October 2008

Vol. 28, No. 10
ISSN:1541-9576
Periodicals
6200 Aurora Avenue • Suite 200W
Des Moines, Iowa 50322-2864, USA

Food Protection Trends

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FOOD PROTECTION TRENDS

SCIENCE AND NEWS
FROM THE INTERNATIONAL ASSOCIATION FOR FOOD PROTECTION

Food Protection Trends (ISSN-1541-9576) is published monthly beginning with the January number by the International Association for Food Protection, 6200 Aurora Avenue, Suite 200W, Des Moines, Iowa 50322-2864, USA. Each volume comprises 12 numbers. Printed by Heuss Printing, Inc., 911 N. Second Street, Ames, Iowa 50010, USA. Periodical Postage paid at Des Moines, Iowa 50318 and additional entry offices.

Manuscripts: Correspondence regarding manuscripts should be addressed to Donna A. Bahun, Production Editor, International Association for Food Protection.

News Releases, Updates, Coming Events and Cover Photos: Correspondence for these materials should be sent to Donna A. Bahun, Production Editor, International Association for Food Protection.

"Instructions for Authors" may be obtained from our Web site at www.foodprotection.org or from Donna A. Bahun, Production Editor, International Association for Food Protection.

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Subscription Rates: ***Food Protection Trends*** is available by subscription for $248.00 US, $263.00 Canada/Mexico, and $278.00 International. Single issues are available for $26.00 US and $35.00 all other countries. All rates include shipping and handling. No cancellations accepted. For more information contact Julie A. Cattanach, Membership Services, International Association for Food Protection.

Claims: Notice of failure to receive copies must be reported within 30 days domestic, 90 days outside US.

Postmaster: Send address changes to ***Food Protection Trends,*** 6200 Aurora Avenue, Suite 200W, Des Moines, Iowa 50322-2864, USA.

Food Protection Trends is printed on paper that meets the requirements of ANSI/NISO 239.48-1992.

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"PERSPECTIVES" FROM YOUR PRESIDENT

By **STAN BAILEY**
PRESIDENT

"I have never known a more dedicated and dynamic group of individuals than the members of IAFP"

Wow! What a great Annual Meeting we had in Columbus. Over 1,850 people from 38 countries experienced an outstanding program. Many thanks go to the Program Committee, chaired by Emilio Esteban, for once again organizing a diverse and cutting-edge program consisting of 27 symposia and roundtables with about 160 speakers, 80 technical talks and 365 posters.

There were too many excellent symposia and presentations to mention them all, but I would like to highlight the late breaker symposium "Tomatoes, Peppers, Cilantro? Consequences of the *Salmonella* Saintpaul Produce-Related Outbreak." Every year we save a spot in the program for topical situations or issues that arise after the program has been organized in February. After the *Salmonella* Saintpaul outbreak was first reported in June and grew in scope in July, Gary Acuff and Alejandro Castillo organized this year's late breaker symposium. Fortunately we were able to get the scientists from government, industry, and academia most involved in trying to solve the outbreak to participate. The understanding of the outbreak was evolving so rapidly that in the month before the meeting the title of the symposium and the scope of the outbreak findings had to be changed three times. The interest in the topic was great and over 450 people attended the session. Special thanks go to the organizers and speakers for being flexible and willing to share data, almost as soon as it was received. Hopefully, next spring and summer there will be less new and urgent food safety issues to deal with, but if the past is any indicator, there will be something happening which will require special attention, and the IAFP program will have it covered.

Special thanks goes to the Local Arrangements Committee chaired by Gloria Swick-Brown. The hospitality and facilities in Columbus were outstanding. I also want to thank all of our sponsors and vendors for their financial assistance with the receptions, breaks and lunches that make the IAFP meeting special. Please make sure that you thank and support the sponsors throughout the year.

Another highlight of this year's meeting was the addition of three new international affiliates: Spain, Turkey and the United Arab Emirates. The growth in international affiliates is another indication of the recognition the significant role that IAFP is playing in the promotion of global food protection.

Thanks to the IAFP Foundation for their generous support of the Student Travel Scholarship Award. In 2007 we awarded five scholarships. This year six extremely bright and motivated students from South Korea, Australia, Nigeria, Sweden, Delaware and New York received travel support scholarships. With the help of the IAFP Foundation, we plan to increase the number of student travel scholarships to eight next year. It is always dangerous when you start thanking people for helping organize something as large as the IAFP Annual Meeting. Invariably you will forget someone. For those of you who contributed to this year's meeting that I did not mention, I apologize and thank you.

I would like to share with you one of my thoughts that I shared with those in attendance at the Awards Banquet in Columbus when I became President of IAFP. Among the many reasons that I was willing and look forward to serving on the IAFP Executive Board is the membership of IAFP. Most of my professional and many of my personal friends are members of IAFP. In my adult and professional life, I have had the honor and pleasure of working with several professional and non-profit organizations. I have never known a more dedicated and dynamic group of individuals than the members of IAFP. Our membership is always willing to step up and do whatever they can to help the organization. One of the most difficult jobs the President-Elect has is making appointments to committees balanced between industry, academia and government. This is hard because so many people volunteer for these positions that someone will always be disappointed when they are not appointed.

The IAFP Executive Board understands that the members are the lifeblood of any organization. After two years of surveys and discussions and responding to the requests of the membership, the Executive Board made the decision in January of 2007 to change membership from an all inclusive membership to a menu driven membership whereby each member can choose what membership options fit them best.

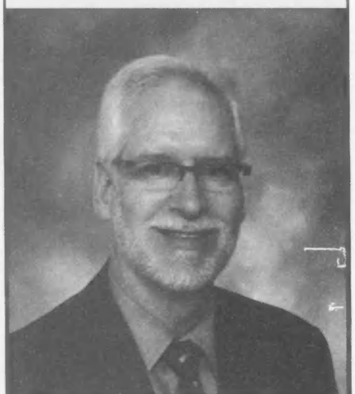
The full array of available types of membership can be seen at www.foodprotection.org/membership/types.asp. A basic membership with access to a monthly electronic newsletter is available for only $50 per year. Membership with access to all journals range from $200 for US members to $280 for members from outside of North America. You can pick and choose the plan that best fits your needs and interest.

In addition to basic individual memberships, I wanted to highlight our sustaining membership options. Sustaining membership provides organizations, corporations and individuals the opportunity to ally themselves with IAFP in support of Advancing Food Safety Worldwide. It is through this partnership that the IAFP Foundation is able to support various educational efforts including student travel scholarships. There are three levels of sustaining membership: Gold – $5,000, Silver – $2,500 and Sustaining – $750. IAFP currently has 15 Gold, 9 Silver and 73 sustaining members. I would encourage you or your company to become a sustaining member or if you are already a member to increase your level of membership. Benefits of each membership level can be seen at the food protection Web site.

IAFP began a membership drive in July of this year and on August 1, 2008 there were a little over 3,200 members of IAFP, about 8% higher than the same time last year. This is good but not as good as we can do. At the Awards Banquet, I challenged each of the 600 or so people in the room to reach out to their food safety friends and find at least one new member to join IAFP before the end of the year. I now extend this challenge to the full membership. If each of you accept this challenge, we could double our membership.

Why would we work so hard to increase the number of members of IAFP? First, we do not want any food safety professionals to miss out on the fun we are having. Most important of all, we want to share the opportunities to network and learn from each other as we strive to promote food safety worldwide.

"COMMENTARY"
FROM THE EXECUTIVE DIRECTOR



By DAVID W. THARP, CAE
EXECUTIVE DIRECTOR

"This year, so far, and as we look to the end of 2008, has been nothing but incredible when we consider the international activities of IAFP"

Today, I am writing this column as I'm passing over the Atlantic Ocean travelling to the Food Micro 2008 meeting in Aberdeen, Scotland. This year, so far, and as we look to the end of 2008, has been nothing but incredible when we consider the international activities of IAFP. We have reviewed this in previous columns, but I think it is worth another look to emphasize what YOUR Association is doing not only in North America, but around the globe.

Since the first of the year, we participated in the Dubai International Food Safety Conference (DIFSC) held last February in Dubai. Then at the end of May, in conjunction with the Brazil Association for Food Protection and the Latin America Subcommittee of ICMSF, we held the first ever, IAFP International Symposium on Food Safety in Campinas, Sao Paulo, Brazil. Now, we are participating in the Food Micro 2008 conference as an exhibitor to promote IAFP to the European contingent of food microbiologists (and others since professionals attend this meeting from all continents!). In addition, we are looking to gather potential attendees for our European Food Safety Symposium this coming November.

Soon, your President, Stan Bailey and I will travel to Beijing, China for the Second China International Food Safety and Quality (CIFSQ) conference which will be held at the end of September (realizing that you are reading this in October, but I am writing at the beginning of September). On our way to Beijing, we will stop in Korea to meet with the Korean Affiliate leadership to continue and firm up plans for the Second IAFP International Symposium on Food Safety (similar to the May 2008 meeting in Brazil). This symposium in Korea will be held in the fourth quarter of 2009.

Then, toward the end of November, IAFP will hold its Fourth European Symposium on Food Safety in Lisbon, Portugal. This meeting promises to be a premier event for IAFP and for Europe. There will be more than 25 leading food safety experts presenting over the 3-day conference. In addition, many social functions are built into the program and during the evenings to allow for the very important interaction between professionals.

So, if you happened to be counting, that makes five (five!) international events that IAFP has been or will be associated with during 2008! If you take a moment to look back, it was just four years ago that IAFP held its First European Symposium on Food Safety in Prague, Czech Republic. That is some really fast growth on an international scale for any association!

We are proud of the partnerships we have built with World Services and other organizations in China for the CIFSQ Conference and with the Dubai Municipality for the DIFSC. In addition, we have had some avid supporters for the series in Europe. ILSI Europe helped us to get off the ground with our first conference in 2005 and the World Health Organization along with the United Nations–Food and Agricultural Organization has supported us each year. We are happy to include the Society for Applied Microbiology also as our partner in Europe.

These partnerships are in addition to the many companies and organizations that have financially supported each of these important conferences. Without their support, it would not be possible to even consider holding events such as these outside of North America. The valued financial contributions from our supporters allow IAFP to keep with an economical registration rate for our Members.

Speaking of Members, I have mentioned it prior in this column, but you can trace our international involvement directly back to our Membership growth. As we build up to each event, you can see evidence of new Members joining from the specific region where our next meeting will be held. As we move towards our next scheduled event in Lisbon, keep an eye on our new Member list that runs each month in *Food Protection Trends*. I believe you will notice a number of new Members from Europe.

As Stan pointed out in his President's Column, now is a great time for you (each current IAFP Member) to reach out to a colleague and invite them to join IAFP. Help us to promote IAFP's very reasonable $50 Membership fee and ask a colleague to join today! This rate is good all around the world!!! It just cannot be more economical for someone to join IAFP than our $50 fee.

Before I end for this month, there are two points I need to touch on. First is to recognize the Dubai Municipality for sending three people to attend IAFP 2008 in Columbus. We took the opportunity to meet with the DIFSC leadership and firmed up our commitment to be involved with the 2009 DIFSC in Dubai.

The second point is that I want to recognize that we gained three new international Affiliates this past year. The first Affiliate to be Chartered was the Turkey Food Safety Association; then at Annual Meeting we announced the Chartering of the Spain Association for Food Protection and the United Arab Emirates Association for Food Protection. Each of these groups saw the value in becoming associated and affiliated with IAFP. There are many Affiliate organizations both internationally and within North America where you can become active (or just attend educational sessions). They all serve a great purpose in promoting safe food practices in their more localized region, whether a state in the USA, a province in Canada or a country around the world. We encourage your involvement in an Affiliate organization close to your home. Let us know if you need help finding a group in your area.

ARTICLES

Food Protection Trends, Vol. 28, No. 10, Pages 704–711

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

International Association for Food Protection.

Employee Motivators for Following Food Safety Practices: Pivotal Role of Supervision

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SUMMARY

Many college-age students work in the foodservice industry; thus, it is important to understand what motivates them to follow safe food handling practices. The purpose of this research was to develop a model to explain employee motivators for following safe food handling practices. Components of the expectancy theory were integrated into the study to explore retail foodservice employees' motivators related to handwashing, wearing clean uniforms, cleaning and sanitizing, and measuring food temperatures. Questionnaires that included both open-ended and close-ended questions were distributed to 169 hospitality management students at one university. Analysis of open-ended questions through qualitative methods showed the pivotal role of supervisors through common themes: establishing policies and standards, expecting accountability, serving as role models, providing training, controlling rewards and punishment, and providing resources. A model focused on the pivotal role of the supervisor in motivating foodservice employees to follow good food safety practices was developed.

