greater health risk *(37)*. Home gardeners must be educated that chemical concerns cannot outweigh potential pathogenic microorganism issues, regardless of the method of gardening utilized. Microbial issues for organically and conventionally grown fruits and vegetables are the same. However, home gardeners appeared to equate produce safety more with chemical contamination not bacterial contamination, a misconception that must be changed.

Bacterial contamination

The on-site interview continued to explore the gardener's perceptions about bacterial contamination in home grown fruits and vegetables and potential sources of contamination in the garden (soil, water, manure/compost). The written survey administered by Pivarnik et al. *(26)* indicated low knowledge scores concerning sources of pathogenic contamination of fruits and vegetables during gardening practices, particularly with regard to the use of manure and compost, issues associated with water safety and, as mentioned previously, overall association of produce with pathogenic microorganisms. Although the latter perception may have changed somewhat, at least in regard to commercially grown fresh spinach and *E. coli* O157:H7 due to the recent widespread outbreak, *(8, 15)*, home gardeners may not associate issues and sources of contamination with their own growing practices, since the attitudinal questions in the written survey *(26)* revealed that home-grown produce was considered safer than produce found in markets or grocery stores.

Gardeners were asked several questions regarding general perceptions of bacterial contamination of homegrown produce. However, the contradictory nature of beliefs revealed incomplete understanding. Of those interviewed, 79% indicated that they believed they could get sick from eating produce and cited a variety of reasons, including inherent bacteria as well as reasons implying bacterial contamination – (improper handling, improper washing, or preparation). However, 86% indicated that they still tasted their produce while harvesting. The respondents replied that they could not resist the fresh, ripe delicious produce that they had grown with little concern for potential contamination. As with the mail-in survey, the majority (79%) of the gardeners interviewed recognized that damaged or bruised produce were more susceptible to bacteria, insects and mold and indicated they would cut away the rotten spot if the entire fruit/vegetable was not damaged. Of those interviewed, 81% believed that fruits and vegetables could get contaminated while they were growing in the garden. When specifically probed about the effects of bacteria associated with produce (N = 84), a majority of respondents agreed that consequences could be negative, 64% indicating quality/illness or illness alone. However, when these individuals were probed further as to overall contamination issues and the relative importance of potential contaminants, 41% expressed a belief that chemical fertilizers and/or pesticides were the biggest problem, with 13% believing that bacteria and chemicals were equally at fault. Only 14% identified bacterial contamination as the larger contamination issue (data not shown).

Water safety

Water sources used by the home gardeners interviewed are shown in Table 2. The mail-in survey indicated low knowledge concerning water safety, and results of the on-site interview clearly reflected the lack of awareness that water could be a source of contamination and cause for food safety concerns. Fruits and vegetables can become contaminated not only through soil or improperly composted manure, but also because of contaminated water *(33)*. The majority of those

TABLE 2. Home gardeners' perceptions of the safety of water (N = 94)

	Frequency	Percent
Well vs. Municipal Water – Which is safer for gardening?		
Well	35	37
City/Municipal	7	7
Both the same	17	18
Don't know or No answer	35	37
Backflow Protector – Do you know what this is?		
Yes	37	39
No	56	60
No answer	1	1
Is there *anything* in water used in the garden that can cause illness?		
Yes	22	23
No	67	71
Don't know or No answer	5	5
Do you think there can be *harmful/foodborne* bacteria in water used for gardening?		
Yes	29	31
No	51	54
No answer	14	15

interviewed believed that well water was safer to use in a garden than a municipal water source, with 37% indicating well water was safer, followed by 18% who believed that the two were equally safe and only 7% indicating that municipal water was safer (Table 2). Chemical, not bacteriological, concerns was the major issue cited by the respondents who thought that the water supply could be harmful to plants, with chlorine and fluoride specifically mentioned. Only 9 people interviewed mentioned regular monitoring of municipal water, and only 4 recognized that bacterial contamination could be an issue. While groundwater is usually considered less susceptible than surface waters to microbial contamination studies of well water samples have shown that over 30% exceeded the coliform levels recommended by drinking water standards *(33)*. Private wells are not regulated by the USEPA *(10)* and owners are responsible for their own drinking water. If individuals are convinced that well water is safe because there are no chemicals and they do not consider microbiological contamination issues, water testing would be expected to be nominal, thus increasing the food safety risk of home grown produce. Furthermore, only 39% of those interviewed knew about back-flow protectors, and few knew whether any of these devices had been installed on the outside faucets used to water their gardens. However, of most concern was the perception that water was not a potential source of contamination, with 71% believing that nothing in the water source could cause illness to people. When probed and specifically asked about harmful or foodborne bacteria in the water used in the garden, 54% of those interviewed still did not agree that there was potential for contamination. Furthermore, there was some confusion with regard to testing of water and what bacteria or chemicals were targeted. Overall, water was not recognized as a potential source of bacterial contamination, nor was the potential for bacterial contamination of produce by water used in the garden recognized.

Compost and manure

The mail-in survey *(26)* indicated that home gardeners had low knowledge scores regarding proper compost temperatures, the relationship between bacteria in compost and bacteria in soil, and proper application of fresh manure. The majority of the home gardeners (75%) interviewed had compost bins/piles (Table 3). Although they knew that composting created good fertilizer through breakdown of compost materials to nutrients, completion of the composting process was determined by look or feel; no respondent indicated the need to monitor temperature of the compost pile. Only when the interviewers were specifically asked about a potential relationship between temperature needs and readiness of compost for garden application did the interviewees acknowledge the importance of temperature, with only 26% indicating that increased temperature would kill bacteria. Follow-up inquiries clearly showed that home gardeners did not connect the possibility of pathogenic bacterial contamination of their produce with the application of poorly composted materials or fertilizer. Only 26% of those who composted were certain that foodborne bacteria could be in the compost; the rest were unsure, did not know, or felt that only consumption of compost directly could cause illness. More importantly, temperature measurements of the compost piles (Table 4) indicated that no compost piles used by the home gardeners met the required temperature of 130°F for a minimum of three days *(13, 20, 24)* to ensure produce safety. Finally, of those who clearly indicated that they used fresh manure to fertilizer their gardens, 60% were applying manure in a way that could put them at high risk for foodborne illness. Fresh animal manure is a source of human pathogens such as *Listeria monocytogenes, E. coli* O157:H7 and *Salmonella* spp. Application of fresh, uncomposted manure, constitutes a high food safety risk for produce, and such manure should be applied in late fall, after harvest or two weeks prior to planting, with no harvesting until at least 120 days after application *(13, 27)* and with thorough incorporation of the manure into the soil. Research has shown that pathogen survival in soil and produce is very complicated and can depend on the

TABLE 3. Home gardeners' use and knowledge of compost and manure (N = 70)

	Frequency	Percent
Gardeners Composting (N = 94)		
Yes	70	75
No	23	24
No answer	1	1
How do you determine compost process complete? (Open-ended)		
Look and/or feel	70	100
Temperature	0	0
Is temperature important to composting? (Probe)		
Yes	61	87
No	6	9
No answer	3	4
Why is temperature important? (N = 61)*		
Kill seeds	12	20
Speeds breakdown/decomposition	32	52
Kills bacteria	16	26
No reason given	14	23
Are there harmful/foodborne bacteria in compost? (Probe)		
Yes	24	26
No	3	3
Maybe – Yes **	30	32
Maybe – No **	4	4
Don't Know/No answer	27	29
Don't Eat Compost	6	6
Use of animal manure for fertilizer		
Yes	65	69
Aged/Bagged ***	15	23
Fresh ***	20	31
No	28	30
No answer	1	1
What is the timeframe for fresh manure application? (N = 20) (Probe)		
No timeframe	8	40
End of summer/winter	8	40
Springtime	4	20

* More then one response per person

** Respondents were unsure about their answers

*** Not answered by all respondents who indicated they used fresh manure

soil type, identity of the specific microorganism and commodity, and factors such as temperature, pH, moisture and sunlight exposure. Fresh manure and improperly composted materials can contain pathogens, and viability of these in soil has been reported to be months *(3, 6, 33)*. Furthermore, damage to fruits or vegetables could enhance the attachment of the pathogenic microorganism and stimulate microbial proliferation *(3)*.

Overall, home gardeners using compost and/or manure clearly do not consider the possibility of bacterial contamination and, ultimately, of foodborne illness. The issue appeared to be only one of nutrients for garden produce and/or the desire to apply "safer" organic practices.

Interviewees were asked questions regarding health and hygiene (Table 5) and postharvest handling practices (Table 6). Of the knowledge-based questions asked in the primary, mail-in survey, these two topics had the highest knowledge scores, but scores were still below mastery level *(26)*.

Health and hygiene

The majority (64%) changed shoes and/or clothes following gardening, with "dirty" and not wanting to track "dirt" into the house being the reason most often cited. Some gardeners responded

TABLE 4. Temperature (°F) of interviewee refrigerator (N = 84) and compost pile (N = 64)

	Average (°F)	Range (°F)	Desired Temperature (°F)
Temperature of Refrigerator	41	34 – 60	≤ 40
Temperature of Compost Pile	79	65 – 100	≥ 130

TABLE 5. Home gardeners' beliefs regarding health and hygiene (N = 94)

	Frequency	Percent
Change clothes and/or shoes after gardening		
Yes	60	64
Yes – at end of day	4	4
No	17	18
Sometimes	12	13
No answer	1	1
Are there harmful bacteria in the soil? (Probe)		
Yes	42	45
No	14	15
Maybe	15	16
No answer	23	24
Is it okay to harvest when ill?		
Yes	52	55
No	33	35
Don't know	5	5
No answer	4	4

that whether they would change depended on what they had been doing in the garden, i.e., picking vs. planting or fertilizing. In accordance with the previous findings, bacterial contamination of "dirty" clothing and shoes was not expressly identified as a concern until the interviewer specifically asked about it. Few recognized that bacteria would come from the garden soil. When asked about the possibility of the presence of harmful microorganisms in the soil, only 45% agreed that this could be a problem. When asked if they would harvest if they were ill, 56% replied that they would, even though more then half of those individuals believed they might contaminate the produce. Some felt that washing their hands and/or the produce would keep the products safe. However, while washing produce under running water prior to consumption, along with rubbing and brushing, has been shown to significantly reduce *surface* microbial contamination as well as, if not better than, other cleaning methods *(18)*, and is currently the recommendation given to consumers to reduce the potential for microbial food safety hazards in fruits and vegetables, it is not 100% effective, and prevention is still the key.

Postharvest handling

Finally, home gardeners were asked to outline their handling of produce from harvest to storage and/or consumption (Table 6). Most interviewees indicated only those activities associated with harvest and storage of homegrown produce. The vast majority (80%) rinsed produce prior to storage, but 63% were using cold water. The rationale for this behavior was to keep the produce fresher, to minimize degradation and rot, and to minimize microbial growth. Although proper washing targets filth and bacteria and is an important step in reducing microbial contamination, wash water should be warmer than the fruits or vegetables or no more than 10°F colder, to minimize uptake of microorganisms in the tissue *(4, 11, 12, 27)*. This may be more important for some produce, such as apples and tomatoes, than for others. For those products that may be susceptible to internalization of pathogens, water that is colder then the produce could cause pathogens to be absorbed through the stem or blossom ends, stomata, or bruised tissue, resulting in internalization of the pathogen and thus in systemic contamination of the edible portions and protection of the bacteria from washes *(11, 29)*.

USDA recommendations for washing of store-bought produce has been clearly delineated; however, recommendations for post-harvest handling of homegrown produce include recommendations that the produce can be stored *either* washed *or* unwashed *(2, 35, 36, 37)*. Gardeners were washing produce prior to storage. The home gardeners were not queried and did not volunteer information about drying produce prior to storage. However, improper drying would create both quality and safety risks due to mold or bacterial growth. Although the intent was good, the messages regarding handling of produce (keep clean and keep cold), versus recommendations for other commodities need clarification. Improper

TABLE 6. Postharvest handling of produce by home gardeners (N = 94)

	Frequency	Percent
Rinsing prior to storage		
Yes	75	80
No	6	6
Sometimes	9	10
Pick for immediate use only, no storage	3	3
No answer	1	1
Temperature of Rinse Water of Fruits or Vegetables (Probe)		
Hot	3	3
Warm	23	24
Cold	59	63
No Preference	9	10
Produce Storage (Refrigerated vs. Room Temperature)		
Proper	69	73
Improper	24	26
No answer	1	1
Wash Produce That Have Peels or Skins Prior to Removal		
Yes	73	78
No	5	5
Sometimes	15	16
No answer	1	1

produce storage included storage at room temperature of produce that should have been stored at refrigerator temperature. Those vegetables that appeared to be stored improperly most often were cucumbers, zucchini, eggplant, peppers and "others." Surprisingly, the average refrigerator temperatures were, on average, acceptable (below 41°F) (Table 4).

As had been found with the mail-in survey, home gardeners were aware of the need to wash fruits and vegetables that have peels and skins prior to removal of these (78%). Of those who chose to answer further queries (N = 33), cross contamination issues, associated equally with dirt and/or bacteria, were most often identified as the issue of concern, with few specifying pesticides. Although the majority of the home gardeners had adopted the correct behavior, it was unclear from the results of this interview at to whether they understood the reasoning behind the practice.

Finally, home gardeners interviewed were presented with a meal preparation scenario that included, as part of the inquiry for post-harvest handling, possible cross-contamination issues between raw poultry and vegetables intended for salad. The interview respondents were keenly aware of cross-contamination concerns and 93% indicated the need for either the use of separate cutting boards and/or washing of a cutting board between uses. Some interviewees indicated that they would prepare the salad first, then the chicken. These results indicated better knowledge of the behavior required to control this food safety issue than had appeared in the results of the mail-in survey.

CONCLUSION

Home gardeners, while acknowledging they could get sick from produce, did not seem to understand that contamination could come from a variety of sources such as soil, compost, fresh manure and/or the water supply. Many gardeners used organic practices to grow produce because they considered it safer from a chemical perspective, but they did not connect microbial issues to organically grown products. Furthermore, many practiced composting but did not use temperature as an indicator of process completion. Although most respondents understood the concept of cross contamination, the majority used very cold water to wash harvested produce in hopes of better preserving texture and freshness, unaware of the increased potential for bacteria contamination due to temperature differential. There was a "disconnect," or lack of understanding, of the sources and mechanisms of pathogenic bacterial contamination with regard to homegrown produce. If home gardeners understood the correct reasons for practices, behaviors might improve or become more consistent. Using the results of the interview to inform the data obtained by the original mail-in survey, outreach programming targeting home gardeners of fruits and vegetables can be designed that will better focus on those garden-to-table food safety issues where there is misunderstanding.

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IAFP's Third European Symposium

Advancements in Food Safety

ABSTRACTS

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18–19 October 2007

Keynote Presentation: Food Safety – A European Perspective

PATRICK WALL, EFSA – European Food Safety Authority, Largo N. Palli 5/A, Parma, I-43100, Italy

In the nineties a chronology of food scares, culminating in BSE, damaged consumer confidence in the safety of food, in the commitment of industry to produce safe food and in the ability of the regulatory agencies to police the food chain. These scares precipitated a review by many EU Member States of how they coordinated their food safety control programmes and caused the EU Commission to reform EU food legislation. In 2002, Regulation (EC) No 178/2002 of the European Parliament set down the general principles and requirements of food law and established the European Food Safety Authority (EFSA).

EFSA was set up as the keystone of EU risk assessment regarding food and feed safety, nutrition, animal health and welfare, plant protection and plant health in an attempt to provide a scientific basis for policies and risk management decisions. At times in the past, policies were formulated, and items moved up the political agenda, in proportion to the media coverage of the issue rather than in proportion to the risk to the public's health. Now, in close collaboration with the national authorities and in open consultation with its stakeholders, EFSA provides scientific advice and clear communication on existing and emerging risks to public health posed by food and feed. Independence, openness and transparency are fundamental to the effective operation of EFSA. It is funded from the Community budget but operates independently of the Community Institutions. It is not managed by the EU Commission but by an Executive Director, who is answerable to a Management Board.

SESSION I: Assessment and Enumeration Aspects

Innovations in Classic and Rapid Test Methods for Pathogens

BETH ANN CROZIER-DODSON, Kansas State University, Dept. of Animal Sciences & Industry, 1600 Midcampus Drive Call Hall 139, Manhattan, KS 66506-1600, USA

Historically, rapid methods have been used predominantly in the field of medical microbiology. However, over the past 15 to 20 years, rapid methods have emerged as important tools for the general field of applied microbiology as well due in part to their ease of use and advances in technology. Rapid methods and automation in microbiology is a growing area in applied microbiology dealing with the study of improved methods for the isolation, early detection, characterization, and enumeration of microorganisms and their products in clinical, food, industrial and environmental samples. Rapid methods are gaining momentum nationally and internationally as an area of research and application to monitor the numbers, kinds, and metabolites of microorganisms related to food spoilage, food preservation, food fermentation, food safety, and foodborne pathogens. This presentation will discuss and provide information about rapid method technologies for identification and enumeration as well as major developments in the field of rapid methods from the viewpoint of food safety and food microbiology.

Assessing Microorganisms in Food and Factory

JEAN-LOUIS CORDIER, Nestlé Nutrition, CT-QM, Nestlé 55 Ave., Vevey, CH-1800 Switzerland

The production of safe foods is based on effective preventive measures such as Good Hygiene Practices (GHP) and Good Manufacturing Practices (GMP). Significant specific hazards are addressed through specific control measures by applying the Hazard Analysis Critical Control Points (HACCP) system.

Sampling and testing has a role to play in the establishment of preventive measures as well in the verification or monitoring of their effectiveness along the whole food chain. Different elements pertaining to such testing activities will be discussed, i.e. for the steps from the raw materials and ingredients, throughout processing up to the final product.

In the case of industrially processed foods, post-process contamination plays a major role in the presence of pathogens in finished products and thus a cause of foodborne outbreaks. This presentation will focus in particular on sampling and testing to verify the correct and effective implementation of all preventive measures, i.e. the processing environment including the processing lines.

Emergence of Antibiotic Resistance among Bacteria from Food Animals

LUCA BUSANI, Istituto Superiore di Sanità, Dept. of Food Safety and Veterinary Public Health and Istituto Zooprofilattico Sperimentale delle Venezie, Epidemiology Unit, Romaviale Regina Elena 299, Italy

Antimicrobial agents are used in human and veterinary medicine, but the selective pressure created by their use has resulted in the emergence and dissemination of antimicrobial resistant bacteria.

Bacteria resistant to antimicrobials critical for the treatment of infections in humans can transmit from animal to humans, causing public health concern. Moreover, the emergence of resistance has been linked to the indiscriminate antimicrobial use in food animals. Estimates from Europe suggest that 35% of all antimicrobials is used in animals, but accurate and updated information are needed.

The antimicrobials in animals are used for therapy, prophylaxis and growth promotion. Therapeutic and prophylactic use have the final goal to ensure animal health and welfare, while the usage as feed additives for growth promotion is controversial. All growth promoters are banned in Europe due to the risk of antimicrobial resistance posed by the use for growth promotion of antimicrobials also used in therapy. As a result, in Northern European Countries a considerably decreased use of antimicrobials in food animal production associated with a considerably lower prevalence of antimicrobial resistance in animal bacterial populations was observed, while in other countries it has been less effective. A related consequence was an increased use of antimicrobials for therapy in animal production (DANMAP).

Risk management strategies for the containment of antimicrobial resistance in food-animal production include the surveillance and control of antimicrobial use, and surveillance of antimicrobial resistance in bacteria in the food chain. The reasons for monitoring drug resistance are:

1. to obtain data that will help the practitioners at the patient level, driving the drug choice for the empirical treatment;
2. to understand the size of the problem and the trends;
3. to provide scientific data for risk assessment;
4. to evaluate the impact of intervention in the long term.