A peer-reviewed article

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INTRODUCTION

Food safety is a global concern, with over two billion people each year affected by foodborne illnesses *(40)*. Known foodborne disease outbreaks have been caused by foods served in retail foodservice operations, including restaurants, hospitals, schools, and nursing homes *(4)*. The US Food and Drug Administration *(12)* reported the three major areas for non-compliance in food handling as poor personal hygiene, incorrect time and temperature control, and contaminated equipment resulting in inadequate prevention of contamination. Although training appears to be an important component of food safety, training alone does not ensure implementation of safe food handling practices that result in safe food. A gap exists between food handling practices and knowledge *(17)*. Understanding employees' motivators for following food safety behaviors, especially those related to the key areas of noncompliance, is important. Therefore, the purpose of this study was to: (1) identify factors that would motivate foodservice employees to follow safe food handling practices, (2) examine college-age students' perceptions of foodservice employees' motivation for following food safety practices, and (3) develop a preliminary model to explain motivators for following food safety practices, using expectancy model as a theoretical underpinning.

REVIEW OF LITERATURE

Food safety

Research related to food safety examines all aspects from the farm to table. At the farm end of the continuum, research has focused on methods producers can use to improve safety practices to minimize the risk of foodborne illnesses, while research at the table end of the continuum has focused on what retail foodservice employees can do to provide safe food.

Well publicized foodborne illness outbreaks all over the world, including the outbreak caused by bagged spinach contaminated with *E. coli* O157:H7 in the United States and the 1988 Hepatitis A outbreak in China affecting 300,000 people, have heightened consumers' food safety awareness. Between 1998 and 2001, the number of foodborne disease outbreaks caused by microorganisms was greater for foods prepared in commercial and non-commercial foodservice operations than for those prepared at home or linked to food manufacturers for countries including the United States, the United Kingdom and Japan *(1)*. Some researchers have approached food safety through cost-benefit analysis, attempting to quantify various expenses incurred when an outbreak occurs *(42)*. Others have emphasized the legal aspect, noting that between the years 1988 and 1997, one-third of liability lawsuits targeted restaurants *(3)*.

Food safety practices

Adequate handwashing practices, proper sanitizing, and proper measuring and recording of food temperatures have been identified as food safety practices that often are not followed in schools *(17)*. Giampaoli, Cluskey, and Sneed *(13)* developed an audit tool to assess school foodservice employees' food handling practices and tested the tool in 15 schools. School foodservice employees were not following all recommended food safety practices, and these shortcomings included not refrigerating potentially hazardous foods between preparation steps, not minimizing bare hand contact with food, and not keeping food temperature logs. Handwashing, temperature monitoring, and sanitizing effectiveness were areas in need of improvement in assisted-living facilities *(31)*. Interviews and site visits at 153 restaurants in seven states revealed unsafe handling practices with eggs *(22)*.

In focus groups with foodservice workers, internal and external barriers to following proper handwashing procedures were identified, including time pressure, inadequate facilities/supplies, lack of accountability, lack of involvement of managers/coworkers, and lack of support from organization *(26)*. Barriers to following various safe food handling practices have been identified as: time constraints, lack of resources, inadequate knowledge, and lack of understanding the consequences *(25)*; inadequate resource management, employee motivation, and employee confidence *(14)*; and problems related to employees and resources *(41)*.

Food safety education

Guion, Simonne, and Easton *(16)* surveyed 248 Florida 4-H youth ranging in age from 13 to 19 years. Youth surveyed indicated that they received their food safety information from parents and friends. Ellis, Sebranek, and Sneed's *(11)* survey of Iowa high school students found that 62% had some food safety education in school and 32% worked in jobs where they prepared or handled food.

Researchers have assessed college students' attitudes, practices, and knowledge about food safety and noted improvement after the students took a food safety course *(36, 39)*. Strohbehn *(33)* tracked training of college students working in various foodservice operations. She found that corporate-owned quick service operations were more likely to train employees than other types of foodservice operations. In contrast, Johnson, Shin, Feinstein, and Mayer *(19)* found that employees in fine dining restaurants had higher scores on a food safety knowledge test than employees in quick service restaurants.

Researchers have studied multiple food safety education methods and settings for effectiveness *(2, 5, 20, 29)*. Some researchers report that the majority of managers studied indicted willingness to pay for food safety training and/or pay trained workers a premium wage *(18)*. Lynch, Elledge, Griffith, and Boatright *(23)* found that more experienced managers (more than 4 years in management) had higher mean scores on a food safety knowledge questionnaire than those with shorter tenure (1–4 years in management).

It is well documented that knowledge, education, and training alone do not ensure safe food handling practices. In a study of school foodservice employees, Henroid and Sneed *(17)* found that food safety knowledge was high, but safe food handling practices were not consistently followed. Green and Selman *(15)* conducted focus groups with food workers and managers and found that food safety education and training were just one component of preparing safe food; other factors included restaurant procedures, time pressure, equipment and resources, management and coworker emphasis on food safety, and worker characteristics. Mentoring, with extensive education, has been shown to improve food safety knowledge and food handling practices *(30, 32)*.

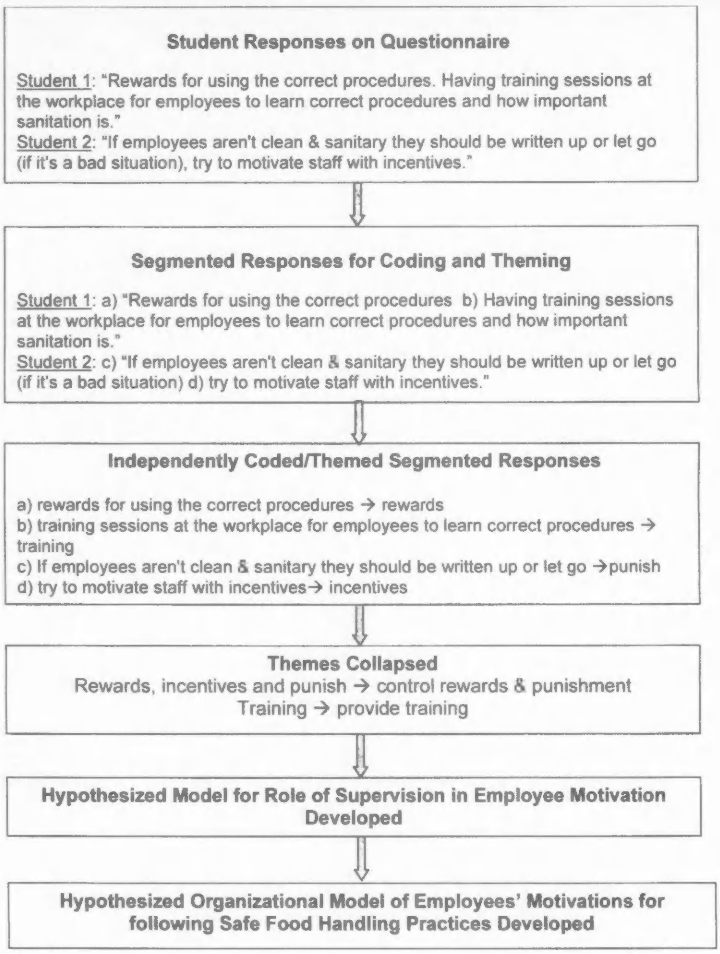
Motivation theory and research

Expectancy theory of motivation was first proposed by Vroom *(43)* to explain employees' motivation to perform as they do. Central to the theory and subsequent model are three variables: valence, expectancy, and instrumentality. Valance is the value an employee places on the expected outcome of an action. Expectancy refers to a relationship between an employee's effort and the success of the action. Instrumentality refers to the relationship between the success of the action and the expected outcome of the action. The theory supports the concept that employees behave in a way that brings them pleasure and allows them to avoid pain.

Putting this into a food safety context utilizing a foodservice employee's perspective:

Valance: "I value praise from my supervisor"
Expectancy: "If I work hard to follow safe food handling practices, then food will be safer"
Instrumentality: "If I serve safe food, I will be praised."

FIGURE 1. Qualitative data analysis process and research examples



Vroom *(43)* recognized that skills, knowledge, and abilities were factors influencing employees' job performance. Later, the expectancy model was expanded by Lawler and Porter *(21)* and antecedents to job behavior (performance) were added, including employee ability to do the job and role perception.

Researchers have incorporated into their work theories and models of motivation related to food safety, but only to a limited extent. Early work by Schafer, Schafer, Bultena, and Hoiberg *(28)* applied the Health Belief Model to food safety behaviors of individuals. The Health Belief Model is a framework used by researchers to help predict individuals' health behaviors based on their perceptions of health jeopardy, seriousness, and benefits. Edwards, Edlefsen, Hillers, and McCurdy *(9)* utilized the transtheoretical model of change to examine high school students' use of food thermometers. They found a positive relationship between motivation and confidence in their ability to use thermometers. In other work *(10)*, they applied behavior change theory, specifically the Health Belief Model and Stages of Change Model, to develop educational materials for promoting food thermometer use. These models focused on decision making and behavior change that impacted the health of the decision maker.

Employee motivation

DiPietro and Condley *(8)* found motivation to be a key factor in employee turnover in hotel and quick service restaurants. Tesone, Ricci, and Severt *(35)* used Maslow's model to compare perceived motivation needs of younger and older workers. They found motivational priorities to be different—younger workers had higher scores for social belonging and lower scores for self actualization. In another study of motivation, Salazar, Ashraf, Tcheng, and Antun *(27)* investigated the link between self-perceived motivation and learning during food safety training. They found no relationship between motivation and learning, measured by a pre/post test.

METHOD

Sample selection

Students in three hospitality management classes at a Midwest university comprised the study sample. Students taking more than one of the classes were not permitted to complete the questionnaire multiple times. Total enrollment for the courses was 250, with 13 students taking multiple courses.

Questionnaire

A three-part questionnaire was developed. The first part included eight belief statements related to motivation theory *(43)* measured on a Likert-type rating scale (1 = strongly disagree to 5 = strongly agree). The second section included four open-ended questions related to perceived motivators. Two forms of the questionnaire were developed. Each sudent received only two open-ended questions, to shorten writing requirements and encourage participation. All four questions began with the stem: "What do you think would motivate foodservice workers to." Phrases related to four areas were used at the end of the sentence: cleaning and sanitizing, handwashing, wearing clean uniforms, and taking food temperatures. All four topics related to the non-compliance areas identified by the FDA *(12)* of poor personal hygiene, time and temperature control, and contaminated equipment/prevention of contamination. The third section contained demographic questions, including work experience and past food safety training/instruction.

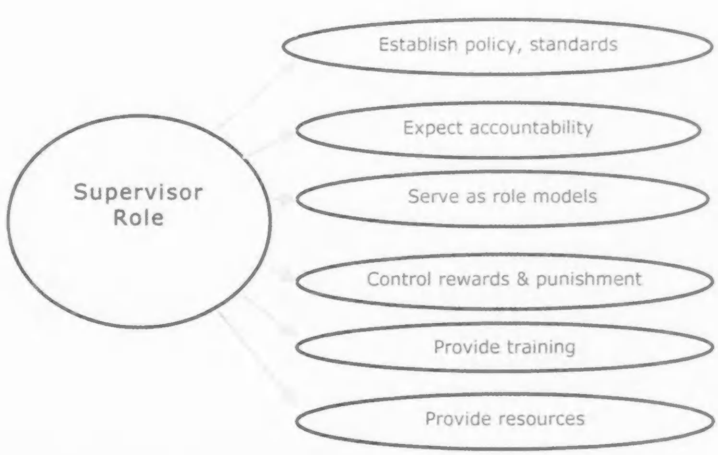
Data collection and analysis

One researcher distributed questionnaires in classes and students were allowed to complete them during class time. No

TABLE 1. Demographic characteristics of participants (N = 169)	
Characteristic	**%**
Gender (n = 169)	
Female	66.0
Male	34.0
Major (n = 168)	
Hotel, Restaurant, and Institution Management	71.0
Other	29.0
Classification status (n = 168)	
Freshman	16.0
Sophomore	17.5
Junior	34.0
Senior	32.0
Other	0.5
Age (n = 168)	
18–19 years	25.5
20–21 years	41.0
22–25 years	28.5
26–30 years	3.0
31–40 years	2.0
Foodservice work experience (n = 168)	
Yes	83.0
No	17.0
Trained on topics (n = 169)	
Proper handwashing	87.0
Preventing cross contamination	77.0
Temperature danger zone	76.0
Training locations	
Work	49.5
Class	65.5
Other	7.0
Not Trained	13.0

Note: The total is greater than 100% for both a "trained on topics" and "training locations," as multiple responses were selected by some.