The EU requires mandatory monitoring of antimicrobial susceptibility (EU Directive 2003/99/EC) of *Salmonella* spp., *Campylobacter jejuni* and *Campylobacter coli*, from human cases, animals and food. The Italian monitoring programme coordinated by the Veterinary National Reference Centre for Antimicrobial resistance (CRAB) in cooperation with the National Institute of Public Health (ISS) and the OIE and National Reference Laboratory for Salmonella (IZSVe) started in 2002. Data on *Salmonella* spp. from food animals, derived food products and human cases are collected in an harmonized way at national level. Moreover, the monitoring on antimicrobial resistance in bacteria of animal origin was implemented, and particularly on animal pathogens, zoonotic and commensal bacteria.

Differences in antimicrobial resistance in respect to the bacteria and the animal species of origin were observed. These differences may be linked to the type, the quantity and the attitude of the antimicrobial use in the different animal productions. In regard of some emerging public health issues, such multi-resistant *Salmonella* spp. and *E. coli* and meticillin resistant *Staphylococcus aureus*, the surveillance provided insight on their extent.

In conclusion, the use of antibiotics can over time result in significant pools of resistance genes among bacteria, including human pathogens, but the risk posed to humans by resistant organisms from livestock has not been clearly defined. The "magic bullets" have lost some of their magic, but they still remain valuable. Reduction of the "abuse", promotion of prudent use and alternatives such biosecurity and vaccines can preserve the effectiveness of antimicrobials and minimize the risks of antibiotic-resistant bacteria spread.

Developing Harmonized Test Methods for Protozoa

SIMONE M CACCIÒ, Istituto Superiore di Sanità, Dept. of Infectious, Parasitic and Immunomediated Diseases, Viale Regina Elena 299, Parma, 00161 Italy

Many protozoan parasites can be transmitted to humans via the ingestion of contaminated water and food. A common feature of these pathogens is their ability to produce large numbers of small, environmentally resistant transmittable stages, i.e., oocysts and cysts. Here, I will focus on the protozoan parasites *Cryptosporidium* and *Giardia*, which are major causes of diarrhoeal disease in humans, worldwide and have also been recognised as the predominant causes of protozoan waterborne diseases. Human infection is caused by at least seven *Cryptosporidium* species and two *Giardia duodenalis* assemblages, which are also capable to infect a range of animal hosts, and that must be distinguished from host-adapted species that are non pathogenic to humans. This can only be accomplished by the genetic characterization of the parasite. A variety of molecular techniques, based on the *in vitro* amplification of nucleic acids by PCR, have been developed and can be used to determine species and genotypes of *Cryptosporidium* and *Giardia* and to distinguish human from non-human pathogens.

Standardised methods exist for detecting oocysts and cysts in water, but those are based on microscopic identification, which has technological limitations that lead to an underestimation of contamination and confusion from the detection and enumeration of organisms which have no public health significance. Further, there are no national or international guidelines for determining oocyst and cyst contamination in or on foodstuffs, albeit optimised, validated methods for soft fruit and salad vegetables have been recently developed. It should be stressed that recovery methods for water and food matrices must be maximised because of the low infectious doses for human cryptosporidiosis and giardiasis. Concerted multidisciplinary studies that include parasite biology, genetics and public health, using agreed and validated sets of markers and methods are required. Progress towards this direction will be illustrated in an European perspective.

European RASFF System

PAOLA FERRARO, RASFF – Rapid Alert System for Food and Feed and EUROPEAN COMMISSION, Rue de Froissart, 101 (B232 - 4/63), B-1049, Brussels, Belgium

The European Rapid Alert System for Food and Feed is a tool for exchange of information regarding food or feed between competent authorities in cases where a risk to human or animal health has been identified. The quick exchange of information about food and feed-related risks ensures coherent and simultaneous actions by all Member States and represents a concrete and visible result of European integration. A close cooperation with Third Countries is also being established as the creation of a worldwide network for rapid exchange of information is one of the main projects in place.

This presentation will give an overview on the history and functioning of the RASFF and on the notifications transmitted through this system over the last years with the aim to explain its role in the food-safety field.

SESSION 2: Food Safety Management and Control

Use of Microbiological Criteria in Food Safety Assurance – An Industry View on the New EU Criteria

KAARIN GOODBURN, Consultant, 18 Poplars Farm Road, Kettering, Northants NN15 5AF, UK

The European Union (EU) Microbiological Criteria Regulations (MCR) were published on 22 December 2005 and came into force on 11 January 2006. The MCR relate to the package of new EU hygiene regulations that also came into effect at that time, and to the General Food Law Regulation 178/2002, which came into force on 1 January 2006.

This presentation will outline the content, ethos and implications of the Regulation, clarifying common misunderstandings and debunking myths.

What it's NOT about – myths

Increased sampling of foods even where HACCP is in place

- NO! – no change proposed to current HACCP-based approaches
- BUT specified sampling frequency for minced meat/preparations etc. (1 product per site per week)

I have to test every batch

- NO! – frequency is HACCP-based except for minced meat/preparations etc.

5 samples need to be tested per batch (e.g. RTE foods)

- NO! – compositing is allowed for between comparable lots

Positive release is required

- NO! – using functioning HACCP-based systems is required

Challenge testing required to demonstrate safe shelf life

- NO! – hierarchy of approaches is set out in the Regulation

Testing emphasised over control – diverts resources

- NO! – having functioning HACCP-based systems is the key legal requirement

It all means extra work for labs

- NO! – no change if sampling is already HACCP-driven

Food Security at Large Public Events

BIZHAN POURKOMAILIAN, McDonald's Europe, 11-59 High Road, East Finchley, London, N2 8AW, UK

Food safety and security at the Olympics is a task that takes McDonald's back to basics as well as elevated sense of awareness. One of our responsibilities at McDonald's is to serve safe food. Safe food is free of harmful bacteria, viruses, and harmful substances that could cause our customers to become ill. Such hazards can be from natural presence of hazard on raw material as well as cross contamination due to inappropriate procedures in the supply chain or deliberate adulteration of products. Procedures must be implemented to avoid hazards reaching the customer.

It takes a team effort to incorporate and implement effective food safety and security procedures. Restaurant staff, distribution, suppliers and McDonald's Quality Assurance staff have an active role in learning and practicing the food safety and security procedures that have been established. The security systems have to begin from farm to across the counter as well as observation of large number of customers entering and exiting the restaurant.

During the Olympic period, the system will be operating under unusual conditions. In this period the menu items will be limited, international crew will be working in the restaurants and suppliers from different countries that usually are not active in the country are brought in to play. As well such internal activities, McDonald's has to meet the strict criteria set by the Olympics Committee.

Traceability and Maintenance of Spoilage Control and Food Safety in Retail and Processing

EDWARD L.C.VERKAAR, Ecolab GmbH & Co. OHG, Reisholzer Werftstr. 38-42, 40589, Düsseldorf, Germany

Although far from optimal, communication between retailers and processors is pivotal in the food chain. As of 1 January 2006, Commission Regulation EC 2073/2005 harmonises the microbiological criteria for foodstuffs of animal origin. Important issues are the strict control and documentation of microbiological, food safety and process hygiene criteria. Provisions are clearly mandated for sampling, testing and trend analysis. The consequences of non-compliance are severe, For example, minced meat, meat preparations, MSM and meat products placed on the market for the duration of their shelf life and intended to be eaten cooked, should be free of *Salmonella* in 10 g (25 g in 01.01.2010). When found positive, the product or batch should be withdrawn or removed from the market. Most of the sources of bacterial contamination can be sourced back to secondary production: Results show that poultry contamination resulted mainly from farm strain carryover, and that the carcasses were probably contaminated during processing. Strict control and documentation of processing CCPs in combination with a final AM wash (which should be regarded as a CCP as well) may minimise microbiological hazards. Retailers may basically use the same tools to optimize hygiene SOPs, temperature control and logistics and subsequently optimize their part of the food chain. Communication with the same tools may be used to optimise both parts of the chain. Ecochexx® and Sanova/Inspexx® are two highly automated examples of how CCPs can be overseen by processor and retailer and how they may be used to optimize shelf life and food safety simultaneously.

Driving Improvements in Food Safety Programmes through Changes in Behaviour

CHRISTOPHER GRIFFITH[1] and FRANK YIANNAS,[2] [1]University of Wales Institute, Cardiff, Room D104, Llandaff Campus, Cardiff, South Wales, CF5 2YB, UK; [2]Walt Disney World Company, P.O. Box 10000, Lake Buena Vista, FL 32830, USA

Human behaviour is a sometimes neglected component of ensuring safe food and includes the behaviour of consumers, enforcement officers and professional food handlers. The behaviour of the latter may be of

particular importance if the food receives no further safety treatment. The actions of food handlers are partly as a result of them acting as individuals and partly as members of a collective or organisation.

The presentation summarizes what we know about the psychology of individual food handler behaviour and introduces the concepts of food safety management culture and climate. These concepts will then be developed using a food safety performance management model applied in a real-world setting. Principles which will be presented are believed to be applicable to all food businesses.

SESSION 3: Current and Emerging Food Safety Issues

Risk Assessments Available to Guide Risk Management Regarding *Enterobacter sakazakii, Campylobacter* and *Vibrio*

PETER BEN EMBAREK, World Health Organization, 20 Ave. Appia, Geneva 27 CH-1211, Switzerland

FAO and WHO provide scientific advice at the international level on microbiological and chemical hazards in food in support of the work of the Codex Alimentarius to develop international food standards and management guidelines. This advice is provided in the form of risk assessments and technical guidance. The field of microbiological risk assessments is rather new but has evolved rapidly over the last decade. The presentation will describe briefly the process used by FAO and WHO to develop microbiological risk assessments and some of the most recent developments in this area. One of the main challenge in developing and presenting risk assessments to risk managers is how to make them more user friendly and responsive to the needs of risk mangers. Examples from some of the most recent work of FAO and WHO in this area including risk assessments of *E. sakazakii*, *Campylobacter* and vibrios will illustrate the presentation.

Baked Potatoes to Beluga Whales – The Last 20 Years of Botulism in Canada

JOHN AUSTIN, Microbiology Research Division, Bureau of Microbial Hazards, Food Directorate, Health Products and Food Branch, Health Canada, Tunney's Pasture, PL2204A2, Ottawa, ON, K1A 0L2

In Canada, since 1985, approximately 4.4 outbreaks of foodborne botulism occur annually, with an average of 2.5 cases/outbreak. The fatality rate of botulism in Canada has decreased from greater than 45% in the 1960s to less than 3%, due mainly to the availability of antitoxin to type E neurotoxin. Most botulism outbreaks in Canada have occurred in northern and west coast native communities. The foods involved were mainly raw meats from marine mammals, fermented meats such as muktuk (meat, blubber and skin of the beluga whale), raw fish or fermented salmon eggs. Type E was implicated in almost every case involving traditional foods. Commercial products are rarely implicated in outbreaks. Commercial pate caused two cases of type B botulism, while a cooked boneless pork product caused a single case of type A botulism. Two cases of type A botulism from commercial carrot juice were reported in October 2006. Garlic-in-oil, bottled mushrooms and a baked potato have been responsible for outbreaks involving foodservice establishments. A cluster of three cases of colonization botulism, all in individuals with Crohn's Disease, occurred from November 2006 to February 2007. Recent research results on the use of a genomic DNA microarray for genomic indexing of proteolytic *C. botulinum* strains and the potential of *C. difficile* as a foodborne pathogen will also be discussed.

Virus Detection in Food Implicated in Outbreaks

SOIZICK F. LE GUYADER, IFREMER, Laboratoire de Microbiologie, BP 21130 Nantes, France

The importance of foodborne transmission in outbreaks of viral origin is increasingly recognized. Different types of food have been implicated in outbreaks: shellfish, vegetables (lettuce, berries), delicatessen, or bakery products. Foods served raw are at greatest risk of transmitting viruses, including foods that could be in contact with contaminated waters such as shellfish or vegetables. For a long time, diagnosis of food related outbreaks relied mostly on epidemiological investigations, coupled with identification of the causative pathogen in persons with health complaints. Final confirmation by detection of the pathogens in food remains a challenge for various reasons, such as the lack of sensitive methods and the very low levels of contamination. Few methods were developed for detection of viruses in foods and limitations exist to isolate and detect viruses in complex food matrixes. Moreover, most of the viral food-borne outbreaks are caused by noroviruses, difficult to detect due to their high genetic diversity.

Recent improvements in molecular technics such as real-time RT-PCR, combining detection and confirmation of the amplicon specificity, seems a promising tool for virus detection in food samples. However

the low contamination of food samples requires efficient preliminary steps to elute and concentrate viral particles. Another crucial point is multiple contamination. Following an acute foodborne gastroenteritis outbreak, epidemiological data pointed to raspberry cakes as the source. Analysis of the fruit, using a method with extraction efficiency and inhibitor removal controls, allowed the detection of two different norovirus strains. Similarly in an international gastroenteritis outbreak linked to oyster consumption, several strains of noroviruses were identified both in human stool and shellfish samples. The level of food contamination was found to be about 100 copies of the NV genome. If in case of multiple contaminations, it is not obvious that one food could be the link, it is important to consider the role of food as a vehicle for viral strains between countries.

Noroviruses are the most common cause of nonbacterial gastroenteritis outbreak, but in a recent outbreak in France linked to oysters consumption, the presence of up to six different strains both in patient stool and shellfish samples was detected. Beside norovirus, astrovirus, enterovirus and rotavirus, Aichi virus was also detected probably for the first time in Europe in a food related outbreak.

To assess the real impact of food in viral outbreak transmission, standardized methods need to be developed for use in control laboratories. While significant progress has been made in detection of enteric viruses in shellfish, efforts need to be done for virus detection in other high-risk food item. Further developments need also to take into consideration emerging viruses that can be exchanged between countries with food trade.

SESSION 4: Hot Topics in Food Safety

Managing Real and Perceived Chemical Contaminant Risks

MANFRED KERNER, Kraft, Bayerwaldstr. 8, 81737 Munich, Germany

In February 2006, DG Sanco and EFSA published a survey with the objective to obtain a view on the EU citizens' risk perception on food safety (www.efsa.europa.eu/EFSA/General/comm_report_eurobarometer_en2,1.pdf). Looking into the overall outcome, perception of food is positive, food safety is not on the top of people's mind. Whilst quality and price are cited by more than 40% of respondents as the most important factors that influence the food shopping choice, food safety is cited by only 8%. However, asked about food-related problems or risks, food poisoning and chemicals/pesticides/toxic substances are the most often spontaneously mentioned areas, clearly ahead of obesity ranking third. When confronted with a list of prompted risks/issues, most of these attract fairly high level of worry. The top tier covers food contamination by outside agents many of which often feature in the news. The middle tier covers other features beyond the consumers' control which are controversially debated in public and for which possible adverse effects are not so clear. More individual factors and personal habits (weight gain, allergies, food handling at home) range in the bottom tier. Effectively, the less control the consumer has over an issue and the more frequently/sensationally it is covered in the media, the higher its perceived risk.

Some of the chemical contaminants/pesticides /toxic substances that have received particular media coverage and attracted strong consumer attention in recent years are acrylamide and 3-MCPD, industrial dyes (Sudan, Para red), dioxin & PCP and Coumarin. In a number of instances they have caused product recalls or withdrawals, with considerable economic impact, both regarding loss of food products and ingredients as well as issues management efforts.

Some consideration and insights regarding these situations and their management will be shared. The acrylamide issue is widely seen as a positive example where, followed by substantial initial media attention, there has been a constructive, science based and solution orientated cooperation between the key stakeholders, i.e. authorities, industry, science and consumer groups. The industrial dye contamination in spices and dioxin/PCP contamination in guar gum underscore a heightened need for close collaboration with raw material sourcing countries outside the EU, but also careful consideration of true short term safety risks for consumers vs. the authority measures put in place and affecting the food operators within the Community. The coumarin / cinnamon situation sheds some light on the implications of national differences in interpretation & enforcement of Community law, in this case the EC Flavourings Directive.

Some conclusions can be drawn from these and other cases. Prevention of contaminants related food-safety risks require an adequate legal framework to be in place and actively enforced. Furthermore, food operator maintained due diligence programs based on the operators' experience and judgment on the specifically relevant contaminants play an important role – acknowledging that these programs are by definition not capable of systematically addressing purposeful adulteration. With a notion that food safety is pre-competitive and global, a climate of trust and respect between the relevant stakeholders enabling open yet protected discussions appears imperative to effectively address emerging and acute issues.

Overall, when it comes to effectively managing true and perceived contaminants risks, sound science based and timely risk assessment, proportionate and reasonable risk management considering the needs of consumers and economic operators, and transparent and consistent risk communication are seen as important pillars. In the context of communication in the public domain, it may be worth while considering stronger engagement of consumer groups, general practitioners and scientists who have emerged as the most trusted communicators on food-related issues, according to the 2006 Eurobarometer survey.

Managing Public Health Risks and the Microbiological Quality of Fresh Produce – UK Perspective

CHRISTINE LITTLE, Health Protection Agency, Enviromental & Enteric Diseases Dept., Colindale Ave., London NW9 5EQ61, UK

· Fresh produce is an important part of a healthy diet. Prepared produce or salads, such as ready-to-eat salad vegetables or fruit, requiring minimal or no further processing prior to consumption and have seen rapid year-on-year market expansion due to their obvious convenience to the consumer. In recent years the importance of prepared salads as potential vehicles of gastrointestinal infection has been highlighted by several large outbreaks in Europe and beyond. In the UK between 1992 to 2006, 2,274 foodborne general outbreaks of infectious intestinal disease were reported to the Health Protection Agency, of which 3.6% were associated with the consumption of prepared salads. In total, 3,434 people were affected, with 66 hospitalizations and one death reported. The attribution of types of prepared salads and pathogens among prepared salad associated outbreaks will be presented and discussed. Findings from UK and other European studies on various prepared salad vegetables, fruit and mixed salads from 1995 to date indicate that most bacteria of concern with regard to human health are relatively rare in these products. However, outbreaks of salmonellosis have been uncovered associated with bagged salad leaves and pre-packed fresh herbs during two UK studies. Although it is known that fresh ready-to-eat produce may become contaminated from environmental sources, only in recent years has the association of foods of non-animal origin, such as salad vegetables, with foodborne illness become evident and recurrent, demonstrating that major health problems can arise from consumption of contaminated prepared produce if hygiene practices break down.

Managing Public Health Risks and the Microbiological Quality of Fresh Produce – US Perspective

ROBERT BRACKETT, Center for Food Safety and Applied Nutrition, US Food and Drug Administration, 5100 Paint Branch Pkwy., College Park, MD 20740, USA

Over the past decade, the United States Federal Government has focused significant resources on reducing foodborne illness from all sources. However, despite these efforts, foodborne illness associated with fresh produce continues to be documented. The persistence of foodborne illness associated with fresh produce may be attributable to a number of factors, but in some cases are preventable. Most produce is grown in a natural environment and is vulnerable to contamination with pathogenic microorganisms. Factors that may affect the occurrence of such contamination include agricultural water quality, the use of manure as fertilizer, the presence of animals in fields or packing areas, and the health and hygiene of workers handling the produce during production, packing, processing, transportation, distribution or preparation. The fact that produce is often consumed raw without any type of intervention that would reduce, control, or eliminate pathogens prior to consumption contributes to its potential as a source of foodborne illness. Given the importance of produce consumption and its central role in a healthy diet, it is imperative that the incidence of foodborne illness cases associated with produce be reduced.

International Association for Food Protection®

2008-2009 Secretary Election

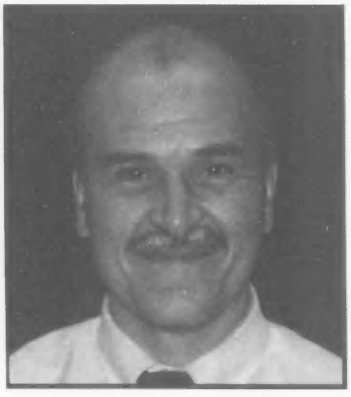
The following page contains biographical information for the 2008–2009 Secretary Candidates. This information is provided to help you make your selection of the next IAFP Secretary.