FIGURE 2. Hypothesized model for role of supervision in employee motivation



incentives were provided for participation. A total of 169 (100% response rate from students in class on the day of data collection) returned completed questionnaires.

Quantitative data analysis for demographic variables was performed using SPSS (version 14.0, Chicago, IL). Data coding and entry were done according to procedures recommended by Dillman *(7)*. Descriptive statistics (including means, standard deviations, and frequencies) were calculated for all closed-ended items on the questionnaire.

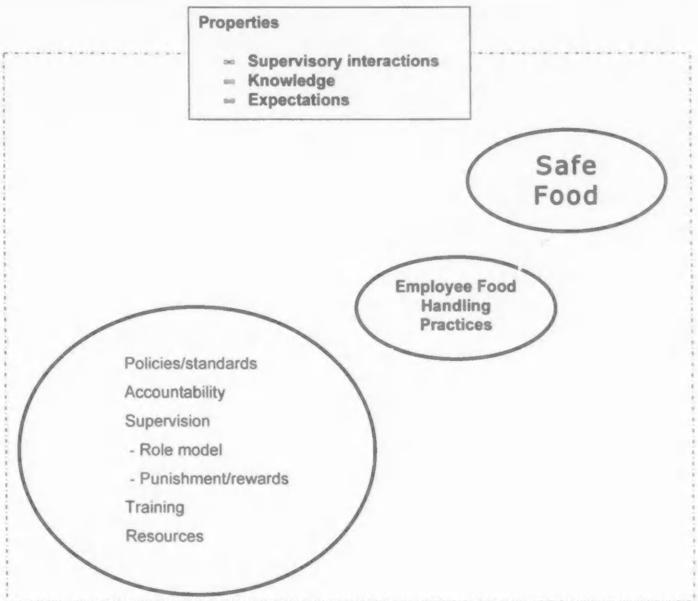
Responses from the second section of the questionnaire were sorted (coded) and then categorized (themed) by four individuals with expertise in research and food safety. This is consistent with procedures recommended by Taylor and Bogdan *(34)*. Theming among the different research-

TABLE 2. Themes developed based on hospitality students' responses to questions related to motivators to implement food safety practices

Themed Areas (average number of coded segmented responses):	Student Response Examples
Establish policy and standards (14.5)	• "I think strict guidelines on when, and how often to wash hands would help." • "clear guidelines and procedures to follow" • "make it a mandatory requirement to wear clean uniform." • "Put it in their job description."
Expect accountability (63)	• "Knowing that they will be held accountable if they don't" • "constant monitoring by managers to ensure employees' uniforms are clean" • "Inspectors should make unannounced visits to restaurants. This would motivate foodservice workers to keep up with temps." • "Placing logs for documentation near grill, ovens, etc. and having consequences in place if logs are not correctly done."
Serve as a role model (27)	• "Watching management also washing their hands" • "Also having superiors who both demonstrate and reward appropriate behaviors." • "Supervisors leading by example!!" • "If the foodservice manager always monitors his/her works and keeps track on records"
Provide training (89)	• "I think that just educating them on what happens when they don't wash their hands should motivate them to." • "Better education as to the seriousness of food safety including real life examples and demonstration of proper techniques." • "Training on the dangers of cross contamination and how microbes can grow on clothing if unclean." • "More videos, etc. to fully explain dangers of the food temp. danger zone and how it can impact people in negative ways."
Control rewards and punishment (133)	• "use of a reward system or choices of shifts" • "rewards for the employees who had the cleanest work area" • "higher pay and other incentives" • "There should be some punishment for the areas that are real bad." • "by awarding an employee with outstanding cleanliness" • "pay raise, or some kind of other benefit (i.e. free food, more discount, etc.)"
Provide resources (38)	• "sinks available at convenient spots, signs posted reminding them" • "Giving the employees ample amounts of time to clean those surfaces, and providing quick and easy access to the proper cleaning tools. When employees are in a rush or are behind, they will pass up cleaning in the interest of saving time." • "Giving 3-4 uniforms so they aren't having to do laundry every day; have them leave uniforms at work and have the place of work provide the cleaning." • "Having thermometers available throughout the entire kitchen so they are there when they need to monitor temp."

Note: The average number of coded segmented responses was calculated by summing the total segmented responses in each theme area by researcher and dividing it by the number of researchers doing the coding. Because one student response might contain multiple segmented codings, averages do not total sample size.

FIGURE 3. Hypothesized organizational model of employees' motivations for following safe food handling practices



ers was compared. Collapsing of themes was done based on overlap and theming terminology similarities. An example of collapsing of themes was with the theme area of rewards and punishment; some researchers had this as two separate themes, whereas others had collapsed it into a rewards/punishment category. An example of theming terminology similarities is as follows: researchers used the terms facilities, resources, and equipment to capture the same data verbiage. Categorization of responses was consistent among researchers. The analysis process and research examples are provided in Fig. 1.

FINDINGS AND DISCUSSION

A total of 169 students participated in the study. The majority of participants were female (66%), Hotel, Restaurant, Institution Management students (71%), upperclassmen (66%), and between 18 and 25 years of age (95%). Additional demographic information is presented in Table 1. Participants reported on foodservice work experience (83% had experience), training topics (76%–87% reported having had training on handwashing, cross contamination, or temperature danger zone), and training location (almost 50% at work and 65% in school class as multiple locations identified).

Utilizing the expectancy model as the theoretical underpinning, motivators to following safe food handling practices were examined: specifically, proper hygiene, temperature taking, and cleaning and sanitizing. Analysis of responses from the first part of the questionnaire was not utilized, because motivational scales were not as reliable as desired.

Based on students' responses to open-ended questions, themed areas of motivation were identified: establish policy and standards, expect accountability, serve as a role model, provide training, control rewards and punishment, and provide resources. Table 2 contains themed areas along with examples of students' responses in each theme area. The mean number of coded segmented responses in each theme area ranged from 14.5 for "establishes policy" and standards to 133 for "control rewards and punishment."

Further exploration led to the development of a preliminary model (Fig. 2) in which all themed areas identified linked back to the importance of the supervisor's role in motivating employees to follow safe practices. The supervisor establishes policies and standards in the workplace and holds employees accountable to follow policies and standards. Supervisors serve as role models for utilizing safe food handling practices and thus motivate employees by leading by example. Supervisors' actions of providing rewards and punishment as well as training are viewed as motivators. As reported by Salazar, Ashraf, Tcheng, and Antun *(27)*, employees must be motivated for learning to occur; thus, training would be expected to be more effective with motivated employees. The provision by supervisors of facilities and equipment, including adequate handwashing facilities and clean uniforms, also is seen as a motivator by employees. While Salazar, Ashraf, Tcheng, and Antun *(27)* found that foodservice workers who reported lower supervision scores had higher food safety post-test scores, these authors noted that the measurement of supervision was based on feeling (affect) rather than on the supervisor's ability to manage (do the job).

Walczak and Reuter *(38)* integrated into their study the importance of supervisory decision making as a means to prevent corporate violence by serving unsafe food. Further development led to a preliminary model that placed the supervisor role within the organization context. Although the importance of the supervisor is noted, consideration of the context—the organization—cannot be ignored. Figure 3 incorporates the role of the supervisor into the context of the organization with identified properties important to establishing a culture of food safety. As noted by Walczak *(37)*, organizational behavior cannot be ignored when it comes to food safety. Similarly, organizations not supportive of proper food safety procedures (e.g., handwashing) are recognized as barriers *(26)*.

Significant work using focus group methods provide some results consistent with findings in this study. Green and Selman's work *(15)* addressing factors impacting ability to prepare safe food showed commonalities with the current study in the following areas: equipment and resources, management emphasis on food safety, negative consequences (termed "punishment" in the reported model), food safety education and training, and procedures. Pragle, Harding, and Mack *(26)* focused on handwashing and identified facilities, reminders, education/training, and accountability upheld by managers as facilitators to proper handwashing.

CONCLUSIONS

Food safety, food sanitation, and food handling continue to be concerns for restaurant owners and managers. The model proposed in this research offers a holistic approach to improving employees' safe food handling behaviors by addressing motivation as a supervisory function. While previous work in this area focused mainly on the need for training and effectiveness of training, this work emphasizes the importance of the supervisor and the context of supervision. Cohen, Reichel, and Schwartz *(6)* noted that "for the... sanitation training program to be fully effective, it must take into consideration the different environments and circumstances in which the departments operate" (p. 14). This may be extremely difficult for supervisors in foodservice organizations. Therefore, because the "one size fits all" employee training program has been proven ineffective, approaching training at the supervisory level may be more effective. A linkage between motivation and performance has been made whereby motivation can affect both learning outcomes and job performance *(24)*. By training supervisors to help motivate employees to follow safe food handling practices, employee behaviors may be changed. As recommended by other researchers *(35)*, motivational strategies may need to differ, based on employee maturity.

LIMITATIONS AND FUTURE RESEARCH

The findings from this study cannot be generalized as it is qualitative in nature. Rather, qualitative research provides opportunity to build theory as opposed to testing theory. From this unique piece of work, future research efforts can be focused on testing and validating the proposed model.

Although college-aged adults comprise the largest segment of foodservice workers, other age groups working within the industry are also of interest. Motivational priority differences may be a real factor to consider in motivating older employees.

ACKNOWLEDGMENTS

This research was funded in part by the Food Safety Consortium.

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Food Protection Trends, Vol. 28, No. 10, Pages 712–722

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International Association for Food Protection

Knife Sanitizing in Abattoirs: The Effectiveness of Current and Alternative Practices

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SUMMARY

For many years, regulations have required the use of water at temperatures no less than 82°C to disinfect knives used during slaughter and dressing. Because of recent amendments in several countries, regulators may now consider alternatives to water at 82°C if these alternatives can be demonstrated to be effective and reliable. In this review, the historical reasons for using 82°C water are traced and the new regulations and guidelines outlined. We describe the current industry practice for slaughter and dressing using knives and other tools, consider their role in contaminating meat, and, with reference to available microbiological data, assess current and alternative industry practices for knife disinfection.

According to available evidence, the numbers of bacteria on knives in abattoirs are reduced by 1 to 2.5 $\log_{10}$ units by current rinsing and sanitizing procedures. Because there is no evidence that rinsed and sanitized tools are significant sources of carcass contamination, and scant evidence of a scientific basis for prescribing water at 82°C, it is concluded that a risk-based approach to sanitization of knives and equipment could be implemented. Combinations of lower water temperature and extended treatment times result in adequate disinfection, lower water and energy consumption, and lower health and safety risks.

A peer-reviewed article

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INTRODUCTION

Since the 1960s, there have been regulatory requirements in many countries for the use of hot water at temperatures no less than 82°C (180°F) for disinfection of knives and other implements used during slaughter and dressing operations. All Australian red meat establishments have been required to have available, during processing, water at a minimum of 82°C for disinfection of tools. The water is required for knife sterilizers, sterilizers for carcass splitting saws, hock cutters, brisket shears and other large items, and for viscera tables. The premise for the requirement is that unless the knives and other implements are disinfected they become sources of microbiological contamination. Failure to maintain knife sterilizers at 82°C will lead to suspension of slaughter and dressing until this has been corrected.

Recent amendments to guidelines, standards or regulations in several countries mean that regulators will consider alternatives to water at 82°C if these alternatives can be demonstrated to be at least as effective and reliable as brief contact with the 82°C water.

The purpose of this review is to:

1. Consider the role of knives in contaminating meat during slaughter and dressing;

2. Trace the origins and historical reasons for using 82°C water for disinfection;
3. Outline the current regulatory requirements and guidelines;
4. Describe current industry practice in Australia for knife disinfection;
5. Assess the microbiological efficacy of current knife cleaning regimes; and
6. Describe recent investigations of alternative procedures equivalent to 82°C water in the laboratory and in the plant.

THE ROLE OF THE KNIFE

The single-bladed knife is used for a range of operations in slaughter and dressing of meat animals. Skin and underlying tissues of the neck are opened by a lateral incision when sheep and calves are slaughtered and exsanguinated; smaller cuts to the throat of pigs open the arteries in the neck to allow bleeding; cattle may be slaughtered by means of a single cut across the throat in religious slaughter operations or by using a vertical incision into the common carotid artery at the thoracic inlet. The skin is opened by incisions that are made so that they do not extend to underlying tissues; opening cuts are developed by so-called "spear cuts" in which the knife is reversed and the hide incised from "inside-out"; the hide is cleared from opening incisions by cuts that separate skin from selvedge; feet, tails and heads are removed by cuts through the joints; the rectum is freed by a circular cut at the anus; an incision is made to open the abdomen and extended by a spear cut; viscera are removed by incisions; bruised and visibly abnormal tissues are excised; fat and surface tissue are trimmed.

Traditionally, the entire slaughter and dressing process, particularly of sheep, was done by a single operator – so-called "solo butchery." Over time, the process was divided into unit operations and the number of operators increased, with each performing fewer operations on animals that were conveyed past each work station. In addition, for some tasks the single-bladed knife was replaced by pneumatically operated knives – oscillating ones for hide clearing and by rotary slicing knives (e.g., Whizard® knife) for trimming. Mechanical equipment was also developed for opening the brisket, for removing feet and heads, and for splitting the backbone of beef carcasses.

As meat processing evolved, meat inspection focused, *inter alia*, on identifying and removing gross pathological lesions and on improving operator hygiene procedures. To prevent transfer of pus, disease agents and other infectious materials from carcass to carcass, the operator was required to "sterilize" the knife between animals by dipping the knife into a bath containing hot water (called a "sterilizer"). However, for the past half century the prevalence of animal disease in developed countries in general, and in those countries that export meat in particular, has gradually decreased. In modern meat production, the meat safety issues are those that do not produce visible pathology of the tissues, such as microbiological contamination with enterohemorrhagic *Escherichia coli*, *Campylobacter* spp. or *Salmonella* spp. As a result, some question the benefit of traditional "organoleptic" or visual meat inspection in controlling meatborne illness *(4, 18, 28)*. Similarly, the potential for invisible microbial contamination to be transferred between carcasses through handling has led to the suggestion that the number of incisions and palpations carried out during traditional inspection should be reduced or that such handling should be stopped altogether.

Despite this, the requirement to sterilize knives and other equipment has remained, with the strict enforcement of a minimum temperature of 82°C in sterilizers. The implication of such regulation is that each operator will use a sterile knife on each carcass. However, even a passing consideration of the process will confirm that use of the terms "sterilize" and "sterilizer" is unsustainable from the microbiological viewpoint. Also, it is moot whether "sanitize" or "disinfect" are appropriate terms, because although both imply elimination or reduction to an acceptable level of microorganisms of public health importance, no process criteria have been set for the performance of sterilizers in meat production plants.

ORIGINS OF THE 82°C/180°F REQUIREMENT

The origins of 82°C (180°F) as the cardinal temperature for meat hygiene are unclear. Although such temperatures as 65°C (cooking), 72°C (pasteurization), and 121°C (sterilization, e.g. canning) and the corresponding treatment times are frequently specified in food microbiology texts (e.g., *16*), no corresponding treatment time is provided in meat hygiene texts and no reason is given for using water of 82°C or 180°F.

Publications earlier than 1970 refer to a number of equipment cleaning procedures. For example, two publications suggested that water should be heated to 140°F (60°C) for one minute or to 130°F (54.4°C) for 5 minutes to kill low-temperature types of organisms by heat *(7, 8)*. Empey and Scott *(8)* also recommended that knives and saws should be replaced and subjected to immersion in alkali at 160–180°F (71.1–82.2°C) after twelve carcasses had been processed. Collins *(7)* commented that the circular saw used for carcass splitting must be periodically wiped clean of all visible blood and sawdust.

Past and present staff at the United States Department of Agriculture (USDA) have provided a number of opinions on the origins of the 82°C water requirement (Brewer, R., personal communication). In the 1950s, a Dr. Sloan, working for the USDA Agricultural Research Service (ARS) in Beltsville, Maryland, is believed to have investigated methods of sterilizing carcass-splitting saws. Sloan found that dipping the carcass splitting saws in water at 82°C effectively killed sufficient numbers of organisms to satisfy regulatory requirements. Eventually, 82°C water became the standard for all slaughter floor operations.

Unfortunately, there is no evidence of publication of Sloan's studies, and during changes of administrations at USDA, reports of most of the old investigations pertaining to sanitation were apparently discarded.

An alternative explanation given is that the 82°C requirement was based on the heat resistance of a particular zoonotic pathogen (Brewer, R., personal communication). Historically, tuberculosis was still a widespread concern in the 1950s. Water at 82°C may have been chosen as the knife sterilization procedure that would kill *Mycobacterium tuberculosis*, an important target organism in milk and other foods at that time. Mandatory pasteurization of milk (72°C for 15 s) had been introduced many years before to reduce the risk of contracting tuberculosis from consuming milk. It is documented that 2–3 s at 80°C will assure inactivation of *Mycobacterium tuberculosis (15)*. Yet another suggestion is that 82°C was about as hot as water could be reticulated without cavitation in the pumps that were used at the time.

There appears, therefore, to be no clear scientific basis for the historical international focus on 82°C as a disinfection temperature. In addition, there is clear evidence that on the slaughter floor, momentary exposure to 82°C is not sufficient by itself to ensure that all Gram negative indicators of fecal contamination, such as *E. coli*, are inactivated. That is, under normal processing conditions, the efficacy of a "dip" into 82°C water will depend on a number of variables. Thermal inertia of the equipment will prevent surfaces from attaining the water temperature until several seconds have elapsed *(17)*. Peel and Simmons *(22)* showed that immersion of knives into water at 82°C was ineffective in totally removing viable salmonellae from knives, most probably because the knives were dipped only momentarily. It was found *(27)* that when fats or proteins were present on a stainless steel plate, immersion at 82°C for 10 seconds brought about a reduction of 2.9 $\log_{10}$ (from an initial level of 6.9 $\log_{10}$ CFU/ml minced meat slurry). The authors considered this an unsatisfactory reduction in bacterial contamination. Furthermore, hot water at 82°C was found to affix proteins onto the surface of the equipment *(25, 32)*, leading to possible entrapment of bacteria and to cleaning difficulties.

Current requirements and practices

Codex Alimentarius Commission

In February 2002, a proposed draft code of hygienic practice for fresh meat *(5)* was tabled at the Codex Committee on Meat and Poultry Hygiene. That document stated that equipment should be installed that provides hot potable water heated to at least 82°C for the purposes of disinfecting equipment, unless an equivalent sanitation system is available. The final code of practice *(6)* does not contain reference to a specific temperature, merely stating that the premises should have "hot potable water for effective sanitizing of equipment, or an equivalent sanitation system" and that equipment should be "cleaned and sanitized by immersion in hot water or alternative method with appropriate frequency during and/or between periods of work."

European Union

The 1964 European Commission Council Directive 64/433/EEC required that meat-producing and meat-processing establishments must have facilities for disinfecting tools with hot water supplied at not less than 82°C. In June 2001, the European Commission's Scientific Committee on Veterinary Measures relating to Public Health (SCVPH) adopted an opinion paper entitled "The cleaning and disinfection of knives in the meat and poultry industry" *(9)*. SCVPH concluded, *inter alia*, that using water at or above 82°C is not fully effective in the absence of cleaning and that use of water at lower temperatures with lactic acid or other agents can be a satisfactory alternative to the currently approved procedure. The current EU Regulation 853/2004 on the hygiene of foods of animal origin requires that meat production plants have facilities for disinfecting tools with hot water supplied at temperatures not less than 82°C, or an alternative system having an equivalent effect *(10)*. To assist food processors to comply with the EU Regulation, a guidance document has been produced *(11)*. With regard to knives, the guidance document states that: "The objective of the requirement is to ensure that meat is not contaminated through equipment, e.g., knives. This objective can be achieved through different means, such as:

Having sterilizing equipment for knives at key places in the slaughterhouses directly accessible by the workers. Such equipment may be the appropriate choice in the bigger slaughterhouses.

Sterilizing in a single operation a number of knives sufficient to ensure that clean knives are available throughout the slaughter operations. This solution may be appropriate in low capacity slaughterhouses."

United States of America

In its Final Rule on Sanitation Requirements for Meat and Poultry Establishments *(30)*, date of effect 25 January 2000, the USDA Food Safety and Inspection Service rescinded, in Title 9, Code of Federal Regulations, Part 416.3, the previous requirement for use of water at 180°F (82°C) to disinfect utensils and equipment used to dress diseased meat carcasses. While accepting that many meat establishments will continue using 180°F water for this purpose, USDA recognized that others will use different means. Establishments that want to innovate may do so if they can maintain sanitary conditions and prevent adulteration of product.

Australia

Until 2002, Australian regulations required that facilities for cleaning and sanitizing implements be provided with an adequate supply of hot potable water at a temperature no less than 82°C. The revision of the relevant Australian standard in 2002, carried across to the current requirement, is more flexible. Australian Standard 4696:2007 *(1)* specifies that facilities be provided with an adequate supply of hot potable water at no less than 82°C or an equivalent method of sanitizing.

New Zealand

In its industry standards for slaughter and dressing, the New Zealand Food Safety Authority states that all equipment (including knives) that comes into contact with exposed product before inspection shall be rinsed clean after each carcass and must be sterilized regularly *(21)*. The standards state that sterilizing units be provided with water at a minimum temperature of 82°C.

South America

The world's largest exporter of beef, Brazil, has 15 establishments listed as eligible to export to the USA *(31)* and 76 listed by the EU *(12)*. These are required to maintain sanitizer units at 82°C. Establishments in other South American countries, e.g., Uruguay and Argentina, are also listed as eligible to export to the USA and the EU.

Current knife cleaning practices in Australia

Information was gathered on knife disinfection practices from ten plants in April 2002 through visits or telephone interview *(20)*. Six processed beef, one handled smallstock and three were multi-species plants. During visits to five of the plants, flow measurements were taken on a range of their knife and equipment

TABLE 1. Summary of information from survey of abattoir hot water sterilizing practices – adapted from Midgley and Eustace 2003 *(20)*

Plant	Hot water storage (°C)	Sterilizer water distribution (°C)	Type of sterilizer[1]	Two-knife operation	No. of two- knife locations[2]
A	82	90	Overflow	Yes	17
B	65	93	Overflow	Yes	11
C	90	95	Overflow	Yes	5
D	51	88	Overflow & spray	No	-
E	85	90	Overflow	Yes	7
F	60	> 90	Overflow & spray	No	-
G	70	90	Overflow & spray	Yes	24
H	88	82	Overflow	Yes	11
I	none	95	Overflow	No	-
J	84	80	Overflow	No	-

[1]Overflow – immersion baths with continuous water flow; overflow and spray–some immersion baths, some jacketed sprays

[2]Two-knife system defined in text below

TABLE 2. Total viable counts (TVC) of hands before and after rinsing and of knife blades[1] before and after cleaning by rinsing in warm water then immersion in 82°C water on a sheep slaughter floor — adapted from Bell and Hathaway 1996 *(3)*

Treatment	Mean log TVC/cm² (SD)	
	Before treatment	After treatment
44°C spray rinse (n = 50)		
Knife blades	5.04 (0.41)	3.29 (0.68)
Knife hands	5.06 (0.29)	4.16 (0.42)
44°C spray rinse, then 82°C immersion (n = 50)		
Knife blades	5.04 (0.41)	2.42 (0.65)

[1]Blades swabbed with cotton gauze swabs; counts at 25°C for 72 h

sterilizers and other relevant information was collected. Questionnaires were completed by an additional five plants. A summary of some of these data is presented in Table 1.

Typical sterilizer water usage on the slaughter floors was divided between knives, equipment and viscera table as follows: knives (50–55%), equipment (30–35%) and viscera table (10–15%). In 8 of the 10 plants, the temperature of the available hot water had to be boosted for circulation in order to ensure a minimum temperature of 82°C at the knife and equipment sterilizers. Most sterilizers were a water bath type with the rate of overflow adjusted to ensure the required minimum temperature (82°C) was maintained. Flow rates measured for individual units ranged from 38.5 to 224 liter/h.