Members with valid E-mail addresses will receive election notices and a unique personal identification number via E-mail from IAFP's election service provider. Members without E-mail addresses, or invalid E-mail addresses, will be sent their unique personal identification number via postal service. Voting will take place on a Web site hosted by Survey & Ballot Systems (SBS), an independent, external organization who is conducting the IAFP election. Safeguards are in place to insure each Member votes only once.

The election Web site will be open from January 31 to March 17. Election results will be reported directly from SBS to the IAFP Teller who will report directly to President Gary Acuff. Watch for the election results on the IAFP Web site in April and also in the May *IAFP Report* and the May issue of *Food Protection Trends*.

If you have questions about the election process, contact David W. Tharp, CAE, Executive Director at 800.369.6337; 515.276.3344 or E-mail dtharp@foodprotection.org.

The Candidates



EMILIO ESTEBAN

ISABEL WALLS

EMILIO ESTEBAN

Alameda, California

Dr. Jose Emilio Esteban is the Laboratory Director for the USDA, Food Safety and Inspection Service, Western Laboratory, a position held since 1992. While developing and directing program and administrative policies, he supervises a workforce of approximately 50 professionals and support staff engaged in chemical and microbiological food analyses. To other parts of the agency, he provides technical consultation on scientific and technical issues related to food safety and directs the implementation of analytical methods, emergency response plans, and any associated sampling requirements. As the lead laboratory resource for current FSIS regulatory policy, Dr. Esteban focuses on generating and using information that supports the development of a sound scientific basis for regulatory decision making. His epidemiological expertise helps with the development of new policies and sampling programs that emphasize public health.

A native of Mexico, Dr. Esteban worked in private practice and as a consultant for a European refrigeration firm while earning his DVM (1982) and MBA (1985) degrees from the National Autonomous University in Mexico. He immigrated to the US in 1985, working a number of interesting jobs before joining the Fuller-Jeffrey Broadcasting Company. In 1987, he founded a small business communications firm dedicated to developing marketing messages to Spanish-speaking audiences, and soon furthered his education with an MPVM and his Ph.D. in Epidemiology (1994) from the University of California-Davis.

In 1994, Dr. Esteban joined the Centers for Disease Control and Prevention Epidemic Intelligence Service as an EIS Officer for the National Center for Environmental Health. In work that took him around the world between 1994 and 1998, he conducted several field outbreak investigations and health assessments related to chemical or toxic exposures. In 1998, he transitioned to Assistant Director in the Food Safety Office of the National Center for Infectious Diseases, also at CDC, where he provided technical consultation on scientific and technical issues related to food safety, and served as principal advisor on planning, development, coordination, and implementation of epidemiological and laboratory capacity enhancement. He also developed and planned strategies to meet office goals; oversaw public health programs or cooperative agreements, grants, and contracts; and maintained working relationships with other federal agencies (FDA, USDA, EPA), national health organizations (CSTE, APHL, NACCHO), international health organizations (WHO, PAHO), and private industry groups. Additionally, he participated as an expert consultant for food microbiology, foodborne disease surveillance, and risk assessment consultations with FAO/WHO.

Dr. Esteban has served on the IAFP Program Committee since 2003, and is Chairperson for IAFP 2008. He also judged the 2006 and 2007 Developing Scientist Awards competition, serving as Committee Chairperson in 2007.

ISABEL WALLS

Washington, D.C.

Dr. Isabel Walls is a Senior Advisor with USDA's Foreign Agricultural Service, where she manages the development of technical reports and provides scientific advice on sanitary and phytosanitary issues that may impact international trade, including issues related to the World Trade Organization policies and the Codex Alimentarius Commission.

Previously, Dr. Walls was a Senior Scientist with the USDA's Food Safety and Inspection Service, where her scientific support on food defense issues included vulnerability assessments and identifying countermeasures to threats to the food supply. She was part of a team that developed training programs on food defense for the Asia Pacific Economic Cooperation (APEC) Economies, ensuring the development and endorsement of voluntary APEC Food Defense Principles. Additionally, she organized and presented the "Food Defense Research and Application" symposium held at IAFP 2007.

During her time as Senior Scientist at the International Life Sciences Institute, Dr. Walls advised the ILSI North America Technical Committee on Food Microbiology, helping to organize IAFP Annual Meeting symposia on cutting edge food safety issues, including "Use of Food Safety Objectives and Other Risk-based Approaches to Reduce Foodborne Listeriosis" (2003); "Moving Beyond HACCP – Food Safety Objectives" (2001); and "The Significance of Mycotoxins in the Global Food Supply" (2000). She managed Expert Panels that prepared reports on microbial and toxicological food safety issues. Prior to ILSI, she was a researcher at the National Food Processors Association, where she focused on microbial risk assessment and developed and evaluated predictive mathematical models for microbial growth.

Dr. Walls earned her Ph.D. in Food Microbiology from the University of Ulster in Northern Ireland and has postdoctoral experience from the USDA Agricultural Research Service in Pennsylvania. She has published original research on rapid methods for detection and enumeration of bacteria, microbial adhesion, predictive microbiology, microbial risk assessment, and characterization and control of *Alicyclobacillus acidoterrestris*.

Dr. Walls is a member of the Society for Risk Analysis, the American Society for Microbiology, and the Institute of Food Technologists. She has spoken by invitation at several international workshops on Microbiological Risk Assessment, and is a Peer Reviewer for the WHO/FAO Joint Expert Panel on Microbial Risk Assessment (JEMRA).

An IAFP Member since 1992, Dr. Walls has served on the Journal of Food Protection Editorial Board since 1996. She chaired the *Journal of Food Protection* Management Committee (2002–2004) and, as vice chair, oversaw the development of JFP Online. A founding member of the Microbial Risk Analysis PDG, she is also active in the Meat and Poultry Safety and Quality and Food Law PDGs. In past work with the Water Quality and Safety PDG, Dr. Walls helped to co-convene a symposium on "Water's Role in Food Contamination" for IAFP 2004, and was a Local Arrangements Committee member for IAFP 2005.

95th Annual Meeting

IAFP 2008

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AWARD NOMINATIONS

The International Association for Food Protection welcomes your nominations for our Association Awards. Nominate your colleagues for one of the Awards listed below. You do not have to be an IAFP Member to nominate a deserving professional. Nomination criteria is available at:

www.foodprotection.org

Nominations deadline is March 4, 2008

You may make multiple nominations. All nominations must be received at the IAFP office by March 4, 2008.

- Persons nominated for individual awards must be current IAFP Members. Black Pearl Award nominees must be companies employing current IAFP Members. GMA Food Safety Award nominees do not have to be IAFP Members.
- Previous award winners are not eligible for the same award.
- Executive Board Members and Awards Committee Members are not eligible for nomination.
- Presentation of awards will be during the Awards Banquet at IAFP 2008 – the Association's 95th Annual Meeting in Columbus, Ohio on August 6, 2008.

Contact IAFP for questions regarding nominations.

International Association for Food Protection®

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Nominations will be accepted for the following Awards:

Black Pearl Award

Award Showcasing the Black Pearl, *Sponsored by Wilbur Feagan and F&H Food Equipment Company*

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

Fellow Award

Distinguished Plaque

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

Honorary Life Membership Award

Plaque and Lifetime Membership in IAFP

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

Harry Haverland Citation Award

Plaque and $1,500 Honorarium, *Sponsored by ConAgra Foods, Inc.*

Presented to an individual for many years of dedication and devotion to the Association ideals and its objectives.

Food Safety Innovation Award

Plaque and $2,500 Honorarium, *Sponsored by 3M Microbiology*

Presented to a Member or organization for creating a new idea, practice or product that has had a positive impact on food safety, thus, improving public health and the quality of life.

International Leadership Award

Plaque, $1,500 Honorarium and Reimbursement to attend IAFP 2008, *Sponsored by Cargill, Inc.*

Presented to an individual for dedication to the high ideals and objectives of IAFP and for promotion of the mission of the Association in countries outside of the United States and Canada.

GMA Food Safety Award

Plaque and $3,000 Honorarium, *Sponsored by GMA*

This Award alternates between individuals and groups or organizations. In 2008, the award will be presented to a group or organization in recognition of a long history of outstanding contributions to food safety research and education.

Maurice Weber Laboratorian Award

Plaque and $1,500 Honorarium, *Sponsored by Weber Scientific*

Presented to an individual for outstanding contributions in the laboratory, recognizing a commitment to the development of innovative and practical analytical approaches in support of food safety.

Sanitarian Award

Plaque and $1,500 Honorarium, *Sponsored by Ecolab Inc.*

Presented to an individual for dedicated and exceptional service to the profession of Sanitarian, serving the public and the food industry.

Elmer Marth Educator Award

Plaque and $1,500 Honorarium, *Sponsored by Nelson-Jameson, Inc.*

Presented to an individual for dedicated and exceptional contributions to the profession of the Educator.

Harold Barnum Industry Award

Plaque and $1,500 Honorarium, *Sponsored by Nasco International, Inc.*

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

How the Audiovisual Library Serves IAFP Members

Purpose ...

The Audiovisual Library offers International Association for Food Protection Members an educational service through a wide variety of quality training videos dealing with various food safety issues. This benefit allows Members free use of these videos.

How It Works ...

(1) Members simply fill out an order form (see page 151 of this issue) and fax or mail it to the IAFP office. Members may also find a Library listing and an order form online at the IAFP Web site at www.foodprotection.org.

(2) Material from the Audiovisual Library is checked out for a maximum of two weeks (three weeks outside of North America) so that all Members can benefit from its use.

(3) Requests are limited to five videos at a time.

How to Contribute to the Audiovisual Library ...

(1) As the IAFP Membership continues to grow, so does the need for additional committee members and materials for the Library. The Audiovisual Committee meets at the IAFP Annual Meeting to discuss the status of the Audiovisual Library and ways to improve the service. New Members are sought to add fresh insight and ideas.

(2) Donations of audiovisual materials are always needed and appreciated. Tapes in foreign languages (including, but not limited to Spanish, French, Chinese [Mandarin/Cantonese]), are especially desired for International Members who wish to view tapes in their native language.

(3) Members may also make a financial contribution to the Foundation Fund. The Foundation Fund sponsors worthy causes that enrich the Association. Revenue from the Foundation Fund supports the IAFP Audiovisual Library. Call Lisa Hovey, Assistant Director or Lani McDonald, Association Services at 800.369.6337 or 515.276.3344 if you wish to make a donation.

International Association for Food Protection

AUDIOVISUAL LIBRARY

as of December 17, 2007

A Member Benefit of IAFP

DAIRY

D1010 **The Bulk Milk Hauler: Protocol & Procedures** – (8 minutes). Teaches bulk milk haulers how they contribute to quality milk production. Special emphasis is given to the hauler's role in proper milk sampling, sample care procedures, and understanding test results. (Iowa State University Extension–1990) (Reviewed 1998)

D1030 **Cold Hard Facts** – This video is recommended for training personnel associated with processing, transporting, warehousing, wholesaling, and retailing frozen foods. It contains pertinent information related to good management practices necessary to ensure high quality frozen foods. (National Frozen Food Association–1993) (Reviewed 1998)

D1031 **Dairy Plant** – (28 minutes). Join in on this video as it follows a tour of the University of Wisconsin Dairy Plant. Observe the gleaming machinery and learn the ins and outs of milk processing, packaging, and storage. Watch as workers manufacture butter, cheese, yogurt, sour cream and ice cream, and learn about secondary dairy products. (Chipsbooks Company–2003)

D1040 **Ether Extraction Method for Determination of Raw Milk** – (26 minutes). Describes the ether extraction procedure to measure milk fat in dairy products. Included is an explanation of the chemical reagents used in each step of the process. (CA–1988) (Reviewed 1998)

D1050 **Food Safety: Dairy Details** – (18 minutes). Dairy products are prime targets of contamination because of their high protein and water content, but this presentation shows how to maintain dairy foods. It explores techniques such as selection, handling, preparation and storage for milk, yogurt, cheese and other dairy products. (Chipsbooks Company–2003)

D1060 **Frozen Dairy Products** – (27 minutes). Developed by the California Department of Food and Agriculture. Although it mentions the importance of frozen desserts, safety and checking ingredients, emphasis is on what to look for in a plant inspection. Everything from receiving, through processing, cleaning and sanitizing is outlined, concluded with a quality control program. Directed to plant workers and supervisors, it shows you what should be done. (CA–1987) (Reviewed 1997)

D1070 **The Gerber Butterfat Test** – (7 minutes). Describes the Gerber milk fat test procedure for dairy products and compares it to the Babcock test procedure. (CA–1990) (Reviewed 1998)

D1080 **High–Temperature, Short–Time Pasteurizer** – (59 minutes). Developed to train pasteurizer operators and is well done. There are seven sections with the first covering the twelve components of a pasteurizer and the purpose and operation of each. The tape provides the opportunity for discussion after each section or continuous running of the videotape. Flow diagrams, processing and cleaning are covered. (Borden, Inc.–1986) (Reviewed 1997)

D1090 **Managing Milking Quality** – (33 minutes). This training video is designed to help dairy farmers develop a quality management process and is consistent with ISO 9000 certification and HACCP processes. The first step is to evaluate the strengths and weaknesses of a dairy operation. The video will help you find ways to improve the weaknesses that are identified on your farm.

D1100 **Mastitis Prevention and Control** – (Two–45 minute tapes). This video is ideal for one-on-one or small group presentations. Section titles include: Mastitis Pathogens, Host Defense, Monitoring Mastitis, Mastitis Therapy, Recommended Milking Procedures, Post milking Teat Dip Protocols, Milk Quality, and Milking Systems. (Nasco–1993)

D1105 **Milk Hauling Training** – (35 minutes). This video covers the procedures and duties of the milk hauler from the time of arrival at the dairy farm, to the delivery of the milk at the processing plant. It also provides the viewer with a general understanding of the quality control issues involved in milk production and distribution. Topics include milk composition breakdown, milk fat content measurement, testing for added water, antibiotic and pesticide residues, somatic cell and bacteria counts, sediment, and aflatoxins. (Avalon Mediaworks LLC–2003)

D1110 **Milk Plant Sanitation: Chemical Solution** – (13 minutes). This explains the proper procedure required of laboratory or plant personnel when performing chemical titration in a dairy plant. Five major titrations are reviewed...alkaline wash, presence of chlorine and iodophor, caustic wash and an acid wash in a HTST system. Emphasis is also placed on record keeping and employee safety. (1989)

D1120 **Milk Processing Plant Inspection Procedures** – (15 minutes). Developed by the California Department of Food and Agriculture. It covers pre- and post-inspection meetings with management, but emphasis is on inspection of all manual and cleaned in place equipment in the receiving, processing and filling rooms. CIP systems are checked along with recording charts and employee lockers and restrooms. Recommended for showing to plant workers and supervisors. (CA–1986)

D1125 **Ohio Bulk Milk Hauling Video** – (15 minutes). Milk haulers, weighers, and samplers are the most constant link between the producer, the producer cooperative, and the milk processor. This video shows their complete

understanding of all aspects of farm milk collection and handling, milk quality and quality tests, and sanitation and sanitary requirements that contribute to the trust between the producer and the dairy plant. The video educates prospective haulers, weighers, and samplers throughout Ohio. (Ohio State University–2001)

D1130 **Pasteurizer: Design and Regulation** – (16 minutes). This tape provides a summary of the public health reasons for pasteurization and a nonlegal definition of pasteurization. The components of an HTST pasteurizer, elements of design, flow-through diagram and legal controls are discussed. (Kraft General Foods–1990) (Reviewed 1998)

D1140 **Pasteurizer: Operation** – (11 minutes). This tape provides a summary of the operation of an HTST pasteurizer from start-up with hot water sanitization to product pasteurization and shut-down. There is an emphasis on the legal documentation required. (Kraft General Foods–1990) (Reviewed 1998)

D1150 **Processing Fluid Milk** – (30 minutes). This slide set was developed to train processing plant personnel on preventing food poisoning and spoilage bacteria in fluid dairy products. Emphasis is on processing procedures to meet federal regulations and standards. Processing procedures, pasteurization times and temperatures, purposes of equipment, composition standards, and cleaning and sanitizing are covered. Primary emphasis is on facilities such as drains and floors, and filling equipment to prevent post-pasteurization contamination with spoilage or food poisoning bacteria. It was reviewed by many industry plant operators and regulatory agents and is directed to plant workers and management. (Penn State-1987) (Reviewed 1998)

D1180 **10 Points to Dairy Quality** – (10 minutes). Provides in-depth explanation of a critical control point in the residue prevention protocol. Illustrated with on-farm, packing plant, and milk–receiving plant scenes as well as interviews of producers, practicing veterinarians, regulatory officials and others. (Dairy Quality Assurance–1992) (Reviewed 1998)

ENVIRONMENTAL

E2012 **Better TEDs for Better Fisheries** – (42 minutes). Introduces the usefulness of turtle excluder devices (TEDs) and demonstrates the working nature of the devices. It covers the major sea turtles and the specific TEDs needed for each. It precedes two segments on installation of appropriate TEDs in shrimp trawl nets. (MS Dept. of Marine Resources–2003)

E3010 **The ABC's of Clean – A Handwashing and Cleanliness Program for Early Childhood Programs** – For early childhood program employees. This tape illustrates how proper hand washing and clean hands can contribute to the infection control program in daycare centers and other early childhood programs. (The Soap & Detergent Association–1991)

E3020 **Acceptable Risks?** – (16 minutes). Accidents, deliberate misinformation, and the rapid proliferation of nuclear power plants have created increased fears of improper nuclear waste disposal, accidents during the transportation of waste, and the release of radioactive effluents from plants. The program shows the occurrence of statistically anomalous leukemia clusters; governmental testing of marine organisms and how they absorb radiation; charts the kinds and amounts of natural and man-made radiation to which man is subject; and suggests there is no easy solution to balancing our fears to nuclear power and our need for it. (Films for the Humanities & Sciences, Inc.–1993) (Reviewed 1998)

E3030 **Air Pollution: Indoor** – (26 minutes). Indoor air pollution is in many ways a self-induced problem...which makes it no easier to solve. Painting and other home improvements have introduced pollutants, thermal insulation and other energy-saving and water-proofing devices have trapped the pollutants inside. The result is that air pollution inside a modern home can be worse than inside a chemical plant. (Films for the Humanities & Sciences, Inc.) (Reviewed 1998)

E3031 **Allergy Beware** – (15 minutes). Designed to educate food and beverage company employees about their role in preventing an accidental allergic reaction caused by a product their company produces. Recommended for product development, production, labeling, scheduling and cleaning. Everyone has an important role to prevent cross contamination and mislabeling issues. (Food and Consumer Products Manufacturers of Canada–2003)

E3040 **Asbestos Awareness** – (20 minutes). This videotape discusses the major types of asbestos and their current and past uses. Emphasis is given to the health risks associated with asbestos exposure and approved asbestos removal abatement techniques. (Industrial Training, Inc.–1988) (Reviewed 1998)

E3055 **Effective Handwashing – Preventing Cross–Contamination in the Food Service Industry** – (3.5 minutes). It is critical that all food service workers wash their hands often and correctly. This video discusses the double wash method and the single wash method, and when to use each method. (Zep Manufacturing Company–1993)

E3060 **EPA Test Methods for Freshwater Effluent Toxicity Tests (Using Ceriodaphnia)** – (22 minutes). Demonstrates the Ceriodaphnia Seven–day Survival and Reproduction Toxicity Test and how it is used to monitor and evaluate effluents for their toxicity to biota and their impact on receiving waters and the establishment of NPDES permit limitations for toxicity. The tape covers the general procedures for the test including how it is set up, started, monitored, renewed and terminated. (1989) (Reviewed 1998)

E3070 **EPA Test Methods for Freshwater Toxicity Tests (Using Fathead Minnow Larva)** – (15 minutes). A training tape that teaches environmental professionals about the Fathead Minnow Larva Survival and Growth Toxicity Test. The method described is found in an EPA document entitled, "Short Term Methods for Estimating the Chronic Toxicity of Effluents & Receiving Waters to Freshwater Organisms." The tape demonstrates how fathead minnow toxicity tests can be used to monitor and evaluate effluents for their toxicity to

biota and their impact on receiving waters and the establishment of NPDES permit limitations for toxicity. (1989) (Reviewed 1998)

E3075 **EPA: This is Super Fund** – (12 minutes). Produced by the United States Environmental Protection Agency (EPA) in Washington, D.C., this videotape focuses on reporting and handling hazardous waste sites in our environment. The agency emphasizes community involvement in identifying chemical waste sites and reporting contaminated areas to the authorities. The primary goal of the "Super Fund Site Process" is to protect human health and to prevent and eliminate hazardous chemicals in communities. The film outlines how communities can participate in the process of cleaning up hazardous sites. The program also explains how federal, state and local governments, industry and residents can work together to develop and implement local emergency preparedness/response plans in case chemical waste is discovered in a community.