The extent of lethality of hot water to bacteria is primarily a function of contact time and temperature, and in some plants operators use a two-knife system, in which one knife is held in the sterilizer while the other knife is in use. Where only a single knife is used, the knife is momentarily dipped into the sterilizer between uses. Six of the plants surveyed by Midgley and Eustace *(20)* had implemented two-knife systems at stations mainly prior to the hide puller; these plants generally had approval to export to the European Union. When two-knife systems were used, the residence time of the knife in the sterilizer depended on chain speed and operator procedures *(13)*. In plants where knives were changed only when operators passed to the next carcass, residence time varied from about 17 seconds in an abattoir killing over 200 cattle per hour to over 60 seconds for those with slower processing speeds. In Australia, the 31 abattoirs that are listed by the EU as eligible to process red meat for export all employ a two-knife system. In New Zealand, nearly 60 establishments are

TABLE 3. Total viable counts (TVC) of knives[1] and hands before rinsing and after rinsing (hands) and after rinsing and immersion in 82°C water (knives) on a beef slaughter floor — adapted from Bell 1997 *(2)*

Station	Mean log TVC/cm² (SD) Before cleaning	After cleaning
Knife blades (n = 20)	3.61 (0.47)	2.64 (0.44)
Knife hands (n = 20)	4.74 (0.67)	3.73 (0.42)

[1]Blades swabbed with cotton gauze swabs; counts at 25°C for 72 h

licensed to export to the EU. The world's largest exporter of beef, Brazil, has over 60 abattoirs licensed for export to the EU. Of interest is the fact that in these two countries, none of these 120 abattoirs reportedly employs a two-knife system.

Effectiveness of current practices

There are no guidelines and no published information on how to assess whether knives actually are significant sources of contamination of carcasses or how to determine the extent of regular disinfection that is necessary. However, there are studies that can be used as a guide. The effect of washing the knife followed by a momentary dip in 82°C water during sheep and beef processing was investigated in New Zealand abattoirs (Tables 2 and 3).

Bell and Hathaway *(3)* measured the effect of knife cleaning at the work station where opening cuts on the hind legs of lamb carcass are made. Before cleaning, knives had a mean log TVC/cm² of 5.04, reflecting the heavy soiling that can occur from the fleece. Rinsing the knife in hand wash water at 44°C removed 98.2% of contamination (1.8 log reduction) from the blade and, after subsequent dipping in 82°C water, 99.8% of contamination was removed, to effect a 2.6 log reduction (Table 2). Bell *(2)* found that on the beef floor, contamination on knife blades approximated that of the hide on the hind legs (mean log TVC/cm² of 3.61). Cleaning the knife by rinsing it in hand wash water and then dipping it in 82°C water reduced the loading on the blade to mean log 2.64/cm², a 1 log reduction. The studies of Bell and Hathaway *(3)* and Bell *(2)* are also of interest because they indicate that the knife hand was generally one log scale more contaminated than the knife blade after washing of hand and knife.

In Australia, Eustace et al. *(13)* and Reyes-Veliz (pers. comm.) studied the microbiological status of knives pre-rinsed under a warm water spray, before a momentary dip in 82°C water. Knives were tested at a range of stations located along beef, mutton and pig slaughter floors, and *E. coli* prevalences and total viable counts (TVCs) were obtained. In Table 4 are presented TVCs and *E. coli* prevalence on cleaned knives used at stations along the beef chain. The overall mean log TVC/cm² was 2.18, and *E. coli* was isolated from cleaned knives on 20/230 (8.7%) occasions, with a mean *E. coli* count on positive knives of log 0.43/cm². In general, higher TVCs occurred earlier in the process, when cuts were made through the hide, and particularly when air knives were used or when knives were used at the head stations.

In Table 5 are presented TVCs and *E. coli* prevalence on knives used at stations along the mutton chain. The mean log TVC/cm² was 1.95, and *E. coli* was isolated from cleaned knives on 24/130 (18.5%) occasions, with a mean log *E. coli* on positive knives of 0.90/cm². Higher TVCs were associated with knives used to incise the brisket, to trim exposed neck tissue, to ring the bung (incise the anus), and to remove the viscera.

Total viable counts on knives after cleaning on a pig slaughter floor (Table 6) indicated a mean log of 1.98/cm². *E. coli* were found on 7/30 (23.3%) of cleaned knives, and the mean log of positive knives was 0.25/cm².

The results of Bell and Hathaway *(3)* indicate that most of the reduction in bacteria on the knife blade is attributable to the spray rinse. Similarly, it was found *(20)* that rinsing the knives under streams of washwater (20–40°C) before immersing them in a sterilizer removed at least 70% of bacteria. From the foregoing, it is clear that the most common knife decontamination process (rinsing in warm water followed by a momentary dip in 82°C water) does not always result in removal of fecal organisms, as evidenced by the *E. coli* counts on 8.7%, 18.5% and 23.3% of cleaned knives used for beef, sheep and pig dressing, respectively. However, the knives themselves, even after rinses in tepid water, are clearly not major sources of contamination either. The TVCs reported after a spray rinse (log 3.3 / cm²) and after rinsing in tepid hand wash water (log 1.6/cm²) attest to this *(3, 13)*. Recent national surveys of the microbiological quality of beef and sheep carcasses in Australia *(23, 24)* indicate low aerobic plate counts and low prevalence of *E. coli*. There is no reason to conclude that the current procedures for rinsing and dipping knives are contributing in any significant way to contamination of meat.

ALTERNATIVE PROCEDURES FOR KNIFE CLEANING

Ultrasound and other physical alternatives

There is little published research on the efficacy of ultrasound for cleaning knives. Ultrasonic cleaning of knives in water baths was examined at different temperatures *(26)*. It was found that the protein deposition on the knife was much reduced by ultrasound at 82°C. The authors recommended using ultrasonic cleaning at room temperature before disinfection. Midgley and Eustace *(20)* investigated the use of a prototype commercial ultrasound bath designed for knife cleaning. Reductions in microbial load on knives coated in fat or minced meat were slightly increased when ultrasound was used in conjunction with hot water treatments.

Chemical alternatives

The European Commission's Scientific Committee on Veterinary Measures

TABLE 4. *E. coli* and total viable counts (TVC) of knives[1] rinsed then sanitized in 82°C water on a beef floor — adapted from Eustace et al. 2007 *(13)*

Station	*E. coli*[*]	Mean log TVC/cm² (SD)
Halal cut	1	1.49 (0.23)
Weasand tie	4	2.77 (0.32)
Sticking	0	2.34 (0.73)
Rinsing	0	1.91 (0.22)
Scalping	0	1.56 (0.59)
1st leg	1	1.64 (1.09)
2nd leg	0	1.72 (0.13)
Air knife 1	1	2.33 (1.22)
Air knife 2	4	3.44 (0.09)
Air knife 3	1	2.31 (0.66)
Air knife 4	1	2.21 (0.78)
Tongue drop	1	3.85 (0.00)
Heads inspection	0	3.85 (0.00)
Head boning	1	3.48 (0.16)
Bung drop	0	2.35 (1.64)
Evisceration	3	1.35 (0.29)
Viscera inspection	1	1.48 (1.06)
Fronts inspection	0	1.77 (0.55)
Separate runners	0	1.54 (0.58)
Neck trim	0	1.70 (0.37)
Whizard knives	0	1.90 (0.55)
Backs inspection	1	1.95 (0.15)
Backs trim	0	1.14 (0.63)
Totals and means	20/230	2.18 (0.99)

[1]Blades swabbed with Whirlpak sponges; *E. coli* enumerated on *E. coli*/Coliform Petrifilm at 37°C for 2 days, TVCs on APC Petrifilm at 20–25°C for 3 days

[*]Number of knives testing positive for *E. coli* out of 10 knives sampled at each station

relating to Public Health (SCVPH) published its opinion on cleaning and disinfection of knives in response to a request from Dutch authorities, who proposed using water at a lower temperature, e.g., 45°C, in combination with a solution of lactic acid *(9)*. The SCVPH concluded that the use of lower temperatures together with a lactic acid solution of 2 to 5% is as effective as the use of water at 82°C. The SCVPH also considered several other chemicals, including tri-sodium phosphate, polyphosphates, chlorine compounds and hydrogen peroxide.

Taormina and Dorsa *(29)* investigated the effectiveness of sanitizers for cleaning artificially inoculated knives. An acid quaternary ammonium compound (QAC) sanitizer at 48.9°C proved more effective than either neutral QAC or peroxyacetic acid sanitizers and almost as effective as a one-second dip in 82°C water. No assessment has been made of the effect of build-up of fat, blood and other organic materials in cleaning baths containing chemical sanitizers with specific reference to the likely need to change sanitizer at regular intervals.

Cleaning in water at temperatures cooler than 82°C

Midgley and Eustace *(20)* investigated the effect of sanitizing knives at temperatures cooler than 82°C by varying the period of immersion. Immersion at 72°C for 10 or 15 s resulted in 3 to 4 log reductions, and the authors concluded that a reduction equivalent to a momentary dip in 82°C water was possible if the knife was allowed to reside at a lower temperature for sufficient time. They further suggested that a two-knife system (already widely adopted in Australia) at a lower temperature might be a practical solution.

It was against this background that rinsing in hand wash water coupled with a two-knife system and 60°C water was evaluated in an abattoir as an alternative procedure to the current system of rinsing and then momentary dipping of the knife in 82°C water. Under the alternative sys-

TABLE 5. *E. coli* and total viable counts (TVC) of knives[1] rinsed then sanitized in 8°C water — adapted from Eustace et al. 2007 *(13)*

Station	*E. coli*[*]	Mean log TVC/cm² (SD)
Sticking	0	0.73 (0.74)
Briskets	2	2.13 (0.94)
Forequarters	1	2.46 (1.33)
Heads off	1	2.03 (1.08)
Ventral cut	0	1.07 (0.59)
Tail trim	3	1.70 (1.36)
Neck trim	0	2.07 (0.63)
Bung drop	6	1.83 (1.39)
Pluck removal	3	2.02 (0.19)
Evisceration	4	1.81 (0.77)
Viscera inspection	1	2.41 (0.90)
Separate runners	1	1.95 (0.73)
Pluck table	2	3.12 (0.22)
Totals and means	24/130	1.95 (1.01)

[1]Blades swabbed with Whirlpak sponges; *E. coli* enumerated on *E. coli*/Coliform Petrifilm at 37°C for 2 days, TVCs on APC Petrifilm at 20–25°C for 3 days

[*]Number of knives testing positive for *E. coli* out of 10 knives sampled at each station

TABLE 6. *E. coli* and total viable counts (TVCs) of knives[1] rinsed then sanitized in 82°C water on a pig slaughter floor — source: Reyes-Veliz, (pers. comm.)

Station	*E. coli*[*]	Mean log TVC/cm²
Shaving	5	3.46 (0.29)
Bung and testes	0	1.65 (0.82)
Gutting	1	0.64 (0.31)
Trotter removal	1	1.15 (0.64)
Backing off	0	3.52 (0.18)
Final trim	0	1.49 (0.99)
Totals and means	7/30	1.98 (1.26)

[1]Blades swabbed with Whirlpak sponges; *E. coli* enumerated on *E. coli*/Coliform Petrifilm at 37°C for 2 days, TVCs on APC Petrifilm at 20–25°C for 3 days

[*]Number of knives testing positive for *E. coli* out of 5 knives sampled at each station

TABLE 7. *E. coli* and TVCs of knife blades[1] (n = 230) rinsed and sanitized under the current system (single knife dipped in 82°C water) and under the alternative system (a 2-knife system using 60°C water) on the beef floor – adapted from Eustace et al. 2007 *(13)*

Operations	*E. coli*[*]		Mean log TVC/cm²	
	Current system	Alternative system	Current system	Alternative system
Hide incision and clearing	13/110	14/110	2.2	2.0
Head processing	2/30	1/30	3.7	1.4
Evisceration	4/50	4/50	1.7	1.7
Trim and inspection	1/40	2/40	1.7	1.8
Totals and means	20/230	21/230	2.2	1.8

[1]Blades swabbed with Whirlpak sponges; *E. coli* enumerated on *E. coli*/Coliform Petrifilm at 37°C for 2 days, TVCs on APC Petrifilm at 20–25°C for 3 days

[*]Number of knives testing positive for *E. coli* out of 10 knives sampled at each station

TABLE 8. *E. coli* and TVCs of knife blades[1] (n = 130) rinsed and sanitized under the current system (single knife dipped in 82°C water) and under the alternative system (a 2-knife system using 60°C water) on the mutton floor (alternative system) — adapted from Eustace et al. 2007 *(13)*

Station	*E. coli*[*]		Mean log TVC/cm²	
	Current system	Alternative system	Current system	Alternative system
Pelt incision and clearing	7/70	11/70	1.7	1.8
Evisceration and viscera processing	17/60	18/60	2.2	1.5
Totals and means	24/130	29/130	1.95	1.7

[1]Blades swabbed with Whirlpak sponges; *E. coli* enumerated on *E. coli*/Coliform Petrifilm at 37°C for 2 days, TVCs on APC Petrifilm at 20–25°C for 3 days

[*]Number of knives testing positive for *E. coli* out of 10 knives sampled at each station

tem, each operator was provided with two knives, one in use on the carcass and the other immersed in water at 60°C at any one time. The temperature of immersion water (60°C) was selected arbitrarily by abattoir management as one which, if it could be shown to provide an equivalent outcome to 82°C water, would be advantageous for both economic and operator safety reasons. The evaluation was carried out according to a design in which, when the alternative system was being tested, knives always received a final treatment with 82°C water before being used on carcasses, in order to comply with the requirements of the controlling authority at the time.

In Tables 7 and 8 are presented comparisons of the disinfection efficacy of the two systems on knife blades on the beef and sheep floors, of an Australian abattoir. For beef slaughter and dressing (Table 7) the overall mean log TVC/cm² on sanitized knives was 2.18 by the current knife sanitizing process and 1.78 by the alternative procedure. This constituted a significant overall difference in average log TVC/cm² ($P < 0.001$). However, this difference between the procedures was not consistent for all work stations; significantly larger differences were observed at tongue drop, head inspection and head boning stations, where the alternative procedure was much more effective, than at legging, evisceration or trimming. No significantly higher average log TVC/cm² values were observed with the alternate procedure at any of the 23 work stations. With use of the current system, *E. coli* was isolated from sanitized knives on 20/230 (8.7%) occasions, compared with 21/230 (9.1%) occasions with use of the alternative system. The mean log *E. coli* of positive knives (after sanitizing) was 0.43/cm² and 0.61/cm² with use of the current and alternative systems, respectively.

TABLE 9. Combinations of temperature and time providing a minimum 2-log reduction in *E. coli* on knife blades after a pre-rinse at 40°C — adapted from Goulter et al. *(14)*

Temperature (°C)	Time (s)	Log reduction *E. coli* (SD)
60	20	2.72 (0.48)
65	20	3.50 (1.11)
70	5	3.46 (0.47)
75	1	2.70 (0.39)
80	1	3.41 (1.20)
82	1	3.44 (0.34)

[1]Blades swabbed with Whirlpak sponges; *E. coli* enumerated on *E. coli*/Coliform Petrifilm at 37°C for 2 days

On the sheep floor (Table 8), the mean log TVC/cm^2 of knives was 1.95 after the current knife sanitizing process and 1.7 after the alternate procedure. This constituted a significant overall difference in average log TVC/cm^2 (P = 0.014). However, this reduction was not consistent for all work stations, with significantly larger falls being observed at the forequarter, pluck removal and pluck table stations compared with sticking, ventral cut or evisceration. No significantly higher average log TVC/cm^2 values were observed with the alternative procedure at any of the 13 work stations. With use of the current system, *E. coli* was isolated from sanitized knives on 24/130 (18.5%) occasions, compared with 29/130 (22.3%) occasions with the alternative system. The mean log *E coli* count of positive knives was 0.90/cm^2 and 0.76/cm^2 with use of the current and alternative systems, respectively.

In the alternative system used in the investigation reported above, rinsing knives in hand wash water was followed by a 2-knife sanitizing system with 60°C water so that knives had a longer residence time. Residence time varied according to work station, from more than 30 seconds at legging on the beef floor to 1–2 seconds at the heads off and ventral cut (teats removal) station on the mutton floor (data not included).

In Australia, regulatory aspects of implementing an alternative knife sanitizing regime at temperatures below 82°C on the slaughter floor were considered by the Meat Standards Committee (MSC) of the Australia and New Zealand Food Regulation Ministerial Council. The MSC set conditions for approval of an alternative procedure that involved an establishment using a model that integrated temperature, time and reduction of *E. coli* to demonstrate a reduction of *E. coli* of at least 99% (2 log reduction) at each work station *(19)*. For establishments wishing to export, a further condition was that the alternative should meet importing country requirements. The 2-log reduction was based on industry performance as reported for beef and sheep slaughter establishments *(2, 3, 13)*.

To provide scientific underpinning for temperature and time regimes for cleaning knives, a study was undertaken of the response of *E. coli* on meat-soiled knives to time-temperature combinations ranging from 1 to 60 s and 60° to 82°C *(14)*. Combinations providing a minimum 2-log inactivation of *E. coli* are presented in Table 9.

The work of Goulter et al. *(14)* can be used by companies intending to install an alternative procedure based on a two-knife system. From a regulatory viewpoint, it will be necessary to demonstrate that, at each work station, the knife is resident in water of a specified temperature for at least the time specified by the model. For example, a company wishing to use 60°C water would need to have the knife that is not in use immersed for a minimum of 20 s, which will not be sufficient for all work stations on a sheep chain processing 10 animals per minute. However, 70°C immersion would probably satisfy requirements at all work stations on beef and sheep slaughter floors in Australia, where average line speeds are around 75 and 480 head per hour, respectively.

Midgley and Eustace *(13)* document other potential benefits of using temperatures below 82°C for cleaning knives, including:

- Reduced risk of operator injury through scalding;
- Reduced hot water consumption during knife and equipment cleaning;
- Reduced impact of hot water on effluent treatment;
- Reduced fogging and condensation;
- Potential reduction in maintenance requirements.

CONCLUSIONS

Earlier in this review we commented that 'sterilize' is an inappropriate term when used in relation to treating knives during production. We also commented that because no process criteria have been set for the performance of the tool "sterilizers" in meat production plants, it is moot whether "sanitize" or "disinfect" are appropriate terms, since both imply elimination or reduction to an acceptable level of microorganisms of public health importance. The 2005 EU guidance document *(11)* makes the important statement, "The requirement [for disinfecting tools] is to ensure that meat is not contaminated through knives and equipment".

Recent available evidence suggests that the numbers of bacteria on knives in abattoirs are reduced by 1 to 2.5 log units by the current rinsing and sanitizing procedures used. Reductions of this order appear completely adequate because there is no contemporary evidence that rinsed and sanitized tools used in meat production are significant sources of carcass contamination.

There is scant evidence of a scientific basis to the requirement for water at not less than 82°C to be used for sanitizing equipment used in meat production facilities. Alternative procedures appear to be completely satisfactory for reducing numbers of contaminating bacteria.

The important food safety issues in meat production have changed over the past century from zoonotic animal health issues such as tuberculosis or brucellosis, which result in visible pathology in carcasses, to foodborne microorganisms that are undetectable using traditional "organoleptic" meat inspection techniques. A risk-based approach to sanitation of equipment could be implemented, using appropriate combinations of time and temperature to optimize inactivation of microorganisms of concern. Using considered combinations of lower water temperatures and extended immersion times could result in less water and energy consumption by the meat industry, giving a positive environmental benefit. Furthermore, the impact on improved occupational health and safety of a change to water cooler than 82°C should not be underestimated: it is thought that burns from sterilizer water may account for around 10% of all industrial injuries in an abattoir, and limiting the amount of 82°C water would improve safety of operators.

ACKNOWLEDGMENTS

Funding was made available by Meat & Livestock Australia and the Commonwealth Scientific and Industrial Research Organisation. Luisa Reyes-Veliz provided data on knife cleaning at a pig slaughter facility, and we extend our thanks to the management of that company for allowing data to be included in the present study.

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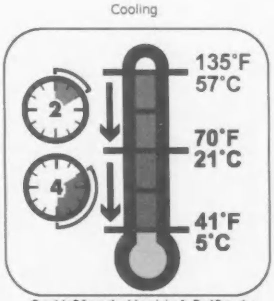

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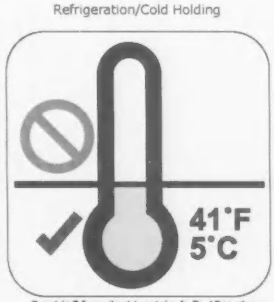

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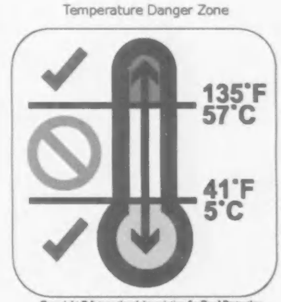

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Call for Nominations 2009 Secretary

A representative from the industry sector will be elected in March of 2009 to serve as IAFP Secretary for the year 2009–2010.

Send letters of nomination along with a biographical sketch to the Nominations Chairperson:

Fred Reimers
Creative FoodSafe Solutions
3905 Arroyo Seco
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Phone: 210.658.9108
E-mail: creativefoodsafesolutions@yahoo.com

The Secretary-Elect is determined by a majority of votes cast through a vote taken in March of 2009. Official Secretary duties begin at the conclusion of IAFP 2009. The elected Secretary serves as a Member of the Executive Board for a total of five years, succeeding to President, then serving as Past President.

For information regarding requirements of the position, contact David Tharp, Executive Director, at 800.369.6337 or 515.276.3344; Fax: 515.276.8655; E-mail: dtharp@foodprotection.org.

Nominations Close November 6, 2008

96th Annual Meeting Grapevine, Texas July 12-15

IAFP 2009

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 February 3, 2009

You may make multiple nominations. All nominations must be received at the IAFP office by February 3, 2009.

- 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 2009 – the Association's 96th Annual Meeting in Grapevine, Texas on July 15, 2009.

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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 2009, *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 2009, the award will be presented to an individual 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.

Larry Beuchat Young Researcher Award

Plaque and $2,000 Honorarium, *Sponsored by bioMérieux, Inc.*

Presented to a young researcher who has shown outstanding ability and professional promise in the early years of their career.

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UV Disinfection Specialist Aquionics Appoints New President

UV disinfection specialist Aquionics has appointed Bill Decker as its new president. Mr. Decker has extensive experience in the wastewater treatment industry, having spent 14 years with Ashbrook-Hartley Operations L.P., a company specializing in wastewater treatment technology. He held various positions with Ashbrook-Hartley, most recently vice president of Biosolids. He also spent two years as an operations director at the company's United Kingdom manufacturing facility.

Mr. Decker has a BSc in civil engineering from the US Air Force Academy and is a member of both the Water Environment Federation (WEF) and the Water and Wastewater Equipment Manufacturers Association (WWEMA).

Nilfisk CFM Names New Director of Sales

Nilfisk CFM has announced Joe Wintsch as their new director of sales for North America. Mr. Wintsch will be responsible for driving sales efforts in the United States, Canada and Mexico, which includes overseeing the company's 20-member direct sales force and extensive range of distributors and dealers throughout North America.

Mr. Wintsch brings over 20 years of industrial sales management experience to the organization. Prior to Nilfisk, he served as vice president of sales at Houghton International Inc. During his sales leadership at Houghton, he spearheaded a new business initiative contributing to Houghton's record revenues and profits in 2006 and 2007.

In addition to his sales management expertise, Mr. Wintsch offers first-hand knowledge of the various other aspects of industrial manufacturing and distribution. He spent 9 years with The Tilley Chemical Company as a product manager and 5 years with Bausch & Lomb Inc., Diecraft Division.

Mr. Wintsch holds a bachelor's degree in business administration from Towson State University and a master's degree in management from The John Hopkins University.

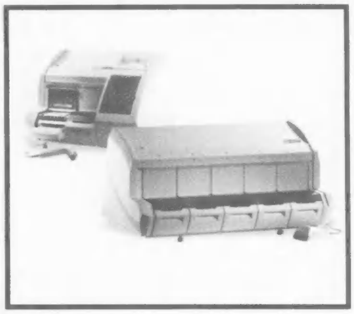
Dunn Appointed General Manager to Head NSF's Beverage Quality Program

NSF International has announced the appointment of Christopher Dunn, a 30-year veteran of the beverage industry, to general manager of NSF's Beverage Quality Program. The beverage quality program tests, audits and certifies bottled water and natural mineral waters, flavored and functional beverages, and packaged ice.