E3080 **Fit to Drink** – (20 minutes). This program traces the water cycle, beginning with the collection of rain-water in rivers and lakes, in great detail through a waer treatment plant, to some of the places where water is used, and finally back into the atmosphere. Treatment of the water begins with the use of chlorine to destroy organisms; the water is then filtered through various sedimentation tanks to remove solid matter. Other treatments employ ozone, which oxidizes contaminants and makes them easier to remove; hydrated lime, which reduces the acidity of the water; sulfur dioxide, which removes any excess chlorine; and floculation, a process in which aluminum sulfate causes small particles to clump together and precipitate out. Throughout various stages of purification, the water is continuously tested for smell, taste, titration, and by fish. The treatment plant also monitors less common contaminants with the use of up-to-date techniques like flame spectrometers and gas liquefaction. (Films for the Humanities & Sciences, Inc.–1987)

E3110 **Garbage: The Movie** – (25 minutes). A fascinating look at the solid waste problem and its impact on the environment. Viewers are introduced to landfills, incinerators, recycling plants, and composting operations as solid waste management solutions. Problems associated with modern landfills are identified and low-impact alternatives such as recycling, reuse, and source reduction are examined. (Churchill Films) (Reviewed 1998)

E3120 **Global Warming: Hot Times Ahead** – (23 minutes). An informative videotape program that explores the global warming phenomenon and some of the devastating changes it may cause. This program identifies greenhouse gases and how they are produced by human activities. Considered are: energy use in transportation, industry and home; and effects of deforestation, planting of trees and recycling as means of slowing the build-up of greenhouse gases. (Churchill Films–1995)

E3125 **Good Pest Exclusion Practices** – (28 minutes). Most pests you find inside come from outside your food plant. This video covers numerous tactics of keeping pests out of food processing and distribution operations. Tactics include grounds, landscaping and building design; inbound trailer and bulk transportation materials inspection; and key employee actions. Learn how to defend your perimeter with one of the best weapons in the battle against pests – exclusion. (CTI Publications–2004)

E3128 **Integrated Pest Management (IPM)** – (28 minutes). This video develops the IPM concept into a comprehensive 12-point program. To emphasize this concept, computer-animated, digital graphics are used to piece together the IPM puzzle. This dramatic effect assists participants in visualizing and retaining key points of the video. To paint the complete picture, each of the 12 points is discussed providing an IPM overview. (CTI Publications–2004)

E3130 **Kentucky Public Swimming Pool and Bathing Facilities** – (38 minutes). Developed by the Lincoln Trail District Health Department in Kentucky and includes all of their state regulations which may be different from other states, provinces, and countries. This tape can be used to train those responsible for operating pools and waterfront bath facilities. All aspects are included of which we are aware, including checking water conditions and filtration methods. (1987) (Reviewed 1998)

E3131 **Key Pests of the Food Industry** – (28 minutes). Many types of pests can cause waste and loss of profits. Keeping food processing operations free of pest problems is a challenge. This video will assist food plant employees in the review of basic identification, biology, habits and control options of three key groups of pests frequently associated with food processing operations: birds, insects, and rodents. (CTI Publications–2004)

E3133 **Physical Pest Management Practices** – (28 minutes). Do you feel that you cannot do your job without pesticides? There are solutions. Many of them are what we call physical controls. This video will provide you with some of the things which can help you manipulate the physical environment in a manner that will prevent the growth of the pest population, causing them to leave or die. (CTI Publications–2004)

E3135 **Plastics Recycling Today: A Growing Resource** – (26 minutes). Recycling is a growing segment of our nation's solid waste management program. It shows how plastics are handled from curbside pickup through the recycling process to end-use by consumers. This video provides a basic understanding of recycling programs and how communities, companies and others can benefit from recycling. (The Society of the Plastics Industry, Inc.–1988)

E3140 **Putting Aside Pesticides** – (26 minutes). This program probes the long-term effects of pesticides and explores alternative pest-control efforts, biological pesticides, genetically engineered microbes that kill objectionable insects, the use of natural insect predators, and the cross-breeding and genetic engineering of new plant strains that produce their own anti-pest toxins. (Films for the Humanities & Sciences, Inc.) (Reviewed 1999)

E3150 **Radon** – (26 minutes). This videotape explains the danger associated with hazardous chemical handling and discusses the major hazardous waste handling requirements presented in the Resource Conservation and Recovery Act.

E3160 **RCRA–Hazardous Waste** – (19 minutes). This videotape explains the dangers associated with hazardous chemical handling and discusses the major hazardous waste handling requirements presented in the Resource Conservation and Recovery Act. (Industrial Training, Inc.)

E3161 **The Kitchen Uncovered: Orkin Sanitized EMP** – (13 minutes). This video teaches restaurant workers what they can do to prevent pest infestation, and what health inspectors look for. An excellent training tool for food service workers that can be used in conjunction with HACCP instruction. (Orkin–1997)

The New Superfund: What It Is and How It Works – A six-hour national video conference sponsored by the EPA. Target audiences include the general public, private industry, emergency responders and public interest groups. The series features six videotapes that review and highlight the following issues:

E3170 **Tape 1 – Changes in the Remedial Process: Clean–up Standards and State Involvement Requirements** – (62 minutes). A general overview of the Superfund Amendments and Reauthorization Act (SARA) of 1986 and the challenge of its implementation. The remedy process – long-term and permanent clean-up – is illustrated step-by-step, with emphasis on the new mandatory clean-up schedules, preliminary site assessment petition procedures and the hazard ranking system/National Priority List revisions. The major role of state and local government involvement and responsibility is stressed.

E3180 **Tape 2 – Changes in the Removal Process: Removal and Additional Program Requirements** – (48 minutes). The removal process is a short-term action and usually an immediate response to accidents, fires, and illegal dumped hazardous substances. This program explains the changes that expand removal authority and require procedures consistent with the goals of remedial action.

E3190 **Tape 3 – Enforcement & Federal Facilities** – (52 minutes). Who is responsible for SARA clean-up costs? Principles of responsible party liability; the difference between strict, joint, and several liability; and the issue of the innocent land owner are discussed. Superfund enforcement tools-mixed funding, De Minimis settlements and the new nonbinding preliminary allocations of responsibility (NBARs) are explained.

E3210 **Tape 4 – Emergency Preparedness & Community Right–to–Know** – (48 minutes). A major part of SARA is a free-standing act known as Title III: the Emergency Planning and community Right-to-Know Act of 1986, requiring federal, state, and local governments and industry to work together in developing local emergency preparedness/response plans. This program discusses local emergency planning committee requirements, emergency notification procedures, and specifications on community right-to-know reporting requirements such as using OSHA Material Safety Data Sheets, the emergency and hazardous chemical inventory and the toxic chemical release inventory.

E3220 **Tape 5 – Underground Storage Tank Trust Fund & Response Program** – (48 minutes). Another additional to SARA is the Leaking Underground Storage Tank (LUST) Trust Fund. One half of the US population depends on ground water for drinking – and EPA estimates that as many as 200,000 underground storage tanks are corroding and leaking into our ground water. This program discusses how the LUST Trust Fund will be used by EPA and the states in responding quickly to contain and clean-up LUST releases. Also covered is state enforcement and action requirements, and owner/operator responsibility.

E3230 **Tape 6 – Research & Development/ Closing Remarks** – (33 minutes). An important new mandate of the new Superfund are the technical provisions for research and development to create more permanent methods in the handling and disposing of hazardous wastes and managing hazardous substances. This segment discusses the SITE (Superfund Innovative Technology Evaluation) program, the University Hazardous Substance Research Centers, hazardous substance health research and the DOD research, development and demonstration management of DOD wastes.

E3235 **Regulatory and Good Manufacturing Practices** – (42 minutes). This video comes in two parts. Part one is a professional, 20-minute drama using real actors emphasizing the importance of food safety and GMPs. This dramatization will focus your emotions on the importance of cleanliness. Part two is a comprehensive 22-minute video introducing your employees to basic GMP elements. This training video uses numerous split screens of "good" and "bad" practices, and will help viewers understand GMPs and basic food safety. (CTI Publications–2004)

E3236 **Rodent Control Strategies** – (22 minutes). Pest control is a vital part of food safety, and leading pest-control specialist Dr. Bobby Corrigan shows you how to design and maintain a rodent-control program at food processing establishments. (J.J. Keller–2004)

E3240 **Sink a Germ** – (10 minutes). A presentation on the rationale and techniques for effective hand washing in health care institutions. Uses strong imagery to educate

hospital personnel that hand washing is the single most important means of preventing the spread of infection. (The Brevis Corp.–1986) (Reviewed 1998)

E3245 **WashYour Hands** – (5 minutes). Hand washing is the single most important means of preventing the spread of infection. This video presents why hand washing is important and the correct way to wash your hands. (LWB company–1995)

E3250 **Waste Not: Reducing Hazardous Waste** – (35 minutes). This tape looks at the progress and promise of efforts to reduce the generation of hazardous waste at the source. In a series of company profiles, it shows activities and programs within industry to minimize hazardous waste in the production process. "Waste Not" also looks at the obstacles to waste reduction, both within and outside of industry, and considers how society might further encourage the adoption of pollution prevention, rather than pollution control, as the primary approach to the problems posed by hazardous waste. (Umbrella Films)

E3251 **WouldYour Restaurant Kitchen Pass Inspection?** – (29 minutes). Help ensure a perfect score on any health inspection with this video by addressing safe food-handling techniques in the food service industry. Learn how foodborne illness is spread and how it can be prevented. Dramatizations display specific techniques students and employees can use to help any restaurant kitchen meet the highest standards. (Chipsbooks Company–2003)

E3260 **Swabbing Techniques for Sampling the Environment and Equipment –** (DVD) (60 minutes). This training program is designed to assist in providing effective training to technicians that collect environmental samples for APC and *Listeria*. It will help assure that technicians understand the basic principles and best practices, and can demonstrate good sample collection techniques. (Silliker Labs–2005)

FOOD

F2005 **A Lot on the Line** – (25 minutes). Through a riveting dramatization, "A Lot on the Line" is a powerful training tool for food manufacturing and food service employees. In the video, a food plant supervisor and his pregnant wife are eagerly awaiting the birth of their first child. Across town, a deli manager is taking his wife and young daughter away for a relaxing weekend. Both families, in a devastating twist of fate, will experience the pain, fear, and disruption caused by foodborne illness. This emotionally charged video will enthrall new and old employees alike and strongly reinforce the importance of incorporating GMPs into everyday work routines. Without question, "A Lot on the Line" will become an indispensable part of your company's training efforts. (Silliker Laboratories–2000)

F2007 **The Amazing World of Microorganisms** – (12 minutes). This training video provides your employees with an overview of how microorganisms affect their everyday lives and the foods they produce. The video explores how microscopic creatures are crucial in producing foods, fighting disease, and protecting the environment. In addition, certain microorganisms – when given the proper time and conditions to grow – are responsible for food spoilage, illness, and even death. Equipped with this knowledge, your employees will be better able to protect your brand. (Silliker Laboratories Group, Inc.–2001)

F2008 **A Recipe for Food Safety Success** – (30 minutes). This video helps food-industry employees understand their obligations in the areas of safety and cleanliness... what the requirements are, why they exist, and the consequences for all involved if they're not adhered to consistently. Critical information covered includes the role of the FDA and USDA; HACCP systems; sanitation and pest control; time and temperature controls that fight bacteria growth; and the causes and effects of pathogens. (J. J. Keller–2002)

F2009 **Basic Personnel Practices** – (18 minutes). This training video covers the practical GMPs from the growing field to the grocery store with a common sense approach. Employees learn the necessary training to help them understand the basic principles of food safety. (AIB International–2003)

F2010 **Close Encounters of the Bird Kind** – (18 minutes). A humorous but in-depth look at *Salmonella* bacteria, their sources, and their role in foodborne disease. A modern poultry processing plant is visited, and the primary processing steps and equipment are examined. Potential sources of *Salmonella* contamination are identified at the different stages of production along with the control techniques that are employed to insure safe poultry products. (Topek Products, Inc.) (Reviewed 1998)

F2011 **Available Post Harvest Processing Technologies for Oysters** – (8 minutes). This video explains three currently available post-harvest processing (PHP) technologies for oysters that continue to be developed to provide safer oysters to consumers. The Gulf oyster industry increasingly adopts solutions offered by modern technology in its efforts to continue to promote quality, food safety and extended shelf life of oysters. (MS Dept. of Marine Resources–2003)

F2013 **Control of *Listeria monocytogenes* in Small Meat and Poultry Establishments** – (26 minutes). (English and Spanish) – This video addresses a variety of issues facing meat processors who must meet revised regulations concerning *Listeria monocytogenes* in ready-to-eat meats. Topics covered include personal hygiene, sanitation, biofilms, cross contaminations, in plant sampling, and microbiological testing. (Penn State college of Ag Sciences–2003)

F2014 **Controlling Food Allergens in the Plant** – (16 minutes). This training video covers key practices to ensure effective control in food plants and delivers current industry knowledge to help companies enhance in-plant allergen training. Visually communicates allergen-specific Good Manufacturing Practices, from checking raw material to sanitation, to prevent serious, costly problems. (Silliker Laboratories, Inc.–2004)

F2015 **Controlling *Listeria*: A Team Approach** – (16 minutes). In this video, a small food company voluntarily shuts down following the implication of one of its products in a devastating outbreak of *Listeria monocytogenes*. This recall dramatization is followed by actual in-plant footage highlighting key practices in controlling *Listeria*. This video provides workers with an overview of the organism, as well as practical steps that can be taken to control its growth in plant environments. Finally, the video leaves plant personnel with a powerful, resounding message: Teamwork and commitment are crucial in the production of safe, quality foods. (Silliker Laboratories–2000)

F2016 **Bloodborne Pathogens: What Employees Must Know** – (20 minutes). This program provides an overview of the hazards and controls for worker exposure to bloodborne pathogens. Specifically, the program covers the basic requirements of the standard; definitions of key terms (including AIDS, contaminated sharps, and occupational exposure); engineering controls and work practices; housekeeping techniques; Hepatitis B and more. (J.J. Keller–2005)

F2020 **Egg Handling and Safety** – (11 minutes). Provides basic guidelines for handling fresh eggs which could be useful in training regulatory and industry personnel. (American Egg Board–1997)

F2021 **Egg Production** – (46 minutes). Live action footage of a completely automated operation follows the egg from the chicken to the carton. Watch the eggs as they roll down onto the main line, are washed, "candled," sorted by weight, placed into their packing containers, and prepared for shipment. Sanitation and health concerns are addressed. (Chipsbooks Company–2003)

F2025 **"The Special of the Day: The Eggceptional Egg"** – (DVD – 10 minutes). This DVD has been developed to train foodservice workers on today's standards for the expert care, handling, and preparation of "The incredible edible egg™. (American Egg Board–2007)

F2030 **"Eggs Games" Foodservice Egg Handling & Safety** – (18 minutes). Develop an effective egg handling and safety program that is right for your operation. Ideal for manager training and foodservice educational programs, this video provides step-by-step information in an entertaining, visually exciting format. (American Egg Board–1999)

F2035 **Fabrication and Curing of Meat and Poultry Products** – (2 tapes – 165 minutes). (See Part 2 Tape F2036 and Part 3 F2037) This is session one of three-part meat and poultry teleconference cosponsored by AFDO and the USDA Food Safety Inspection Service. Upon viewing, the sanitarian will be able to (1) identify typical equipment used for meat and poultry fabrication at retail and understand their uses; (2) define specific terms used in fabrication of meat and poultry products in retail establishments, and (3) identify specific food safety hazards associated with fabrication and their controls. (AFDO/USDA–1997)

F2036 **Emerging Pathogens and Grinding and Cooking Comminuted Beef** – (2 tapes – 165 minutes). (See Part 1 Tape F2035 and Part 2 Tape F2037) This is session two of a three-part meat and poultry teleconference co-sponsored by AFDO and the USDA Food Safety Inspection Service. These videotapes present an action plan for federal, state, and local authorities, industry, and trade associations in a foodborne outbreak. (AFDO/USDA–1998)

F2037 **Cooking and Cooling of Meat and Poultry Products** – (2 tapes – 176 minutes). (See Part 1 Tape F2035 and Part 2 Tape F2036) This is session three of a three-part meat and poultry teleconference cosponsored by AFDO and the USDA Food Safety Inspection Service. Upon completion of viewing these videotapes, the viewer will be able to (1) recognize inadequate processes associated with the cooking and cooling of meat and poultry at the retail level; (2) discuss the hazards associated with foods and the cooking and cooling processes with management at the retail level; (3) determine the adequacy of control methods to prevent microbiological hazards in cooking and cooling at the retail level; and (4) understand the principle for determining temperature with various temperature measuring devices. (AFDO/USDA–1999)

F2039 **Food for Thought – The GMP Quiz Show** – (16 minutes). In the grand tradition of television quiz shows, three food industry workers test their knowledge of GMP principles. As the contestants jockey to answer questions, the video provides a thorough and timely review of GMP principles. This video is a cost-effective tool to train new hires or sharpen the knowledge of veteran employees. Topics covered include employee practices – proper attire, contamination, stock rotation, pest control, conditions for microbial growth, and employee traffic patterns. Food safety terms such as HACCP, microbial growth niche, temperature danger zone, FIFO, and cross contamination, are also defined. (Silliker Laboratories–2000)

F2040 **Food Irradiation** – (30 minutes). Introduces viewers to food irradiation as a new preservation technique. Illustrates how food irradiation can be used to prevent spoilage by microorganisms, destruction by insects, over-ripening, and to reduce the need for chemical food additives. The food irradiation process is explained and benefits of the process are highlighted. (Turnelle Productions, Inc.) (Reviewed 1998)

F2045 **Food Microbiological Control** – (6 tapes – 12 hours). Designed to provide information and demonstrate the application of basic microbiology, the Good Manufacturing Practices (GMPs), retail Food Code, and sanitation practices when conducting food inspections at the processing and retail levels. Viewers will enhance their ability to identify potential food hazards and evaluate the adequacy of proper control methods for these hazards. (FDA–1998)

F2050 **Food Safe–Food Smart – HACCP and Its Application to the Food Industry (Parts 1 & 2)** – (2 tapes – 16 minutes each). (1) Introduces the seven principles of HACCP and their application to the food industry. Viewers will learn about the HACCP system and how it is used in the food industry to provide a safe food supply. (2) Provides guidance on how to design and implement a HACCP system. It is intended

for individuals with the responsibility of setting up a HACCP system. (Alberta Agriculture, Food and Rural Development) (Reviewed 1998)

F2060 **Food Safe Series I** (4 videos) – (4 tapes – 10 minutes each). (1) "Receiving and Storing Food Safely" details for food service workers the procedures for performing sight inspections for the general conditions of food, including a discussion of food labeling and government approval stamps. (2) "Food service Facility and Equipment" outlines the requirements for the proper cleaning and sanitizing of equipment used in food preparation areas. Describes the type of materials, design, and proper maintenance of this equipment. (3) "Microbiology for Foodservice Workers" provides a basic understanding of the microorganisms which cause food spoilage and foodborne illness. This program describes bacteria, viruses, protozoa, and parasites and the conditions which support their growth. (4) "Foodservice Housekeeping and Pest Control" emphasizes cleanliness as the basis for all pest control. Viewers learn the habits and life cycles of flies, cockroaches, rats, and mice. (Perennial Education–1991) (Reviewed 1998)

F2070 **Food Safe Series II** (4 videos) – (4 tapes – 10 minutes each). Presents case histories of foodborne disease involving (1) *Staphylococcus aureus*, (sauces) (2) *Salmonella*, (eggs) (3) *Campylobacter*, and (4) *Clostridium botulinum*. Each tape demonstrates errors in preparation, holding or serving food; describes the consequences of those actions; reviews the procedures to reveal the cause of the illness; and illustrates the correct practices in a step-by-step demonstration. These are excellent tapes to use in conjunction with hazard analysis critical control point training programs. (Perennial Education–1991) (Reviewed 1998)

F2080 **Food Safe Series III** (4 videos) – (4 tapes – 10 minutes each). More case histories of foodborne disease. This set includes (1) Hepatitis "A"; (2) *Staphylococcus aureus* (meats); (3) *Bacillus cereus*; and (4) *Salmonella* (meat). Viewers will learn typical errors in the preparation, holding and serving of food. Also included are examples of correct procedures which will reduce the risk of food contamination. (Perennial Education–1991) (Reviewed 1998)

F2081 **Food Safety Begins on the Farm** (DVD) – (15 minutes). From planting to consumption, there are many opportunities to contaminate produce. This is an excellent resource for training fruit and vegetable growers Good Agricultural Practices (GAPs). It includes seven PowerPoint presentations that deal with all aspects of food safety relative to growing, harvesting, and packing fresh fruits and vegetables. (Cornell Good Agricultural Practices Program–2000)

F2090 **Food Safety: An Educational Video for Institutional Food Service Workers** – (10 minutes). Provides a general discussion on food safety principles with special emphasis on pathogen reductions in an institutional setting from child care centers to nursing homes. (US Dept of Health & Human Services–1997)

F2095 **Now You're Cooking** – (DVD and video) (15 minutes). Using a food thermometer can improve the quality and safety of meat. This 15-minute video describes the why and how of using a food thermometer when cooking small cuts of meat like meat patties, chicken breasts, and pork chops. Topics include: why color is not a good indicator of doneness; how to choose an appropriate food thermometer for small cuts of meat; quick and easy steps for using an instant-read thermometer; how to calibrate an instant-read thermometer; and the most effective cooking methods for reducing *E. coli* O157:H7 in hamburger patties. (University of Idaho–2005) (Reviewed–2005)

Food Safety for Food Service Series I – An employee video series containing quick, 10-minute videos that teach food service employees how to prevent foodborne illness. This four video series examines sources of foodborne illness, plus explores prevention through awareness and recommendations for best practices for food safety. It also looks at how food safety affects the food service employee's job. (J.J. Keller & Associates–2000)

F2100 **Tape 1 – Food Safety for Food Service: Cross Contamination** – (10 minutes). Provides the basic information needed to ensure integrity and safety in foodservice operations. Explains proper practices and procedures to prevent, detect and eliminate cross contamination.

F2101 **Tape 2 – Food Safety for Food Service: HACCP** – (10 minutes). This video takes the mystery out of HACCP for your employees, and explains the importance of HACCP procedures in their work. Employees will come away feeling confident, knowing how to make HACCP work. The seven steps of HACCP and how HACCP is used in foodservice are some of the topics discussed.

F2102 **Tape 3 – Food Safety for Food Service: Personal Hygiene** – (10 minutes). This video establishes clear, understandable ground rules for good personal hygiene in the foodservice workplace and explains why personal hygiene is so important. Topics include: personal cleanliness; proper protective equipment; correct hand washing procedures; when to wash hands; hygiene with respect to cross contamination; and prohibited practices and habits.

F2103 **Tape 4 – Food Safety for Food Service: Time and Temperature Controls** – (10 minutes). This video examines storage and handling of raw and cooked ingredients, and explains how to ensure their safety. Employees learn how to spot potential problems and what to do when they find them. Topics include: correct thermometer use, cooling, thawing and heating procedures, food storage procedures, holding temperature requirements, and handling leftovers.

Food Safety for Food Service Series II – An employee video series containing quick, 10-minute videos that boost safety awareness for food service

employees and teach them how to avoid foodborne illness. (J.J. Keller & Associates–2002)

F2104 **Tape 1 – Basic Microbiology and Foodborne Illness** – (10 minutes). Covers four common microorganisms in food, how they get into food, and simple ways to prevent contamination. Stresses the importance of keeping food at the right temperature, having proper personal hygiene, and cleaning and sanitizing work surfaces.

F2105 **Tape 2 – Handling Knives, Cuts, and Burns** – (10 minutes). Explains why sharp knives are safer than dull ones, provides tips for selecting a good knife, and gives techniques for cutting food safely. Also explains first aid for cuts and burns and the most common causes of burns.

F2106 **Tape 3 – Working Safely to Prevent Injury** – (10 minutes). Discusses common lifting hazards and how back injuries can happen. Gives proper lifting and carrying techniques to prevent soreness and injury. Also covers how to prevent slips, trips, and falls.

F2107 **Tape 4 – Sanitation** – (10 minutes). Provides tips for good personal hygiene habits, including the proper way to wash your hands, dress, and prepare for work. Also covers cleaning and sanitizing equipment; storing chemicals and cleaning supplies; and controlling pests that can contaminate work areas and food.

F2110 **Food Safety is No Mystery** – (34 minutes). This is an excellent training visual for foodservice workers. It shows the proper ways to prepare, handle, serve and store food in actual restaurant, school and hospital situations. A policeman sick from food poisoning, a health department sanitarian, and a foodservice worker with all the bad habits are featured. The latest recommendations on personal hygiene, temperatures, cross contamination, and storage of foods are included. (USDA–1987) (Reviewed 1998)

F2111 **Controlling *Salmonella*: Strategies That Work** – (16 minutes). This training video provides practical guidelines to prevent the growth of *Salmonella* in dry environments and avoid costly product recalls. Using this video as a discussion tool, supervisors can help employees learn about water and how it fosters conditions for the growth of *Salmonella* in dry processing plants with potentially devastating consequences. (Silliker Laboratories–2002)

F2120 **Food Safety: For Goodness Sake Keep Food Safe** – (15 minutes). Teaches food handlers the fundamentals of safe food handling. The tape features the key elements of cleanliness and sanitation, including: good personal hygiene, maintaining proper food product temperature, preventing time abuse, and potential sources of food contamination. (Iowa State University Extention–1990) (Reviewed 1998)

F2121 **Food Safety the HACCP Way** – (11.5 minutes). Introduces managers and line-level staff to HACCP, or the Hazard Analysis Critical Control Point food safety system. The HACCP system is a seven-step process to control food safety, and can be applied to any size and type of food establishment.

Food Safety Zone Video Series – A one-of-a kind series that helps get your employees to take food safety issues seriously. These short, to-the-point videos can help make your employees aware of various food hazards, and how they can help promote food safety. The four topics are: Basic Microbiology, Cross Contamination, Personal Hygiene, and Sanitation. (J.J. Keller & Associates–1999)

F2125 **Tape 1 – Basic Microbiology and Foodborne Illness** – (10 minutes). Covers four common microorganisms in food, how they get into food, and simple ways to prevent contamination. Stresses the importance of keeping food at the right temperature, having proper personal hygiene, and cleaning and sanitizing work surfaces.

F2126 **Tape 2 – Food Safety Zone: Cross Contamination** – (10 minutes). Quickly teach your employees how they can help prevent cross contamination. Employees are educated on why contaminants can be extremely dangerous, cause serious injury and even death, to consumers of their food products. This fast-paced video will give your employees a deeper understanding of the different types of cross contamination, how to prevent it, and how to detect it through visual inspections and equipment. The emphasis is that prevention is the key to eliminating cross contamination.

F2127 **Tape 3 – Food Safety Zone: Personal Hygiene** (English and Spanish) – (10 minutes). After watching this video, your employees will understand why their personal hygiene is critical to the success of your business. This video teaches employees about four basic good personal hygiene practices: keeping themselves clean, wearing clean clothes, following specific hand washing procedures, and complying with all related work practices. Personnel are also taught that personal hygiene practices are designed to prevent them from accidentally introducing bacteria to food products, and are so important that there are federal laws that all food handlers must obey.

F2128 **Tape 4 – Food Safety Zone: Sanitation** – (10 minutes). Don't just tell your employees why sanitation is important, show them! This training video teaches employees about the sanitation procedures that cover all practices to keep workplaces clean, and the food produced free of contaminants and harmful bacteria. Four areas covered include personal hygiene, equipment and work areas, use and storage of cleaning chemicals and equipment, and pest control.

F2129 **Food Technology: Irradiation** – (29 minutes). Video covers the following issues: history and details of the irradiation process; effects of irradiation on treated

products; and consumer concerns and acceptance trends. Other important concerns addressed include how food irradiation affects food cost, the nutritional food industry, food science and research, and irradiation regulatory industries (such as the Nuclear Regulatory Commission) add insight into the process of irradiation. (Chipsbooks–2001)

F2130 **Food Safety: You Make the Difference** – (28 minutes). Through five food workers from differing backgrounds, this engaging and inspirational documentary style video illustrates the four basic food safety concepts: hand washing, preventing cross contamination, moving foods quickly through the danger zone, and hot/cold holding. (Seattle–King County Health Dept.–1995)

F2131 **Fruits, Vegetables, and Food Safety: Health and Hygiene on the Farm** (DVD and video) – (15 minutes). This presentation shows ways to prevent contamination of fruits and vegetables while you work. It was filmed in real production fields and packinghouses in the United States. Organisms of concern in fruits and vegetables are discussed, along with proper hygiene practices when handling and harvesting fruits and vegetables. (Cornell University–2004)

F2133 **Food Safety First** (English and Spanish) (DVD and Video) – (50 minutes). Presents causes of foodborne illness in foodservice and ways to prevent foodborne illness. Individual segments include personal hygiene and hand washing, cleaning, and sanitizing, preventing cross contamination, and avoiding time and temperature abuse. Food handling principles are presented through scenarios in a restaurant kitchen. (GloGerm–1998)

F2134 **Food Safety: Fish and Shellfish Safety** – (21 minutes). Seafood tops the list for foods that can become contaminated with bacteria–causing foodborne illness. This video shows how to protect yourself from fish and shellfish contamination by learning proper selection, storage, preparation and safe consumption. (Chipsbooks Company–2003)

F2135 **Get with a Safe Food Attitude** – (40 minutes). Consisting of nine short segments which can be viewed individually or as a group, this video presents safe food handling for moms-to-be. Any illness a pregnant women contracts can affect her unborn child whose immune system is too immature to fight back. The video follows four pregnant women as they learn about food safety and preventing foodborne illness. (US Dept. of Agriculture–1999)

F2136 **GLP Basics: Safety in the Food Micro Lab** – (16 minutes). This video is designed to teach laboratory technicians basic safety fundamentals and how to protect themselves from inherent workplace dangers. Special sections on general laboratory rules, personal protective equipment, microbiological, chemical, and physical hazards, autoclave safety, and spill containment are featured. (Silliker Laboratories–2001)

F2137 **GMP Basics: Avoiding Microbial Cross–Contamination** – (15 minutes). This video takes a closer look at how harmful microorganisms, such as *Listeria*, can be transferred to finished products. Employees see numerous examples of how microbial cross contamination can occur from improper traffic patterns, poor personal hygiene, soiled clothing, unsanitized tools and equipment. Employees need specific knowledge and practical training to avoid microbial cross contamination in plants. This video aids in that training. (Silliker Laboratories–2000)

F2140 **GMP Basics: Employee Hygiene Practices** – (20 minutes). Through real-life examples and dramatization, this video demonstrates good manufacturing practices that relate to employee hygiene, particularly hand washing. This video includes a unique test section to help assess participants' understanding of common GMP violations. (Silliker Laboratories–1997)

F2143 **GMP Basics: Guidelines for Maintenance Personnel** – (21 minutes). Developed specifically for maintenance personnel working in a food processing environment, this video depicts a plant-wide training initiative following a product recall announcement. Maintenance personnel will learn how GMPs relate to their daily activities and how important their roles are in the production of safe food products. (Silliker Laboratories–1999)

F2147 **GMP Basics: Process Control Practices** – (16 minutes). In actual food processing environments, an on-camera host takes employees through a typical food plant as they learn the importance of monitoring and controlling key points in the manufacturing process. Beginning with receiving and storing, through production and ending with packaging and distribution, control measures are introduced, demonstrated and reviewed. Employees will see how their everyday activites in the plant have an impact on product safety. (Silliker laboratories–1999)

F2148 **GMP – GSP Employee** – (38 minutes). This video was developed to teach food plant employees the importance of "Good Manufacturing Practices" and "Good Sanitation Practices." Law dictates that food must be clean and safe to eat. This video emphasizes the significance of each employee's role in protecting food against contamination. Tips on personal cleanliness and hygiene are also presented. (L.J. Bianco & Associates)

F2150 **GMP: Personal Hygiene and Practices in Food Manufacturing** (English, Spanish, and Vietnamese) – (14 minutes). This video focuses on the personal hygiene of food-manufacturing workers, and explores how poor hygiene habits can be responsible for the contamination of food in the manufacturing process. This is an instructional tool for new food-manufacturing line employees and supervisors. It was produced with "real" people in actual plant situations, with only one line of text included in the videotape. (Penn State–1993)

A GMP Food Safety Video Series – This five–part video series begins with an introduction to GMPs and definitions, then goes on to review specific sections of the GMPs: personnel, plant and grounds, sanitary operations, equipment and utensils, process and controls, warehousing, and distribution. Developed to assist food processors in training employees on personnel policies and Good Manufacturing Practices (CMPs), the series includes different types of facilities, including dairy plants, canning factories, pasta plants, bakeries, and frozen food manufacturing facilities. (J.J. Keller–2003)

F2151 **Tape 1 – Definitions** – (12 minutes). Provides the definitions necessary to understand the meaning of the CMPs.

F2152 **Tape 2 – Personnel and Personnel Facilities** – (11 minutes). Covers selection of personnel, delegation of responsibilities, development of plant policies for employees, and operational practices.

F2153 **Tape 3 – Building and Facilities** – (16 minutes). Discusses guidelines for the construction and maintenance of the manufacturing plant and grounds around the plant.

F2154 **Tape 4 – Equipment and Utensils** – (12.5 minutes). Provides guidelines for the construction, installation, and maintenance of processing equipment.

F2155 **Tape 5 – Production and Process Controls** – (20 minutes). Covers establishing a food safety committee, in-house inspections, analysis of raw materials and ingredients, cleaning schedules and procedures, and more.

F2160 **GMP: Sources and Control of Contamination during Processing** – (20 minutes). This program, designed as an instructional tool for new employees and for refresher training for current or reassigned workers, focuses on the sources and control of contamination in the food-manufacturing process. It was produced in actual food plant situations. A concise description of microbial contamination and growth and cross contamination, a demonstration of food storage, and a review of aerosol contaminants are also included. (Penn State –1995)

GMPs for Food Plant Employees: Five-Volume Video Series Based on European Standards and Regulations – Developed to assist food processors in training employees in the Good Manufacturing Practices. Examples are drawn from a variety of processing facilities including dairy plants, canning facilities, pasta plants, bakeries, frozen food facilities, etc. (AIB International–2003)

F2161 **Tape 1 – Definitions** – (13 minutes). Begins with an introduction to the GMPs and traces a basic history of food laws in Europe, ending with the EC Directive 93/43/EEC of June 1993 on the hygiene of foodstuffs.

F2162 **Tape 2 – Personnel and Personnel Practices** – (13 minutes). Selecting personnel, delegating responsibilities, developing plant policies for employees and visitors, and establishing operational practices.

F2163 **Tape 3 – Building and Facilities** – (17 minutes). Guidelines for the construction and maintenance of the manufacturing facility and grounds around the factory.

F2164 **Tape 4 – Equipment and Utensils** – (13 minutes). Guidelines for construction, installation, and maintenance of processing equipment.

F2165 **Tape 5 – Production/Process Controls** – (22 minutes). Covers production and process controls, establishing a food safety committee, conducting in-house inspections, analyzing raw materials and ingredients, developing operational methods, establishing cleaning schedules and procedures, creating pest control programs and record keeping.

F2168 **HACCP Advantage – Good Manufacturing Practices** – (English and Spanish) – (DVD) (40 minutes). The HACCP Advantage is based on HACCP principles and was developed by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMARFA). HACCP Advantage was designed to be a practical, cost-effective and preventative food safety system for all nonfederally registered food processing facilities, regardless of size, commodity or volume processed. OMAFRA has developed a 3-step approach to food safety management that makes it easier for small and medium-sized food processors to adopt a HACCP food safety program that meets their requirements. These three components – GMP Advantage, HACCP Advantage and HACCP Advantage Plus+ – collectively encompass all the elements of the original HACCP Advantage program as well as new elements to meet the evolving needs of modern food safety systems. (OMARFA–2006)

F2169 **HACCP: Training for Employees – USDA Awareness** – (15 minutes). This video is a detailed training outline provided for the employee program. Included in the video is a synopsis of general federal regulations; HACCP plan development; incorporation of HACCP's seven principals; HACCP plan checklist; and an HACCP employee training program. (J.J. Keller & Associates–1999)

F2170 **The Heart of HACCP** – (22 minutes). A training video designed to give plant personnel a clear understanding of the seven HACCP principles and practical guidance on how to apply these principles to their own work environment. This video emphasizes the principles of primary concern to plant personnel such a critical limits, monitoring systems, and corrective actions that are vital to the success of a HACCP plan. (Silliker Laboratoraies–1994)

F2172 **HACCP: Training for Managers** – (17 minutes). Through industry-specific examples and case studies, this video addresses the seven HACCP steps, identifying critical control points, record keeping and documentation, auditing, and monitoring. It also explains how HACCP relates to other programs such as Good Manufacturing Practices and plant sanitation. (J.J. Keller & Associates–2000)

F2173 **Inside HACCP: Principles, Practices and Results** (English and Spanish) – (15 minutes). This video is designed to help you build a more knowledgeable work-force and meet safety standards through a comprehensive overview of HACCP principles. Employees are provided with details of prerequisite programs and a clear overview of the seven HACCP principles. "Inside HACCP" provides short, succinct explanations of how HACCP works and places special emphasis on the four principles – monitoring,

verification, corrective action, and recordkeeping – in which employees actively participate. (Silliker Laboratories–2001)

F2175 **Inspecting for Food Safety – Kentucky's Food Code** – (100 minutes). Kentucky's Food Code is patterned after the Federal Food Code. The concepts, definitions, procedures, and regulatory standards included in the code are based on the most current information about how to prevent foodborne diseases. This video is designed to prepare food safety inspectors to effectively use the new food code in the performance of their duties. (Dept. of Public Health Commonwealth of Kentucky–1997) (Reviewed 1999)

F2180 **HACCP: Safe Food Handling Techniques** – (22 minutes). The video highlights the primary causes of food poisoning and emphasizes the importance of self inspection. An explanation of potentially hazardous foods, cross contamination, and temperature control is provided. The main focus is a detailed description of how to implement a Hazard Analysis Critical Control Point (HACCP) program in a food service operation. A leader's guide is provided as an adjunct to the tape. (The Canadian Restaurant & Foodservices Assoc.–1990) (Reviewed 1998)

F2190 **Is What You Order What You Get? Seafood Integrity** – (18 minutes). Teaches seafood department employees about seafood safety and how they can help insure the integrity of seafood sold by retail food markets. Key points of interest are cross-contamination control, methods and criteria for receiving seafood and determining product quality, and knowing how to identify fish and seafood when unapproved substitutions have been made. (The Food Marketing Institute) (Reviewed 1998)

F2191 **Microbial Food Safety: Awareness to Action** (DVD PowerPoint presentation) – (90 minutes). An overview of GAPs and resources by the United Fresh Fruits and Vegetables Association, a hazard identification self-audit, a sample farm investigative questionnaire, copies of relevant California state information, and US federal regulations. Contains numerous commodity flow charts and photos for more than 30 fruits and vegetables, one dozen PowerPoint presentations containing more than 400 slides, including may in Spanish and two dozen supplemental documents on a variety of food safety topics. (UC Davis–2002)

F2210 **Northern Delight – From Canada to the World** – (13 minutes). A promotional video that explores the wide variety of foods and beverages produced by the Canadian food industry. General in nature, this tape presents an overview of Canada's food industry and its contribution to the world's food supply. (Ternelle Production, Ltd.) (Reviewed 1998)

F2220 **Proper Handling of Peracidic Acid** – (15 minutes). Introduces peracidic acid as a chemical sanitizer and features the various precautions needed to use the product safely in the food industry.