Mr. Dunn has served as president of his own company, DunnWorks, LLC, a consulting firm that provides assistance in business development and market strategy to the water, beverage and consumer package goods industries, for the past four years. During the early development of his company, Mr. Dunn served as senior vice president of BIOTA Brands of America, Inc., a bottled water company that developed environmentally-friendly ways using renewable resources to manufacture their bottles.

Mr. Dunn has also worked as vice president of business development, corporate planning and marketing for DS Waters LP, a producer and distributor of home, office and retail bottled water products. Prior to DS Water, he worked at Coca-Cola for nineteen years where he held numerous marketing positions. Mr. Dunn holds an MBA from the Goizueta Business School at Emory University in Atlanta, Georgia, and a bachelor's degree in communications from the University of Denver.

In his new role, Mr. Dunn will be responsible for providing a high level of service to new and existing customers, as well as the ongoing growth of the NSF Beverage Quality Program both domestically and abroad. He will oversee operations including audits, laboratory testing, state licensing and certification services for manufacturers working within the beverage and packaged ice industries. He will also act as a liaison between NSF and regulatory agencies, retailers, code officials, and staff to ensure compliance with voluntary, consensus standards, as well as government and industry regulations.



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bioMérieux Unveils Groundbreaking *E. coli* O157:H7 Detection Technology

bioMérieux, is proud to introduce a breakthrough in food quality testing, VIDAS® UP, for the detection of *Escherichia coli* (*E. coli*) O157:H7. This new solution is based on the latest technology available for food pathogen screening: phage recombinant protein, which offers unique specificity and sensitivity. *E. coli* O157:H7 is a strain of *Escherichia coli* that has caused outbreaks of hemorrhagic colitis in the United States, Canada, Japan, and Europe, in some cases leading to death.

VIDAS UP delivers test results in just seven hours and has the flexibility of analyzing larger sample sizes of up to 375 grams. It is significantly faster than molecular methods which can incur additional equipment expenditure and complexity. Exclusively licensed to bioMérieux, the recombinant phage technology was developed by the German company Profos AG. The new test is available on VIDAS® system for automated pathogen detection.

"*E. coli* O157:H7 is a major health threat and we are very proud to be at the forefront of the industry with an innovative solution for faster and more precise detection," said Alexandre Mérieux, bioMérieux corporate vice president, industrial microbiology. "Quick, accurate detection of *E. coli* O157:H7 is of critical importance today as we see foodborne illness on the rise. VIDAS UP will allow food producers to detect this pathogen earlier and help keep the public safe from outbreaks."

Bacteriophages are highly speccific viruses that only infect bacteria. They use adhesion structures to bind to their bacterial hosts. In VIDAS UP, special binding proteins from bacteriophages are used for the first time for the targeted capture and detection of bacteria from a sample. This technology provides best-in-class sensitivity and specificity, particularly in highly contaminated samples such as animal waste, irrigation water and animal breeding environments.

Bacteriophages are some of the most abundant life forms on earth, and are programmed exclusively to infect and identify host bacteria. Phages have co-evolved with bacteria for more than a billion years and are able to survive in the most extreme environments including soil, animal waste and intestinal tracts. Research shows that phages offer a number of advantages over antibodies, such as superior specificity and superior binding, when used in microbiological test systems. Pnage proteins have been proven to provide robust performance in many different applications, even when challenged with the most demanding and complex food matrices.

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Silliker Food Science Center Launches New Microbial Identification Program

Elusive or hard-to-identify microorganisms are a leading cause of product spoilage and contamination in the food industry. Through its new "Microbial Identification Program," the Silliker Food Science Center can provide companies with accurate and reliable source tracking services utilizing two state-of-the-art technologies: gene sequencing and molecular subtyping by rep-PCR.

Recognized industry-wide as the "gold standard in culture identification," gene sequencing analyzes the ribosomal RNA-encoding genes of microorganisms. Utilized for the identification of bacteria, yeasts and molds, gene sequencing eliminates the need for subjective interpretations that are common in many conventional methods. To identify isolates to their closest genetic relative, the Food Science Center employs a comprehensive database containing over 1,700 known bacteria and 1000 fungi.

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

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

For bacterial isolates, including *Salmonella*, *Escherichia*, and *Listeria*, rep-PCR is a reliable tool for strain differentiation and comparison. This DNA-based method uses repetitive-element PCR to "fingerprint" genetic sequences of samples. Increasingly, food plants are turning to this cutting-edge technology to identify, track, and control contaminants in the processing environment.

"From faster turnaround to improved accuracy, our ID services offer companies a wealth of advantages," says Silliker FSC molecular biologist Sarita Raengpradub. "In our time-crunched business world, this translates into heightened product confidence."

Silliker, Inc.
708.225.1435
Homewood, IL
www.silliker.com

Torrey Pines Scientific, Inc.

Torrey Pines Scientific New Hot Plates and Stirrers with Up to Nine Positions!

Torrey Pines Scientific, Inc. announces its new line of multi-position analog stirring hot plates and stirrers featuring 5 or 9 stirrers.

The large 12" (30.48 cm) square ceramic heater tops have a temperature range to 450°C.

The 5-position stirring units can stir 5-800 ml beakers, and the 9-position units can stir 9-500 ml beakers of aqueous solutions with a stirring range from 100 to 1500 rpm.

The units can support more than 50 pounds (22.6 kg) on the plate surface, and they are designed to keep spills out of the chassis. All controls are mounted well in front of the heater surface to protect against accidental burns.

The units are available in 100VAC/50Hz, 115VAC/60Hz, 220VAC/60Hz and 230VAC/50Hz. They are fused for safety and are supplied with user's manual and detachable line cord for the country of use. All units are UL, CSA and CE or equivalent rated.

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

Gainco Introduces Data Scale with High-End Weigh/Labeling Capabilities

Data Scales from Gainco are specially engineered to improve the speed and simplicity of processing boxed and labeled finished products. Gainco's new high-performance scale design delivers ultra-accuracy and a lower cost of ownership through incorporating advanced electronics and a rugged construction.

Gainco's new data scale can take all the "shocks and hard knocks" of the processing floor – as well as to offer superior washdown protection – making it the ideal weigh/data solution for the harsh environments of meat and poultry processing plants. Its innovative design improves calibration accuracy, operating performance and equipment durability while reducing equipment downtime and operating costs. Sanitation and maintenance operations are also simplified.

Gainco's new data scale offers plant-specific, custom label-making capabilities, with unlimited product codes and configurations possible. The on-screen display includes product code, weight and production totals. Minimizing product "giveaway" has never been easier or more accurate, with the ability to program "over" and "under" thresholds. Scale calibration is likewise quick and easy.

All aspects of the labeling process are easy with Gainco's new data scale. Important label management features include the ability to print catch or fixed weights, as well as having multiple label hotkeys that can be used by operators. Label formats can be formatted at the corporate level, or by designated personnel at individual plant locations.

The data scale is equipped with the revolutionary Gainco Infiniti™ programmable controller, which is specially designed to thrive in the extremes of meat and poultry processing. Cold work environments, hot chemical washdowns and high-pressure cleaning do not affect the performance of the equipment. As a result, the need for double boxing, bagging or removing the indicator from the processing floor during washdown is eliminated.

Additionally, a specially-designed, super-secure stainless steel enclosure for the PC and label printer protects those sensitive electronics from high-pressure washdown water and chemicals.

The data scale's heavy-duty construction utilizes Gainco's DuraWeigh™ 20 × 20 platform and roller-bed. The durable stainless steel construction featuring continuous seam welds really stands up to the rigors of the processing environment. The RF communications minimizes the number of cables needed, thereby reducing the potential for damage on the plant floor.

Due to its robust design, the new scale carries a two-year limited warranty. Through its Blue Ribbon Service subsidiary, Gainco also offers expert 24/7 service on the equipment, distribution systems, software and wireless communications support. Factory-trained technicians are certified in most states, and all service work is guaranteed.

Gainco Inc.
800.467.2828
Gainesville, GA
www.gainco.com

International pbi S.p.A.

International pbi Isolator Microbial Monitoring

Monitoring of atmosphere inside isolators is very critical in maintaining high quality standards.

There are risks in using portable environmental samplers because they must be introduced each time you sample.

"SAS-Isolator" from International pbi is a dedicated instrument for this application.

The sampling aspirating chamber of "SAS-Isolator" is compact, manufactured in stainless steel and separated from the control unit. The compact design save space inside the isolator. The connection is only for power and doesn't compromise the isolator integrity.

It is also very easy to install. The simplicity of the system avoids the extraction and control of air, eliminating risk of contamination.

International pbi S.p.A.
02.48.779.1
20153 Milan Mi
www.internationalpbi.it

Contech Electronics Pesticide-Free Insect Traps Catch Attention of Food Retailers and Consumers

Public pressure to eliminate the use of pesticides, particularly around food and food products, has given rise to a new and growing market of pesticide-free pest management products ideal for the food and grocery industries.

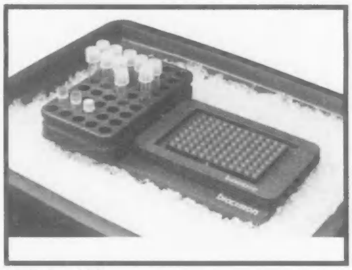
Pest management products that use non-toxic technologies and natural attractants are commanding more shelf space at large grocery retailers, specialty grocers and big box stores, and the number of products available for this growing market is constantly expanding.

"We are working hard to keep up with the demand for pesticide-free pest management products," said Alan Vaudry, new product development manager for Contech, Inc. "The general public is much less inclined to use pesticides. In addition, non-toxic methods and the science behind them are more sophisticated than ever." Contech develops and markets non-toxic pest management products and insect traps that use attractants rather than pesticides to lure, trap and kill problematic insects.

Unlike broad spectrum pesticides, which can kill even beneficial insects and harm the environment, pesticide-free insect traps use natural, food-based attractants like fruit juices and essences to lure the target pests and trap them inside specially-designed devices. The traps, baits and lures are safe for humans, pets and beneficial insects. In addition, the traps are easy to use and aesthetically-pleasing enough to be left on counters and in common public areas.

"Attractant technology is not new. Insects, like people, have always been attracted to certain food smells," Mr. Vaudry said. "Fruit flies, for example, are attracted to rotting fruit so it makes perfect and simple sense to create a trapping system that uses that instinct against them." Contech's fruit fly trap uses fruit essences and other natural products to lure and trap fruit flies. It has also proven to be three times more effective than similar pest management products.

Contech Electronics Inc.
800.767.8658
Victoria, British Columbia, Canada
www.contech-inc.com



BioCision, LLC

BioCision, LLC New Line of Portable Tube and PlateThermoadaptive Modules from BioCision, LLC

Keeping samples organized at a precise temperature is critical to success in the lab and clinic.

BioCision, LLC, located in the Bay Area, has introduced a new line of portable tube and plate thermoconductive modules.

Organizing samples during heating or cooling procedures can be difficult. Losing a sample can cost dearly.

CoolSystem™, BioCision's new line of tube and plate cooling and heating modules now solves those problems, and ensures that each sample is kept organized at the precise temperature all day.

Organization of dozens of samples with a CoolSystem™ lets you protect and find tubes quickly.

The ThermalTray gives a stable, temperature-constant platform for a variety of tube and plate modules that never sink into the ice or water bath. It eliminates floating, lost or contaminated sample tubes.

CoolSystems™ work with any temperature media – Ice, Dry Ice, Water Baths, Heat Plates, Liquid Nitrogen – to keep the samples at controlled, constant temperature all day.

BioCision, LLC
888.478.2221
Mill Valley, CA
www.biocision.com

Eriez® Xtreme™ Rare Earth Magnets are Significantly Stronger Than All Other Existing Magnets

According to the results of a recent performance study conducted by The Pennsylvania State University (Penn State) to analyze the performance of rare earth tube magnet circuits, Eriez Xtreme™ magnets continue to be the strongest magnets in the industry. This is the second test of its kind performed by Penn State in the past five years; results from the previous test also proved Xtreme to be the most powerful.