F2230 **Purely Coincidental** – (20 minutes). A parody that shows how foodborne illness can adversely affect the lives of families that are involved. The movie compares improper handling of dog food in a manufacturing plant that causes the death of a family pet with improper handling of human food in a manufacturing plant that causes a child to become ill. Both cases illustrate how handling errors in food production can produce devastating outcomes. (The Quaker Oats company–1993) (Reviewed 1998)

F2240 **On the Front Line** – (18 minutes). A training video pertaining to sanitation fundamentals for vending service personnel. Standard cleaning and serving procedures for cold food, hot beverage and cup drink vending machines are presented. The video emphasizes specific cleaning and serving practices which are important to food and beverage vending operations. (National Automatic Merchandising Association–1993) (Reviewed 1998)

F2250 **On the Line** (English and Spanish) – (30 minutes). This was developed by the Food Processors Institute for Training food processing plant employees. It creates an awareness of quality control and regulations. Emphasis is on personal hygiene, equipment cleanliness and good housekeeping in a food plant. It is recommended for showing to both new and experienced workers. (The Food Processors Institute–1993) (Reviewed 1998)

F2260 **100 Degrees of Doom...The Time and Temperature Caper** – (14 minutes). Video portraying a private eye tracking down the cause of a *Salmonella* poisoning. Temperature control is emphasized as a key factor in preventing foodborne illness. (Educational Communications, Inc.–1987) (Reviewed 1998)

F2265 **A Day in the Deli: Service, Selection, and Good Safety** – (22 minutes). This training video provides basic orientation for new deli department employees and highlights skills and sales techniques that will build department traffic and increased sales. The focus will be on the priorities of the deli department freshness, strong customer service, professionalism, and food safety. By understanding the most important issues for their position(s), employees can comprehend their contribution to the financial interests of the store. (Food Marketing Institute–2003)

F2266 **HACCP: A Basic Understanding** – (32 minutes). Explore applications for Hazard Analysis Critical Control Points (HACCP), a system of process controls required by federal and state governments for most areas of the food service industry. Learn to minimize the risk of chemical, microbiological and physical food contamination while focusing on the seven principles of HACCP and the chain of responsibility. (Chipsbooks company–2003)

F2270 **Pest Control in Seafood Processing Plants** – (26 minutes). Covers procedures to control flies, roaches, mice, rats, and other common pests associated with food processing operations. The tape will familiarize plant personnel with the basic characteristics of these pests and the potential hazards associated with their presence in food operations.

F2271 **Preventing Foodborne Illness** – (10 minutes). This narrated video is for food service workers, with emphasis on insuring food safety by washing one's hands before handling food, after using the bathroom, sneezing, touching raw meats and poultry, and before and after handling foods such as salads and sandwiches. Safe food temperatures and cross contamination are also explained. (Colorado Dept. of Public Health and Environment–1999)

F2280 **Principles of Warehouse Sanitation** – (33 minutes). This videotape gives a clear, concise and complete illustration of the principles set down in the Food, Drug and Cosmetic Act and in the Good Manufacturing Practices, as well as supporting legislation by individual states. (American Institute of Baking–1993)

F2290 **Product Safety and Shelf Life** – (40 minutes). This videotape was done in three sections with opportunity for review. Emphasis is on providing consumers with good products. One section covers off-flavors, another product problem caused by plant conditions, and a third the need to keep products cold and fresh. Procedures to assure this are outlined, as shown in a plant. Well done and directed to plant workers and supervisors. (Borden, Inc.–1987) (Reviewed 1997)

F2310 **Safe Food: You Can Make a Difference** – (25 minutes). A training video for food service workers which covers the fundamentals of food safety. An explanation of proper food temperature, food storage, cross-contamination control, cleaning and sanitizing, and hand washing as methods of foodborne illness control is provided. The video provides an orientation to food safety for professional food handlers. (Tacoma–Pierce County Health Dept.–1990) (Reviewed 1998)

F2320 **Safe Handwashing** – (15 minutes). Twenty-five percent of all foodborne illnesses are traced to improper hand washing. The problem is not just that hand washing is not done, the problem is that it's not done properly. This training video demonstrates the "double wash" technique developed by Dr. O. Peter Snyder of the Hospitality Institute for Technology and Management. Dr. Snyder demonstrates the procedure while reinforcing the microbiological reasons for keeping hands clean. (Hospitality Institute for Technology & Management–1991) (Reviewed 1998)

F2321 **All Hands On Deck** – (12 minutes) Germ Tells All. A Benedict Arnold of the germ world comes clean by teaching the audience to "think like a germ" when it comes to hand washing. The reasons for hand washing are outlined and proper technique is demonstrated along with suggestions for avoiding immediate recontamination before even leaving the rest room. Interesting, informative, humorous and appropriate for virtually any age group. (Brevis Corporation – 2005)

F2322 **The Why, The When and The How Video** – (5 minutes) An excellent tool for motivating good hand hygiene behavior with existing and new employees. Fast paced. Three modules train the why, when, and how of hand washing. (Brevis Corporation-2005)

F2325 **Safe Practices for Sausage Production** – (180 minutes). This videotape is based on a series of educational broadcasts on meat and poultry inspections at retail food establishments produced by the Association of Food and Drug Officials (AFDO) and USDA's Food Safety and Inspection Service (FSIS), along with FDA's Center for Food Safety and Applied Nutrition. The purpose of the broadcast was to provide training to state, local, and tribal sanitarians on processes and procedures that are being utilized by retail stores and restaurants, especially those that were usually seen in USDA-inspected facilities. The program will cover the main production steps of sausage products, such as the processes of grinding, stuffing, and smoking, and typical equipment used will be depicted. Characteristics of different types of sausage (fresh, cooked, and smoked, and dry/semi-dry) will be explained. Pathogens of concern and outbreaks associated with sausage will be discussed. The written manual for the program is available at www.fsis.usda.gov/ofo/hrds/STATE/RETAIL/manual. htm(1999)

F2330 **Sanitation for Seafood Processing Personnel** – (20 minutes). A training video suited for professional food handlers working in any type of food manufacturing plant. The film highlights Good Manufacturing Practices and their role in assuring food safety. The professional food handler is introduced to a variety of sanitation topics including: (1) food handlers as a source of food contamination, (2) personal hygiene as a means of preventing food contamination, (3) approved food storage techniques including safe storage temperatures, (4) sources of cross contamination, (5) contamination of food by insects and rodents, (6) garbage handling and pest control, and (7) design and location of equipment and physical facilities to facilitate cleaning. (Reviewed 1998)

F2340 **Sanitizing for Safety** – (17 minutes). Provides an introduction to basic food safety for professional food handlers. A training pamphlet and quiz accompany the tape. Although produced by a chemical supplier, the tape contains minimal commercialism and may be a valuable tool for training new employees in the food industry. (Clorox–1990) (Reviewed 1998)

F2341 **Science and Our Food Supply** – (45 minutes). Becoming food safety savvy is as easy as A–B–C! This video includes a step-by-step journey as food travels from the farm to the table; the FightBAC®! Campaign's four simple steps to food safety, clean, cook, separate (combat cross contamination), and chill, and the latest in food safety careers. Other topics covered include understanding bacteria, food processing and day Alliance training courses. There are 12 training modules in the course that cover all of the information on HACCP principles, their application to seafood products, and the FDA regulation. Experience has shown that HACCP implementation can be more effective when a number of key people in the operation have a good understanding of the system and its requirements. (Cornell University–2004)

F2350 **ServSafe Steps to Food Safety** (DVD and Video) (English and Spanish) – The ServSafe food safety series consists of six videos that illustrate and reinforce important food safety practices in an informative and entertaining manner. The videos provide realistic scenarios in multiple industry segments. (National Restaurant Association Education Foundation–2000)

Tape 1 **Step One: Starting Out with Food Safety** – (12 minutes). Defines what foodborne illness is and how it occurs; how foods become unsafe; and what safety practices to follow during the flow of food.

Tape 2 **Step Two: Ensuring Proper Personal Hygiene** – (10 minutes). Introduces employees to ways they might contaminate food; personal cleanliness practices that

help protect food; and the procedure for thorough hand washing.

Tape 3 **Step Three: Purchasing, Receiving and Storage** – (12 minutes). Explains how to choose a supplier; calibrate and use a thermometer properly; accept or reject a delivery; and store food safely.

Tape 4 **Step Four: Preparing, Cooking and Serving** – (11 minutes). Identifies proper practices for thawing, cooking, holding, serving, cooling, and reheating food.

Tape 5 **Step Five: Cleaning and Sanitizing** – (11 minutes). Describes the difference between cleaning and sanitizing; manual and machine warewashing; how sanitizers work; how to store clean items and cleaning supplies; and how to set up a cleaning program.

Tape 6 **Step Six: Take the Food Safety Challenge: Good Practices, Bad Practices – You Make the Call** – (35 minutes). Challenges viewers to identify good and bad practices presented in five short scenarios from different industry segments.

F2370 **Supermarket Sanitation Program – Cleaning and Sanitizing** – (13 minutes). Contains a full range of cleaning and sanitizing information with minimal emphasis on product. Designed as a basic training program for supermarket managers and employees (1989) (Reviewed 1998)

F2380 **Supermarket Sanitation Program: Food Safety** – (11 minutes). Contains a full range of basic sanitation information with minimal emphasis on product. Filmed in a supermarket, the video is designated as a basic program for manager training and a program to be used by managers to train employees. (1998) (Reviewed 1998)

F2390 **Take Aim at Sanitation** (English and Spanish) – (8 minutes). Produced by the Foodservice & Packaging Institute in cooperation with the US Food and Drug Administration, this video demonstrates how to properly store and handle foodservice disposables so customers are using safe, clean products. This video demonstrates: the problem of foodborne illness; how foodservice disposables are manufactured for cleanliness; tips for storing foodservice disposables; tips to help your customers in self-serve areas; guidelines for serving meals and maintaining proper sanitation; and tips for cleaning up after meals. Throughout the program a roving microscope "takes aim" at common mistakes made by workers to help audiences identify unsanitary handling and storage practices. (Foodservice & Packaging Institute, Inc.)

F2391 **Understanding Foodborne Pathogens** – (40 minutes). Explore the major causes of foodborne illness and review the practices used to minimize the risk of contracting or spreading a foodborne disease. Learn about microorganisms associated with foodborne illness such as parasites, viruses, fungi and bacteria. Study ways to reduce harmful pathogens through proper handling, storage, and cooking. (Chipsbooks Company–2003)

F2410 **Wide World of Food Service Brushes** – (18 minutes). Discusses the importance of cleaning and sanitizing as a means to prevent and control foodborne illness. Special emphasis is given to proper cleaning and sanitizing procedures and the importance of having properly designed and constructed equipment (brushes) for food preparation and equipment cleaning operations. (1989)

F2420 **Your Health in Our Hands, Our Health in Yours** – (8 minutes). For professional food handlers, the tape covers the do's and don'ts of food handling as they relate to personal hygiene, temperature control, safe storage, and proper sanitation. (Jupiter Video Production–1993) (Reviewed 1998)

F2430 **Smart Sanitation: Principles and Practices for Effectively Cleaning Your Food Plant** – (20 minutes). A practical training tool for new sanitation employees or as a refresher for veterans. Employees will understand the food safety impact of their day-to-day cleaning and sanitation activities and recognize the importance of their role in your company's food safety program. (Silliker Laborabories–1996)

F2440 **Cleaning and Sanitizing in Vegetable Processing Plants: Do It Well, Do It Safely!** (English and Spanish) – (16 minutes). This training video shows how to safely and effectively clean and sanitize in a vegetable processing plant. It teaches how it is the same for a processing plant as it is for washing dishes at home. (University of Wisconsin Extension–1996)

F2450 **A Guide to Making Safe Smoked Fish** – (21 minutes). Smoked fish can be a profitable product for aquaculturalists, but it can be lethal if not done correctly. This video guides you through the steps necessary to make safe smoked fish. It provides directions for brining, smoking, cooling, packaging, and labeling, and cold storage to ensure safety. The video features footage of fish smoking being done using both traditional and modern equipment. (University of Wisconsin–Madison–1999)

F2451 **A HACCP-based Plan Ensuring Food Safety in Retail Establishments** (DVD) – (11 minutes). This is an educational DVD that provides a brief summary of HACCP. It explains the purpose and execution of each of the seven principles. Can be used as part of a wide range of HACCP training programs beyond retail establishments. The major emphasis is on proper documentation and validation. (Ohio State University–2004)

F2460 **Safer Processing of Sprouts** – (82 minutes). Sprouts are enjoyed by many consumers for their taste and nutritional value. However, recent outbreaks of illnesses associated with sprouts have demonstrated a potentially serious human health risk posed by this food. FDA and other public health officials are working with industry to identify and implement production practices that will assure that seed and sprouted seed are produced under safe conditions. This training video covers safe processing practices of sprouts including growing, harvesting, milling, transportation, storage, seed treatment, cleaning and sanitizing, sampling and microbiological testing. (CA Dept. of Health Service, Food & Drug Branch–2000)

Fast Track Restaurant Video Kit – These five short, direct videos can help make your employees more aware of various food hazards and how they can promote food safety. (Diversey Lever–1994)

F2500 **Tape 1 – Food Safety Essentials** – (23 minutes). This video provides an overview of food safety. All food service employees learn six crucial guidelines for combating foodborne illness. Prepares employees for further position-specific training to apply the six food safety principles to specific jobs.

F2501 **Tape 2 – Receiving and Storage** – (22 minutes). Make sure only safe food enters your doors! Receiving and storage staff learn what to look for and how to prevent spoilage with proper storage with this video.

F2502 **Tape 3 – Service** – (22 minutes). Servers are your last safety checkpoint before guests receive food. This video helps you make sure they know the danger signs.

F2503 **Tape 4 – Food Production** – (24 minutes). Food production tasks cause most food safety problems. Attack dangerous practices at this critical stage with this video training tool.

F2504 **Tape 5 – Warewashing** – (21 minutes). Proper sanitation starts with clean dishes! With this video, warewashers will learn how to ensure safe tableware for guests and safe kitchenware for co-workers.

Worker Health and Hygiene Program for the Produce Industry

F2505 **Manager Guide to Worker Health and Hygiene: Your Company's Success May Depend on It!** (English) – (18 minutes). Covers the importance of foodborne illness as related to the produce industry and provides practical hands-on information of managers/operators on teaching health and hygiene to the workers in their operations (University of Florida/IFAS–2006)

F2506 **Worker Health and Hygiene: Your Job Depends On It!** (English and Spanish) – (11 minutes). Covers the importance of personal health and hygiene and simple hands-on information on foodborne illness and how produce handlers could spread disease if proper personal hygiene is not practiced. Also provides stepwise handwashing procedures for produce handlers in any situation (University of Florida/IFAS–2006)

F2600 **Food Industry Security Awareness: The First Line of Defense** – (24 minutes) (Video and DVD). This video reinforces the importance of security awareness in all phases of product handling, from receiving ingredients to processing and shipping. With this program, you can have an immediate impact on plant security with very little time or resources, all while helping maximize the effectiveness of your overall security investment. Everything you need to turn your biggest security challenge into your biggest security asset is covered. (J. J. Keller–2006)

OTHER

M4010 **Diet, Nutrition and Cancer** – (20 minutes). Investigates the relationship between a person's diet and the risk of developing cancer. The film describes the cancer development process and identifies various types of food believed to promote and/or inhibit cancer. The film also provides recommended dietary guidelines to prevent or greatly reduce the risk of certain types of cancer.

M4020 **Eating Defensively: Food Safety Advice for Persons with AIDS** – (15 minutes). While HIV infection and AIDS are not acquired by eating foods or drinking liquids, persons infected with the AIDS virus need to be concerned about what they eat. Foods can transmit bacteria and viruses capable of causing life-threatening illness to persons infected with AIDS. This video provides information for persons with AIDS on what foods to avoid and how to better handle and prepare foods. (FDA/CDC–1989)

M4030 **Ice: The Forgotten Food** – (14 minutes). This training video describes how ice is made and where the critical control points are in its manufacture, both in ice plants and in on-premises locations (convenience stores, etc.). It documents the potential for illness from contaminated ice and calls on government to enforce good manufacturing practices, especially in on-premises operations where sanitation deficiencies are common. (Packaged Ice Association–1993)

M4050 **Personal Hygiene and Sanitation for Food Processing Employees** – (15 minutes). Illustrates and describes the importance of good personal hygiene and sanitary practices for people working in a food processing plant. (Iowa State University–1993)

M4060 **Psychiatric Aspects of Product Tampering** – (25 minutes). This was presented by Emanuel Tanay, M.D. from Detroit, at the Fall 1986 conference of CSAFDA. He reviewed a few cases and then indicated that abnormal behavior is like a contagious disease. Media stories lead up to 1,000 similar alleged cases, nearly all of which are false. Tamper-proof packaging and recalls are essential. Tampering and poisoning are characterized by variable motivation, fraud and greed. Law enforcement agencies have the final responsibilities. Tamper-proof containers are not the ultimate answer. (1987)

M4070 **Tampering: The Issue Examined** – (37 minutes). Developed by Culbro Machine Systems, this videotape is well done. It is directed to food processors and not regulatory sanitarians or consumers. A number of industry and regulatory agency management explain why food and drug containers should be made tamper evident. (Culbro–1987)

M4071 **Understanding Nutritional Labeling** – (39 minutes). Learn why the government initiated a standardized food labeling system and which foods are exempt. Explore each component listed on the label including cholesterol, carbohydrates, protein, fat, health or nutritional claims, service size, percentage of daily value, and standard calorie reference/comparison. (Chipsboosk Company–2003)

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- ❒ D1150 Processing Fluid Milk
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- ❒ E3055 Effective Handwashing – Preventing Cross-Contamination in the Food Service Industry
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- ❒ E3080 Fit to Drink
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- ❒ E3125 Good Pest Exclusion Practices
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- ❒ E2039 Food for Thought – The GMP Quiz Show
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- ❒ E2060 Food Safe Series I (4 videos)
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- ❒ E2090 Food Safety: An Educational Video for Institutional Food Service Workers
- ❒ E2095 Food Safety for Food Service Series I: Now You're Cooking
- ❒ E2100 Tape 1 – Food Safety for Food Service: Cross Contamination
- ❒ E2101 Tape 2 – Food Safety for Food Service: HACCP
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- ❒ E2103 Tape 4 – Food Safety for Food Service: Time and Temperature Controls
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- ❒ E2106 Tape 3 – Working Safely to Prevent Injury
- ❒ E2107 Tape 4 – Sanitation
- ❒ E2110 Food Safety is No Mystery
- ❒ E2111 Controlling *Salmonella*: Strategies That Work
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- ❒ E2125 Food Safety Zone Video Series: Tape 1 – Food Safety Zone: Basic Microbiology
- ❒ E2126 Tape 2 – Food Safety Zone: Cross Contamination
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- ❒ E2131 Fruits, Vegetables, and Food Safety: Health and Hygiene on the Farm
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- ❒ E2140 GMP Basics: Employee Hygiene Practices
- ❒ E2143 GMP Basics: Guidelines for Maintenance Personnel
- ❒ E2147 GMP Basics: Process Control Practices
- ❒ E2148 GMP – GSP Employee
- ❒ E2150 GMP: Personal Hygiene and Practices in Food Manufacturing
- ❒ E2151 GMP Food Safety Video Series: Tape 1 – Definitions
- ❒ E2152 Tape 2 – Personnel and Personnel Facilities
- ❒ E2153 Tape 3 – Building and Facilities
- ❒ E2154 Tape 4 – Equipment and Utensils
- ❒ E2155 Tape 5 – Production and Process Controls
- ❒ E2160 GMP: Sources and Control of Contamination during Processing
- GMPs for Food Plant Employees: Five-Volume Video Series Based on European Standards and Regulations:
- ❒ E2161 Tape 1 – Definitions
- ❒ E2162 Tape 2 – Personnel and Personnel Practices
- ❒ E2163 Tape 3 – Building and Facilities
- ❒ E2164 Tape 4 – Equipment and Utensils
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- ❒ E2440 Cleaning and Sanitizing in Vegetable Processing Plants: Do It Well, Do It Safely!
- ❒ E2450 A Guide to Making Safe Smoked Fish
- ❒ E2451 A HACCP-based Plan Ensuring Food Safety in Retail Establishments
- ❒ E2460 Safer Processing of Sprouts
- Fast Track Restaurant Video Kit:
- ❒ E2500 Tape 1 – Food Safety Essentials
- ❒ E2501 Tape 2 – Receiving and Storage
- ❒ E2502 Tape 3 – Service
- ❒ E2503 Tape 4 – Food Production
- ❒ E2504 Tape 5 – Warewashing
- ❒ E2505 Worker Health and Hygiene Program for the Produce Industry: Manager Guide to Worker Health and Hygiene
- ❒ E2506 Your Company's Success May Depend on It!
- ❒ E2600 Worker Health and Hygiene: Your Job Depends on It!
- ❒ E2600 Food Industry Security Awareness: The first Line of Defense

FOOD

- ❒ F2005 A Lot on the Line
- ❒ F2007 The Amazing World of Microorganisms
- ❒ F2008 A Recipe for Food Safety Success
- ❒ F2009 Basic Personnel Practices
- ❒ F2010 Close Encounters of the Bird Kind
- ❒ F2011 Available Post Harvest Processing Technologies for Oysters

OTHER

- ❒ M4010 Diet, Nutrition and Cancer: Eating Defensively: Food Safety Advice for Persons with AIDS
- ❒ M4020 Ice: The Forgotten Food
- ❒ M4030 Personal Hygiene and Sanitation for Food Processing Employees
- ❒ M4060 Psychiatric Aspects of Product Tampering
- ❒ M4070 Tampering: The Issue Examined
- ❒ M4071 Understanding Nutritional Labeling

NEW MEMBERS

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Leesburg

Roxana Sanchez-Ingunza
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Springfield

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Louisville

Melissa C. Newman
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Lexington

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EMSL/ANRI/ARS/USDA
Beltsville

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Minneapolis

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Darigold, Inc.
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The University of Wisconsin-Madison
Madison

UPDATES

Dr. Michael Davidson, Food Safety Researcher to Lead Department

Dr. Michael Davidson has been appointed as head of the Department of Food Science and Technology in the UT College of Agricultural Sciences and Natural Resources at the University of Tennessee.

Dr. Davidson, a food microbiologist, specializes in food safety – specifically the study of antimicrobials to combat well-known bacterial pathogens such as *E. coli* O157:H7, *Salmonella*, and *Listeria* – will lead the department, which includes 15 permanent and adjunct faculty and a total of 95 graduate and undergraduate students.

Dr. Davidson's appointment was effective January 1, 2008; however, he has been serving as interim head of the department since Dr. Charles Goan was appointed to serve as interim dean of UT Extension in October 2005.

In announcing the appointment to faculty and staff, UT Vice President Dr. Joseph DiPietro, leader of the UT Institute of Agriculture, wrote "Dr. Davidson has done an outstanding job during his tenure as interim head, and we look forward to continuing to work with him in his permanent role."

Dr. Davidson says his goals are to continue to raise the profile of the department's research and outreach efforts while attracting talented students. "We have excellent research programs in microbiological food safety, food biopolymer chemistry and food preservation and quality. The focus is on methods to improve food product safety and quality. These programs mesh well with our outreach efforts to help ensure safe and high quality processing and food-handling practices for facilities that range from large manufacturers to small on-farm or in-home food preparation sites," he said.

Dr. Davidson holds a Ph.D. in food science and technology from Washington State University, an M.S. in food science and human nutrition from the University of Minnesota, and a B.S. in bacteriology from the University of Idaho. He is a fellow in both the American Academy of Microbiology and the Institute of Food Technologists. He has served on the editorial boards of numerous peer-reviewed scientific publications and is currently scientific co-editor of the *Journal of Food Protection*. In 2002–2003 he was a reviewer for the National Academy of Sciences, Institute of Medicine. He is also the recipient of awards for teaching and service to professional societies.

Dr. David A. Acheson Appointed Interim CFSAN Director

Commissioner of Food and Drugs Andrew C. von Eschenbach, M.D., has appointed David A. Acheson, M.D., acting director of FDA's Center for Food Safety and Applied Nutrition. Dr. Acheson currently is assistant FDA commissioner for food protection, a post he will retain when he assumes his leadership role at CFSAN.

In announcing the interim appointment to FDA employees November 19, Commissioner von Eschenbach said, "With the release of the Food Protection and Import Safety Plans, now more than ever we must continue the strong leadership at CFSAN. That's why I have asked Dr. David Acheson to serve as acting director until a permanent replacement is recruited."

The Food Protection Plan and Import Safety Plan were announced November 6. They include several substantive administrative measures and legislative proposals to further increase the safety of the US food supply.

Dr. Acheson will replace current CFSAN Director Robert Brackett, Ph.D., who left FDA for a position as senior vice president and chief science and regulatory affairs officer with the Grocery Manufacturers/Food Products Association.

Dr. Acheson will serve as CFSAN acting director until a permanent director is recruited. Commissioner von Eschenbach said he would initiate a nationwide search for a permanent CFSAN director as soon as possible.

Dr. Acheson has also served as chief medical officer and director of the Office of Food Defense, Communication and Emergency Response at CFSAN, where he played key roles in managing significant food safety issues and emergencies.

Dr. Acheson is a graduate of the University of London Medical School, with training in internal medicine and infectious diseases. He has published extensively and is internationally recognized both for his public health expertise in food safety and his research in infectious diseases. He is a fellow of both the Royal College of Physicians (London) and the Infectious Disease Society of America. He is on the editorial board of *Infection and Immunity* and is currently the special editor on food safety for *Clinical Infectious Diseases*. He has been a member of the National Advisory Committee for Microbiological Criteria for Foods since 1998 and has served on World Health Organization working groups as well as National Institutes of Health advisory committees. He has also held academic posts at the University of Maryland Medical School in Baltimore, MD, where he focused on research of foodborne

pathogens, and at Tufts University in Boston, MA, where he researched basic molecular pathogenesis of foodborne pathogens.

FDA Commissioner Names Directors to Food Safety and Veterinary Centers

Commissioner of Food and Drugs Andrew C. von Eschenbach, M.D., has announced two major changes in the agency's senior leadership team. Stephen F. Sundlof, D.V.M., Ph.D., is moving from director of FDA's Center for Veterinary Medicine (CVM) to director of FDA's Center for Food Safety and Applied Nutrition (CFSAN). Bernadette Dunham, D.V.M., Ph.D., who is deputy director of CVM, will assume directorship of CVM.

For over a decade, Dr. Sundlof has served as the director of CVM. In that capacity, with his background as a toxicologist, he has overseen the regulation of feed, including food additives, and drugs intended for animals. These include animals from which human foods are derived, as well as food and drugs for pets (or companion animals) and other non-food-producing animals such as zoo animals, parakeets, hamsters, and aquarium fish.

Dr. Sundlof has extensive experience in the food safety and protection arena, including service on numerous domestic and international committees on food safety, where he served as chairman and led the development of new international policies and safety standards. He also provided significant input into the development of the FDA's Food Protection Plan issued in November 2007, a strategic and comprehensive approach to improve food safety and defense in the United States. He was instrumental in putting in place robust animal feed programs to prevent Bovine Spongiform Encephalopathy (BSE), also called mad cow disease, from entering the US feed system. There have been no cases of mad cow disease in the United States resulting from a failure of the feed system.

Prior to joining FDA, Dr. Sundlof served on the faculty of the College of Veterinary Medicine, University of Florida, where he held the rank of professor of toxicology. He also has received many honors and awards as a leader in his field and has authored several scientific and technical papers. Since 1994 he has served as chairman of the Codex Committee on Residues of Veterinary Drugs in Foods.

While serving as CVM deputy director, Dr. Dunham also was the director for CVM's Office of Minor Use and Minor Species Animal Drug Development.

Before joining the FDA in 2002, Dr. Dunham served in several important leadership positions with the American Veterinary Medical Association and held faculty positions at several universities, including at the Department of Pharmacology at the State University of New York Health Science Center (SUNY-HSC) at Syracuse, while concurrently acting as the director of laboratory animal medicine at SUNY-HSC at Syracuse.

FKI Logistex Names Matt Wicks Vice President of Systems Engineering

FKI Logistex® announces the appointment of Matt Wicks to vice president of systems engineering for the company's Manufacturing Systems group. Mr. Wicks' promotion follows a recent consolidation of the Systems and Conveyor Engineering groups within FKI Logistex Manufacturing Systems.

Mr. Wicks began his career with FKI Logistex in 1998 as a controls engineer, steadily assuming increased management responsibility, most recently serving as director of systems engineering. As vice president, he is responsible for managing controls, electrical and mechanical engineering teams, systems sales support and estimating. "Matt has displayed excellent leadership skills throughout his career with FKI Logistex," said Ken Thouvenot, senior vice president of project management and engineering, FKI Logistex Manufacturing Systems

Mr. Wicks has a bachelor of science in electrical engineering from the University of Missouri, Rolla, and a professional engineer (PE) license from the Missouri Division of Professional Registration.

Aquionics Appoints National Industrial Sales Manager for Process Water Disinfection Applications

Aquionics has appointed Marc Scanlon as its new national industrial sales manager for the USA. He will be responsible for selling Aquionics' UV disinfection equipment for a wide range of process water applications including pharmaceutical and semiconductor manufacturing, food and beverage processing, brewing and winemaking.

Marc has over 20 years experience in water treatment, from ultrapure water to wastewater, and brings a wealth of knowledge to Aquionics. Prior to joining the company he worked for Aquafine, Novazone and BOC Gases (Ozone/UV division). He has also had numerous technical articles published in leading trade publications over the years.

NEWS

Frank Yiannas Named as FAAN's Chairman of the Board

The Food Allergy & Anaphylaxis Network (FAAN) is pleased to announce the appointment of Frank Yiannas as Chairman of the Board of Directors. A member of FAAN's Board of Directors since 2005, Frank Yiannas, MPH, is responsible for food safety at the world's largest and most recognized resort – *The Walt Disney World Resort.*®

In his role at Walt Disney World as food safety and health director, Mr. Yiannas is responsible for food safety oversight of Disney's theme parks, resorts, cruise ships, and hundreds of food locations, as well as their food suppliers. A recognized leader in the food safety industry, Frank Yiannas is also the immediate past president of the International Association for Food Protection.

Under Mr. Yiannas' leadership, Disney has instituted a strong allergy awareness program and a variety of allergy-conscious menu options at its theme parks and resorts. The company's approach has become a role model for restaurants and other food establishments nationwide to follow in providing safe-eating environments for the 1-in-25 Americans with food allergies. Frank also serves on FAAN's Food Allergy Advisory Council, where he spearheaded the development of a food allergy awareness poster for the retail, restaurant and food industry.

"With Frank's leadership, food safety background, and commitment to food allergy, FAAN will continue to heighten awareness in the restaurant and food service arena on behalf of the 12 million Americans with food allergies," said Anne Munoz-Furlong, FAAN's Founder and CEO.

2008 Crumbine Award Guidelines Released

Foodservice Packaging Institute (FPI) released the guidelines for the 2008 Samuel J. Crumbine Award for Excellence in Food Protection at the Local Level, which annually recognizes excellence in food protection services by local environmental health jurisdictions in the United States and Canada.

Named for one of America's most renowned health officers and health educators – Samuel J. Crumbine, M.D. (1862–1954) – the award has elevated the importance of food protection programs within government departments and agencies and has inspired excellence in the planning and delivery of those services.

Entries for the Crumbine Award competition are limited to US and Canadian local environmental health jurisdictions (county, district, city, town, or township) that provide food protection services to their communities under authority of a statute or ordinance. Past winners may apply five years after receiving the award.

The guidelines are to be used as the basis for all applications for the Crumbine Award and must be followed in order to be considered for the award. The basic award criteria, by which achievement is measured, are:

- Sustained improvements and excellence, as documented by specific outcomes and achievements, over the preceding four to six years, as evidenced by continual improvements in the basic components of a comprehensive program;
- Innovative and effective use of program methods and problem solving to identify and reduce risk factors that are known to cause foodborne illness;
- Demonstrated improvements in planning, managing, and evaluating a comprehensive program; and
- Providing targeted outreach; forming partnerships; and participating in forums that foster communication and information exchange among the regulators, industry and consumer representatives.

The winner of the Award is selected by an independent panel of food protection practitioners who are qualified by education and experience to discern excellence in a program of food and beverage sanitation. They represent various interests, including leading public health and environmental health associations, past Crumbine Award winners, consumer advocates and the food industry. The jury makes its award selection each spring in a judging process administered by FPI. The application deadline for the award is March 14, 2008.

The Crumbine Award is supported by the Conference for Food Protection in cooperation with the American Academy of Sanitarians, American Public Health Association, Association of Food & Drug Officials, Foodservice Packaging Institute, International Association for Food Protection, International Food Safety Council, National

Association of County and City Health Officials, National Environmental Health Association, NSF International, and Underwriters Laboratories, Inc.

Together We Stand: Bacteria Organize to Survive Hostile Zones

Using an innovative device with microscopic chambers, researchers from four institutions, including Johns Hopkins, have gleaned important new information about how bacteria survive in hostile environments by forming antibiotic-resistant communities called biofilms. These biofilms play key roles in cystic fibrosis, urinary tract infections and other illnesses, and the researchers say their findings could help in the development of new treatments and preventive measures.

"There is a perception that single-celled organisms are asocial, but that is misguided," said Andre Levchenko, assistant professor of biomedical engineering in The Johns Hopkins University's Whiting School of Engineering and an affiliate of the university's Institute for NanoBioTechnology. "When bacteria are under stress—which is the story of their lives—they team up and form this collective called a biofilm. If you look at naturally occurring biofilms, they have very complicated architecture. They are like cities with channels for nutrients to go in and waste to go out."

With a better understanding of how and why bacteria form biofilms, researchers may be able to disrupt activity in the bacterial communities and block harmful effects on their human hosts. The team's findings were detailed in an article published in the November 2007 issue of the journal *Public Library of Science Biology*.

In the article, the researchers from Johns Hopkins; Virginia Tech; the University of California, San Diego; and Lund University in Sweden reported on the observation of the bacteria *E. coli* growing in the cramped conditions of a new microfluidic device. The device, which allows scientists to use nanoscale volumes of cells in solution, contains a series of tiny chambers of various shapes and sizes that keep the bacteria uniformly suspended in a culture medium.

Mr. Levchenko and his colleagues recorded the behavior of single layers of cells using real-time microscopy. Computational models validated their experimental results and could predict the behavior of other bacterial species under similar pressures. "We were surprised to find that cells growing in chambers of all sorts of shapes gradually organized themselves into highly regular structures," Levchenko said. "The computational model helped explain why this was happening and how it might be used by the cells to increase chances of survival." The microfluidic device, which was designed and fabricated in collaboration with Alex Groisman's laboratory at UCSD, allows the cells to flow freely into and out of the chambers. Test volumes in the chambers were in the nano-liter range, allowing visualization of single *E. coli* cells. Ann Stevens' laboratory at Virginia Tech helped to generate new strains of bacteria that permitted visualization of individual cells grown in a single layer.

Hojung Cho, a Johns Hopkins biomedical engineering doctoral student from Levchenko's lab and lead author of the journal article, captured on video the gradual self-organization and eventual construction of bacterial biofilms over a 24-hour period, using real-time microscopy techniques. The experiments were matched to modeling analysis developed in collaboration with Cho's colleagues at Lund. Images were analyzed using tools developed with the participation of Bruno Jedynak of the Johns Hopkins Center for Imaging Science. Observation using microscopy revealed that the longer the packed cell population resided in the chambers, the more ordered the biofilm structure became, Mr. Levchenko said. Being highly packed in a tiny space can be very challenging for cells, so that any type of a strategy to help colony survival can be very important, he adds.

Mr. Levchenko also noted that rod-shaped *E. coli* that were too short or too long typically either did not organize well or did not avoid "stampede-like" blockages toward the exits. The shape of the confining space also strongly affected the cell organization in a colony, with highly disordered groups of cells found at sharp corners but not in the circular shaped microchambers.

Understanding how bacteria produce biofilms is important to researchers developing better ways to combat the diseases associated with them, Levchenko pointed out. For example, people who suffer from cystic fibrosis—a genetic disorder that affects the mucus lining of the lungs—are susceptible to a species of bacteria that colonizes the lungs. Patients choke on the colony's byproducts. Chronic urinary tract infections result from bacterial communities that develop inside human cells. And biofilms cause problems in tissues where catheters have been inserted or where sutures have been used.

"You can put a patient on antibiotics, and it may seem that the infection has disappeared. But in a few months, it reappears, and it is usually in an antibiotic-resistant form," Mr. Levchenko says. To

explore possible treatments, Mr. Levchenko said, the microfluidic device could be used as a tool to rapidly and simultaneously screen different types of drugs for their ability to prevent biofilms.

This research was supported by funding from the National Science Foundation, the National Institutes of Health and the Swedish Research Council.

FDA Announces the Availability of Food Defense Self Assessment Tool

In 2003 the Food and Drug Administration (FDA), Center for Food Safety and Applied Nutrition (CFSAN), issued the Food and Cosmetic Security Preventive Measures Guidances. These documents were designed to be used as aids for several components of the food and cosmetic industry. The guidance documents could be used to identify the kinds of preventive measures that industry may take to minimize the risk that food and cosmetic products under their control would be subject to tampering or other malicious, criminal or terrorist actions. These guidance documents were designed to focus food and cosmetic industry operators' attention on each segment of the food and cosmetic products delivery system that is within their control, to minimize the risk of tampering or other malicious, criminal, or terrorist action at each segment.

The Agency received comments from industry and our stakeholders stating that these guidance documents were useful but that FDA should find a way to simplify the messages. With this in mind, FDA has made an attempt to simplify these documents by repackaging the information found in each guidance document into the Food Defense Self Assessment Tool. The information in each of the Food Defense Assessment Tools is the same information that is contained in each of the guidance documents issued in 2003; just in a more user friendly format. Each tool is available online and is attached as an appendix to its corresponding guidance document. Other than the addition of the tools, there is no new information in each of the guidance documents.

NARMS Retail Meat Annual Report, 2005

The primary purpose of the NARMS retail meat surveillance program is to monitor the prevalence of antimicrobial resistance among foodborne pathogenic and commensal organisms, in particular, *Salmonella*, *Campylobacter*, *Enterococcus* and *E. coli*. The results generated by the NARMS retail meat program will establish a reference point for analyzing trends of antimicrobial resistance among these foodborne bacteria. NARMS retail meat surveillance is an ongoing collaboration between the US Food and Drug Administration (Ceter for Veterinary Medicine), the Centers for Disease Control and Prevention, and in 2005, all 10 of the current FoodNet laboratories: California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New Mexico, New York, Oregon, and Tennessee. Bacterial isolates are sent to FDA/CVM for confirmation of species, antimicrobial susceptibility testing, and genetic analysis.

For calendar year 2005, all test sites began retail meat sampling in January. A total of 40 food samples were purchased per month comprised of 10 samples each of chicken breast, ground turkey, ground beef, and pork chops. Samples were kept cold during transport from the grocery store(s) to the laboratory. All ten FoodNet sites cultured the meats and poultry rinsates for the presence of *Salmonella* and *Campylobacter*. Four of the ten FoodNet laboratories (Georgia, Maryland, Oregon, and Tennessee) also cultured meat and poultry rinsates for the presence of *E. coli* and *Enterococcus*.

INDUSTRY PRODUCTS

KD Scientific

KD Scientific New OS-250 System Protects Your Microscope from Spills!

KD Scientific has introduced the NEW OS-250, a system which detects spills and leaks before they cause a problem in an expensive microscope or other piece of equipment.

As little as 3 drops of liquid will cause the OS-250 to react. The system consists of a moisture sensing mat and control unit. The mat is made from a material specially developed for detecting liquid spills. It is connected to the control unit by a simple connection cable.

When liquid is detected on the sensing mat the OS-250 Controller will sound an audible alarm, flash an LED and will turn off the power of any device plugged into the single outlet, solid state power controller. The switched power outlet can control up to 8 amps.

The OS-250 Spill Sensor is supplied with the controller and four reusable 30 x 30 cm mats that can be cut to any size with a sharp scissors or knife. It also includes the connector cable between the mat and the controller.

Applications for the OS-250 Spill Detector exist in any areas where spills will cause problems or damage to equipment.

KD Scientific
508.429.6809
Holliston, MA
www.kdscientific.com

New In-motion Check-weigher Systems for Red Meat Introduced by Gainco

New In-motion check weighing systems from Gainco, Inc. provide accurate high-speed, in-motion weighing of raw, bagged, boxed or other packaged red meat products to ensure conformance to pre-set weight ranges. Not only are they designed for operating efficiency and labor savings, they also deliver precision weighing accuracy.

With a box unit capacity up to 100 lbs, the weighing capabilities of Gainco In-motion Check Weighers are accurate to +/- 0.04 lbs, 95% of the time, with "gap error" warnings embedded in the software. Accurate downstream distribution of the product is maintained by means of advanced communications from the Check Weigher to various automated or manual functions downstream, including the boxing of multiple finished products, vertical bagging systems or sorting tables.

The rugged construction of Gainco's In-motion Check Weighers is specially designed to withstand the rigors of heavy use in harsh processing environments, and the system can process 50+ pieces (boxes and bags) per minute up to 30" in length.

Gainco's In-motion Check Weighers also feature an optional reject arm that diverts products quickly yet carefully, thereby optimizing quality and appearance of the product prior to re-work. Highly durable plastic belting is employed for reliability and enhanced sanitation. The three-frame design isolates the weigh unit from the heavy-duty infeed and outfeed frames, and an optional reject chute is also available.

An important feature of the In-motion CheckWeigher is the proprietary Gainco Infiniti™ Plus programmable controller, providing protection against washdown water and condensation thanks to a highly durable polymeric housing that protects the weighing apparatus equally well in cold work environments and during hot washdowns and high-pressure washing. Likewise, the housing is impervious to the harsh chemicals typically used in washdown procedures in meat, poultry and seafood processing environments. The unit is NTEP-certified, and third-party tests show that the controller's performance meets the stringent IP69K washdown standard.

Gainco's Dataman® Data Collection System, available for use with In-motion Check Weighers, is a software/hardware combination allowing for the integration of all remote units on the production floor. Operators can set parameters for individual pieces of equipment, monitor yield and throughput, and create customized reports – all from a single location. The data is provid-

ed to plant managers and corporate executives via a network interface. The raw data can then be moved to popular databases such as Oracle, SQL Server and DB2.

Gainco, Inc.
770.534.0703
Gainesville, GA
www.gainco.com

Biolog Initiates Launch of Its Revolutionary GEN III Microbial Identification System

Biolog, Inc. began the launch of its 3rd generation microbial ID system at the Analytical Environmental Microbiology Applications Conference held at the Danforth Plant Science Center in St. Louis.

The new GEN III System is built around a single test panel that can be used to identify more than 1,000 species of gram negative and gram positive bacteria. Set-up consists of a simple one minute protocol and no Gram-stain, pre-tests or follow-on tests are required.

Previous Biolog ID systems identified 800 species and used two panels, one for gram negative bacteria and a different panel for gram positive bacteria. Bacterial ID systems from other companies utilize 2 or more panels and identify only about 300 species. The GEN III system is revolutionary in its speed and simplicity of testing as well as in its broad and comprehensive species coverage.

The 96-well GEN III MicroPlate™ panel incorporates 71 carbon source and 23 chemical sensitivity assays in a pre-coated dry chemistry format. With these 94 tests, the system analyzes a bacterial cell's properties including its ability to metabolize all major classes of biochemicals and its sensitivity to chemicals that may inhibit growth. The colorimetric pattern or "fingerprint" generated by the bacterium is automatically interpreted against GEN III's extensive species library.

Biolog's customers work in diverse disciplines of microbiology. The new system is fully compatible with previous Biolog systems, allowing the customer base to quickly and easily upgrade. Using GEN III in conjunction with Biolog's other microbial identification databases, over 2,200 species of bacteria, yeast and filamentous fungi can be identified quickly and easily.

Biolog, Inc.
800.284.4949
Hayward, CA
www.biolog.com

Eriez® *ProGrade*™ Grate Magnets Available at Different Strength Levels to Fit All Needs

Eriez® ProGrade series grate magnets, available in three different magnetic strengths to meet every need, are economical, powerful and now available for online purchase.

ProGrade series grate magnets are designed to remove ferrous contamination from dry, free-flowing granular or powdery products such as sugar, feeds and grains.

The product is required to flow between the 1-inch diameter tube magnets spaced on 2-inch tube centers and held rigidly in place.

Magnet options include single-row square, rectangular and round grates in addition to grate in housing designs.

Eriez complete Pro-Grade line includes magnetic tubes, plates, grates and traps. ProGrade *Series products are* offered at three levels of magnetic strength:

ProGrade Ceramic Series, designed for general industry assemblies, targets the removal of medium to large ferrous contamination. These products offer basic protection from tramp metals damaging downstream equipment.

ProGrade Rare Earth Series, ideal for improving purity in general industry and some food and chemical applications, targets small, fine, weakly magnetic ferrous contamination. Assemblies are designed with precise attention to welds and finish and feature stainless steel construction and high power magnets.

ProGrade Xtreme™ Rare Earth Series, designed for food and pharmaceutical-grade assemblies, offers the ultimate in process purity, the finest materials and construction techniques and the industry's most powerful magnetic circuits.

Eriez
800.300.3743
Erie, PA
www.eriez.com

Wide Temperature Range Wireless Data Logger from TandD Corporation

TandD Corporation has introduced the NEW RTR-52Pt Wireless Data Logger. This new unit uses industry standard three wire Pt-100 RTD sensors available from many sources.

With a temperature measurement range from -200°C to +600°C the RTR-52Pt is ideal for cryogenic applications including liquid NO2. In addition, it has an IP-64 water resistance rating.

The RTR-52Pt is compact, portable and battery operated. Sensors are attached using a standard three wire screw terminal block.

The unit features a large LCD display for reading current values and the device status. The RTR-52Pt can store 8000 readings in either one-time or endless recording mode.

This new model is compatible with any TandD RTR-5x Series of wireless data collectors.

TandD Corporation
518.669.9227
Saratoga Springs, NY
www.tandd.com

High Torque, Variable Speed Metering Pump from Fluid Metering, Inc.

Fluid Metering, Inc. has introduced the new industrial variable speed pump (IVSP) for industrial and process applications.

Featuring a high torque 3 phase drive and a 3-digit LED display control module, the IVSP is ideal for handling a broad range of fluid viscosities.

The complete system consists of a high torque variable speed drive, integrally mounted FMI valveless pump head, and controller. The controller is a space-saving, DIN design, ideal for process control panels and control rooms.

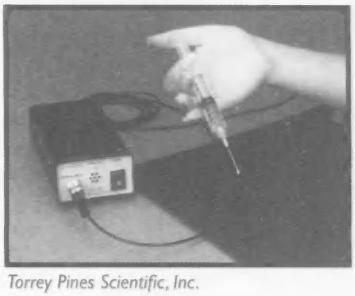
Motor speed can be adjusted either manually with the front panel membrane switches or electronically using a 0-20 mA, 4-20 mA or 0-10 VDC input signals.

Additional control functions include start, stop, acceleration, forward and reverse.

Flow rate is determined by the combination of drive speed, piston size and pump head stroke length. Flow rates cover a range from 0.45 ml/min up to 2300 ml/min.

The controller operates on 115 VAC, 1Φ 50/60 Hz with an output to the motor of 230 VAC, 3Φ 50/60 Hz. All electronic components are UL and CE compliant.

Fluid Metering, Inc.
800.223.3388
Syosset, NY
www.fmipump.com



Torrey Pines Scientific, Inc.

Torrey Pines Scientific Has Announced the New EchoTherm™ SC20XT and SC25XT Models

The SC20XT is a simple digital unit while the SC25XT is fully programmable having a 5-program memory making both ideal for use with biological and other samples.

Both have a temperature range from -20°C to 100°C and incorporate a variable speed orbital shaker for mixing and controlling the temperature of samples simultaneously.

Both units have a 30-day count down timer with alarm and auto-off, data logger, and RS232 I/O port for data logging or controlling the units from a computer.

The SC20XT and SC25XT accommodate accessory sample blocks available for 0.2, 0.5, 1.5, 15 and 50 ml centrifuge tubes. Also available are blocks for 2 ml vials, 20 ml scintillation vials, PCR tubes and plates, 96-well and 384-well assay plates of all shapes, deep-well assay plates, and other blocks for various sizes of test tubes.

The units are Peltier driven, with control to 1°C, shaking range from 200 to 1000 rpm and have a backlit two-line alphanumeric display.

These instruments are excellent molecular biology tools and can be used to run temperature/time profiles, unattended restriction digestions or ligations, automatic enzyme reactions and deactivations, storing oocytes at 17°C, storing DNA libraries at the workstation, and more.

Both units come complete with instructions and universal bench top power supply for use anywhere in the world. They are UL, CSA and CE compliant.

Torrey Pines Scientific, Inc.
866.573.9104
San Marcos, CA
www.torreypinesscientific.com

Sloan Valve Co. Signs on for the Saniguard® Treatment

Component Hardware Group (CHG), a manufacturer and distributor of plumbing and specialty hardware components to healthcare, foodservice, institutional and commercial markets, has announced that Sloan Valve Company will use CHG's proprietary SANIGUARD® antimicrobial treatment on several of its plumbing products.

Sloan Valve, the world's leading manufacturer of plumbing products and accessories for commercial, industrial, and institutional markets worldwide, will use SANIGUARD antimicrobial protection on key touch points for products commonly used in public restrooms, hospitals and other applications.

SANIGUARD is a proven, cost-effective, inorganic antimicrobial treatment that utilizes a silver ion-based technology to retard the growth of bacteria, molds and some viruses on treated surfaces such as faucet handles, door knobs, flush handles and other touch points for the life of the product. The proprietary coating is currently the only antimicrobial treatment to meet National Sanitation Foundation (NSF) protocol standard.

For example, SANIGUARD will be applied to the public toilet flush valve handles on Sloan's signature invention, the Flushometer. SANIGUARD coated flush valves will feature a blue collar to identify those treated with the antimicrobial. The treatment will also be applied to bed pan flushing arms for use in hospitals – a key area of concern due to the high incidences of hospital-acquired infections (HAIs) and new mandatory HAI reporting laws currently taking effect throughout the country.

"SANIGUARD is rapidly becoming a must-have in places where infection control is absolutely necessary," said Tom Carr, president of CHG. "CHG is honored to work with Sloan to bring safer, protected plumbing components to more public spaces."

CHG continually conducts extensive third-party research and evidence-based testing of its SANIGUARD antimicrobial treatment against various microorganisms including Norovirus, *Legionella*, *Staphylococcus*, *Salmonella*, *Listeria*, *E. coli* and others. SANIGUARD is widely accepted by healthcare infection control professionals in the USA and Canada. Restaurants, cruise ships, schools, labs, prisons, extended care facilities and other places where Norovirus and other microorganisms can lead to costly outbreaks of food poisoning have also integrated SANIGUARD products into their infection control strategies.

SANIGUARD antimicrobial protected plumbing and hardware products inhibit the growth of bacteria, mold and fungus on surfaces and help prevent the spread of infection – nonstop and for the life of the product. Unique among plumbing and hardware components, the SANIGUARD line utilizes a patented, proven inorganic silver ion technology, combined with a proprietary powder coating material, to inhibit the growth of microorganisms and prevent their survival on the product's surfaces, offering a benefit with a broad range of applications.

Sloan Valve Company
800.982.5839
Lakewood, NJ
www.sloanvalve.com

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

COMING EVENTS

FEBRUARY

- **28–1, Training for a Recall, Communicating Under Fire,** San Francisco, CA. For more information, go to www.unitedfresh.org.

MARCH

- **2–5, ASM Conference on Manipulation of Nuclear Processes by DNA Viruses,** Charleston, SC. For more information, call 202.737.3600 or go to www.asm.org/Meetings/index.asp.
- **4–7, Food Plant GMP/Sanitation and HACCP Workshops,** St. Louis, MO. For more information, contact AIB at 785.537.4750 or go to www.aibonline.org.
- **12–15, FPSA 2008 Conference,** Hyatt Regency Coconut Point, Bonita Springs, FL. For more information, call 703.761.2600 or go to www.fpsa.org.
- **17, Ohio Association of Food and Environmental Sanitarians Spring Meeting,** Ohio State University, Columbus, OH. For more information, contact Don Barrett at 614.645.6195; E-mail: donb@columbus.gov.
- **17–19, 10th Annual Food Safety and Security Summit,** Convention Center, Washington, D.C. For more information, contact BNP Media at 847.405.4000 or go to www.foodsafetysummit.com.
- **19–21, Certification Training Food Defense Coordinator,** Embassy Suites Hotel, Atlanta Hotel, Atlanta, GA. For more information, contact AIB at 785.537.4750 or go to www.aibonline.org.

APRIL

- **2, Information Systems & Logistics Distribution (IS/LD),** Westin Mission Hills Resort and Spa, Rancho Mirage, CA. For more information, call 202.639.5900 or go to www.gmabrands.com.
- **2–4, Missouri Milk, Food and Environmental Health Association Annual Educational Conference,** Stoney Creek Inn, Columbia, MO. For more information, contact Gala Miller at 573.659.0706; E-mail: galaj@socket.net.
- **8–9, ISO 22000 Food Safety Essentials,** Calgary, Ontario, Canada. For more information, contact QMI at 800.463.6727 or go to www.training@qmi.com.
- **9, Metropolitan Assocation for Food Protection Spring Seminar,** Rutgers University, Cook College Campus Center, New Brunswick, NJ. For more information, contact Carol Schwar at 908.475.7960 E-mail: cschwar@co.warren.nj.us.
- **9, SfAM 2008 Spring Meeting – Broadening Microbiology Horizons,** Aston University, Birmingham, UK. For more information, call 44.0.1234.328330 or go to www.sfam.org.uk.
- **10, Indiana Environmental Health Association Spring Educational Conference,** Emergency Services Education Center, Wayne Township, Indianapolis, IN. For more information, contact Kelli Whiting at 317.221.2256; E-mail: kwhiting@hhcorp.org.
- **11–16, The Conference for Food Protection Biennial Meeting,** The Omni San Antonio Hotel at the Colonnade, San Antonio, TX. For more information, contact Jeff Lineberry at executivedirector@foodprotect.org.
- **17, Ontario Food Protection Association Spring Technical Session, Mississauga Convention Centre,** Mississauga, Ontario, Canada. For more information, contact Gail Seed at 519.463.5674; E-mail: seed@golden.net.
- **17–18, Principles of HACCP Training,** Sheraton Gateway Suites, Rosemont, IL. For more information, contact ASI at 800.477.0778 or go to www.asifood.com.
- **27–29, 2008 ADPI/ABI Annual Conference,** Marriott Downtown, Chicago, IL. For more information, call 630.530.8700 or go to www.adpi.org.
- **28–30, Management Skills for Emerging Leaders in Environmental Health and Safety,** Boston, MA. For more information, contact Harvard School of Public Health at 617.384.8692 or go to www.hsph.harvard.edu/ccpe.

MAY

- **2, Carolinas Association for Food Protection Spring Meeting,** Madren Conference Center, Clemson University, Clemson, SC. For more information, contact Steve Tracey at 704.633.8250; E-mail: smtracey@foodlion.com.
- **4–7, The FMI Show Plus MARKETECHNICS®,** Mandalay Bay Convention Center, Las Vegas, NV. For more information, call FMI at 202.452.8444 or go to www.fmi.org.
- **13–15, Florida Association for Food Protection Annual Education Conference,** St. Petersburg Hilton-Bayfront, St. Petersburg, FL. For more information, contact Zeb Blanton at 407.618.4893 or go to www.fafp.net.
- **14–15, Pennsylvania Association of Milk, Food and Environmental Sanitarians Annual Meeting,** Nittany Lion Inn, Penn State University, State College, PA. For more information, contact Gene Frey at 717.397.0719; E-mail: erfrey@landolakes.com.
- **18–20, 2008 APHL Annual Meeting,** St. Louis, MO. For more information, call APHL at 240.485.2745 or go to www.aphl.org.
- **19–22, 3-A SSI 2008 Annual Meeting,** Four Points Sheraton, Milwaukee Airport, Milwaukee, WI. For more information, call 703.790.0295 or go to www.3-a.org.

IAFP UPCOMING MEETINGS

AUGUST 3-6, 2008
Columbus, Ohio

JULY 12-15, 2009
Grapevine, Texas

AUGUST 1-4, 2010
Anaheim, California

COMING EVENTS

- **26–28, IAFP Latin America Symposium on Food Safety,** Campinas, São Paulo, Brazil. For more information, go to our Web site at www.foodprotection.org.

JUNE

- **9–11, 2008 Midwest Section of AOAC International Annual Meeting and Exposition,** Bozeman Best Western – GranTree Inn, Bozeman, MT. For more information, contact Heidi Hickes at 406.994.3383 or go to www.midwestaoac.org/2008meeting.html.
- **10, Ontario Food Protection Association Professional Development Day and Golf Tournament,** Springfield Golf Course, Guelph, Ontario, Canada. For more information, contact Gail Seed at 519.463.5674; E-mail: seed@golden.net.
- **10–11, Principles of Inspecting and Auditing Food Plants,** Chicago, IL. For more information, contact AIB at 785.537.4750 or go to www.aibonline.org.
- **13–20, Twenty-Eighth International Workshop/Symposium–Rapid Methods and Automation in Microbiology,** Kansas State University, Manhattan, KS. For more information, contact Dr. Daniel Y.C. Fung at 785.532.1208; E-mail: dfung@ksu.edu.
- **24–26, New Zealand for Food Protection *Listeria* Workshop in Association with New Zealand Institute of Food Science and Technology (NZIFST) Annual Meeting,** Rotorua, New Zealand. For more information, contact Lynn McIntyre at 64.3.351.0015; E-mail: lynn.mcintyre@esr.cr.nz.

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