Other magnets rated extremely low compared to Eriez Xtreme, proving once again that rare earth magnets are not all created equal, as some would believe. Eriez recommends that companies verify the holding force of magnetic separators to ensure magnet vendors are quoting equivalent strength separators.

The Xtreme magnet circuit, used in tubes, grates and liquid line traps, provides ultimate product purity and performance, making it an ideal choice for customers in the process industries. Plus, the power of Xtreme comes at no extra cost to customers!

Eriez
888.300.3743
Erie, PA
www.eriez.com

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

COMING EVENTS

NOVEMBER

- **3–4, Internal Auditor Training,** SpringHill Suites, Sanford, FL. For more information, contact D L Newslow & Associates at 407.290.2754 or go to www.newslow.com.
- **3–6, Better Process Control School,** University of Arkansas, Fayetteville, AR. For more information, go to http://www.uark.edu/depts/ifse/bpcsrev1.html.
- **4–7, Business Management/ Food Safety Management,** SpringHill Suites, Sanford, FL. For more information, contact D L Newslow & Associates at 407.290.2754 or go to www.newslow.com.
- **5–6, Alabama Association for Food Protection Annual Meeting,** Birmingham, AL. For more information, contact G. M. Gallaspy at 334.206.5375; E-mail: ggallaspy@adph.state.al.us.
- **5–6, Pasteurizer Operators Workshop,** Penn State University, University Park, PA. For more information, call 814.865.8237, or go to http://conferences.cas.psu.edu/.
- **5–7, The Dairy Practices Council® Annual Conference,** Kellogg Hotel and Conference Center at Michigan State University, East Lansing, MI. For more information, call 732.203.1947 go to www.dairypc.org.
- **9–13, Process Expo 2008,** McCormick Place, West Hall, Chicago, IL. For more information, go to www.fpsa.org.
- **11, Water Conservation Workshop,** Auburn University, Poultry Science Dept., Auburn, AL. For more information, call Regina Crapps at 334.844.2610; E-mail: crappre@auburn.edu.
- **11–12, Implementing SQF 2000 Systems Training Course,** Venue TBA. For more information, E-mail foodsafety@ecolab.com.
- **11–14, FIL–IDF World Dairy Summit and Exhibition,** Mexico City. For more information, go to www.fil-idf.org; E-mail: MLebeau@fil-idf.org.
- **13–14, 2008 Sino-American Flexible Packaging and Film Development Symposium Call for Papers,** Hua Ting Hotel and Towers, Shanghai, China. For more information, go to www.tappia.org/s_tappi/doc_events.asp.
- **17–19, Basic HACCP: A Food Safety System,** University of California-Davis, Da Vinci Bldg., Davis, CA. For more information, call 800.752.0881 or go to www.ucdavis.edu.
- **18–21, HACCP Prerequisite Programs,** SpringHill Suites, Sanford, FL. For more information, contact D L Newslow & Associates at 407.290.2754 or go to www.newslow.com.
- **18–21, New Zealand Association for Food Protection with New Zealand Microbiology Society Annual Meeting,** Christchurch, New Zealand. For more information, contact Lynn McIntyre at 64.3.351.0015.
- **19–21, IAFP's 4th European International Symposium on Food Safety,** Lisbon, Portugal. For more information, contact the Association at 800.369.6337 or go to www.foodprotection.org.
- **19–21, The ILSI Europe International Symposium on Food Packaging,** Prague, Czech Republic. For more information, call 32.2.771.00.14 or go to http://europe.ilsi.org/events/upcoming/4thfoodpckg.htm.
- **20, Ontario Association for Food Protection's 50th Annual Meeting,** Mississauga Convention Centre, Mississauga, Ontario, Canada. For more information, contact Gail Seed at 519.463.6320 or go to www.ofpa.on.ca.
- **20–21, Advanced HACCP: Verification, Implementation and Other Challenges,** University of California-Davis, Da Vinci Bldg., Davis, CA. For more information, call 800.752.0881 or go to www.ucdavis.edu.
- **25–28, VII Workshop on Rapid Methods and Automation in Food Microbiology,** Bellaterra, Barcelona, Spain. For more information, E-mail: marta.capellas@uab.cat/josep.yuste@uab.cat or go to http://quiro.uab.cat/workshop MRAMA.

DECEMBER

- **9–10, Implementing SQF 2000 Systems Training Course,** Venue TBA. For more information, E-mail foodsafety@ecolab.com.
- **10, Whey Processing Workshop,** University of Idaho, Food Science and Toxicology Dept., Twin Falls, ID. For more information, contact Paula Peterman at 208.364.6188; E-mail: paulap@uidaho.edu.

JANUARY

- **4–10, Ice Cream Short Course,** Penn State University, University Park, PA. For more information, call 814.865.8237, or go to http://conferences.cas.psu.edu/.
- **18–24, ILSI 2008 Annual Meeting,** Wyndham Rio Mar Beach Resort and Spa, Rio Mar, Puerto Rico. For more information, contact Donna Tschiffely at 202.659.0074 ext. 114; E-mail: dtschiffely@ilsi.org.
- **22–23 An International Meeting on *Cronobacter* (*Enterobacter sakazakii*),** O'Reilly Hall, University of Dublin, Ireland. For more information, go to www.ucd.ie/crono09.

IAFP UPCOMING
MEETINGS

JULY 12-15, 2009
Grapevine, Texas

AUGUST 1-4, 2010
Anaheim, California

- **24–25, Ice Cream 101**, Penn State University, University Park, PA. For more information, call 814.865.8237, or go to http://conferences.cas.psu.edu/.
- **25–28, NMC 48th Annual Meeting,** Westin Hotel, Charlotte, NC. For more information, go to www.nmconline.org/meetings.html.
- **27, Silliker Scientific Seminar – Assessment and Perspectives for European Union Regulations,** Lyon, France. For more information, contact Catherine Macret at Catherine.Macret@silliker.fr.
- **28–30, IPE/IFE 2009,** Georgia World Congress Center, Atlanta, GA. For more information, go to www.ipe08.org.

FEBRUARY

- **3–4, Industrial Cheese Making Workshop,** University of Idaho, Food Science and Toxicology Dept., Twin Falls, ID. For more information, contact Paula Peterman at 208.364.6188; E-mail: paulap@uidaho.edu.
- **4–6, CIES International Food Safety Conference,** Barcelona, Spain. For more information, contact Marjo Jarvinen at 33.1.44.69.84.82 or go to www.ciesfoodsafety.com.
- **24–26, Dubai International Food Safety Conference,** Dubai Convention and Exhibition Centre, Dubai. For more information, go to www.foodsafetydubai.com.
- **24–27, 6th ASM Biodefense and Emerging Disease Research Meeting,** Baltimore, MD. For more information, go to www.asm.org.

MARCH

- **25, Advanced Artisan Cheese Making Workshop,** University of Idaho, Food Science and Toxicology Dept., Gooding, ID. For more information, contact Paula Peterman at 208.364.6188; E-mail: paulap@uidaho.edu.

ADVERTISING INDEX

FOOD AND ENVIRONMENTAL HYGIENE DEPARTMENT
(Non-civil Service Vacancy)

Food Safety Officer (Salary: HK $80,920/about US $10,370 per month)

Entry Requirements:

(a) A university degree and higher qualification(s) in Food Science, Food Technology, Nutritional Science, Dietetics, Food Toxicology, Food Microbiology, Food Biotechnology, or related subjects from a Hong Kong University, or equivalent;

(b) at least 10 years' relevant post-graduate experience in food safety and related field, including exposure assessment, risk assessment and food safety standard setting; 5 years of which should be in a position with supervisory responsibilities; and

(c) have Level 2 or above in English Language in the Hong Kong Certificate of Education Examination (HKCEE), or equivalent.

(Note: Preference will be given to candidates with a Master of Public Health or related discipline with training in Epidemiology and Biostatistics at a post-graduate level and Chinese language proficiency.)

Duties: Reviewing and updating food safety standards with reference to international and national standards and guidelines; liaising with the Food and Health Bureau and government departments concerned on proposed legislative amendments in relation to food safety standards; organizing and conducting public consultation and technical meetings with the trade and other stakeholders pertaining to food standards setting; and enhancing liaison with international and national food authorities, government departments and food industry on food standards setting.

Terms of Appointment: Successful candidates will be appointed on non-civil service contract terms for a period of three years.

Gratuity: A gratuity up to about HK$400,968/US$51,400 may be granted upon satisfactory completion of the contract with consistently high standard of performance and conduct. The amount of gratuity will be the sum which, when added together with the Government's contribution to the Mandatory Provident Fund Scheme, equals to 15% of the total basic salary drawn during the contract period. (Note: At current rates, salaries tax does not exceed 15% of gross income.)

Fringe Benefits: In addition to rest days, statutory holidays (or substituted holidays), maternity leave and sickness allowance granted in accordance with the provisions in the Employment Ordinance, 14 days of paid annual leave will be granted under a continuous contract of employment for every 12 months.

How to Apply: Application forms [G.F. 340 (Rev. 3/2008)] are obtainable from any Public Enquiry Service Centre of District Office, Home Affairs Department or any Job Centres of the Employment Services Division, Labour Department. The said form can also be downloaded from the Civil Service Bureau's Internet web site (http://www.csb.gov.hk). Completed forms with copies of relevant documents including certificates and transcripts of studies should be sent by mail or by hand to the specified address below **on or before 21 November 2008**. Online application can also be made through the Civil Service Bureau's website (http://www.csb.gov.hk). Candidates who apply online should submit the above documents by mail or by hand to the specified address below **on or before 21 November 2008**. Please clearly mark on the envelope "Application for Food Safety Officer". Applications which are incomplete or without such documents will not be considered. Candidates who are selected for interview will normally receive an invitation in about four to eight weeks after the closing date for application. Those who are not invited for interview may assume that their applications are unsuccessful.

Address and Enquiry Tel.: Executive Officer (Appointments 2) 1, Appointments Section, Food and Environmental Hygiene Department, 44/F., Queensway Government Offices, 66 Queensway, Hong Kong (Fax: (852) 2869 0015). For enquiries, please call (852) 2867 5044 or e-mail to susansslau@fehd.gov.hk.

Closing Date for Application: 21 November 2008.

General Notes:

(a) Non-civil service vacancies are not posts on the civil service establishment. Candidates appointed are not on civil service terms of appointment and conditions of service. Candidates appointed are not civil servants and will not be eligible for posting, promotion or transfer to any posts in the Civil Service.

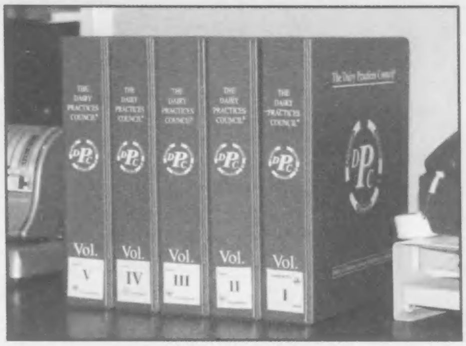
(b) Permanent or non-permanent residents of the HKSAR will both be considered for this post. Persons who are not permanent residents of the HKSAR will be appointed only when no suitable and qualified candidates who are permanent residents of the HKSAR are available.

(c) The entry pay, terms of appointment and conditions of service to be offered are subject to the provisions prevailing at the time the offer of appointment is made.

(d) It is Government policy to place people with a disability in appropriate jobs wherever possible. If a disabled candidate meets the entry requirements, he/she will be invited to attend the selection interview without being subject to any further shortlisting criteria.

(e) Holders of academic qualifications other than those obtained from Hong Kong institutions/Hong Kong Examinations and Assessment Authority may also apply but their qualifications will be subject to assessments on equivalence with the required entry qualifications. They should submit copies of their official transcripts and certificates by mail to the above specified address, by fax to (852) 2869 0015 or by e-mail to susansslau@fehd.gov.hk.

(f) Non-civil service vacancies information contained in this column is also available on the following Internet web sites: http://www.gov.hk of the GovHK and http://www.fehd.gov.hk of the Food and Environmental Hygiene Department.



IAFP

Offers

"Guidelines for the Dairy Industry"

from

The Dairy Practices Council®

This newly expanded Five-volume set consists of 82 guidelines. Now Available on CD

1 Planning Dairy Freestall Barns
2 Effective Installation, Cleaning, and Sanitizing of Milking Systems
3 Selected Personnel in Milk Sanitation
4 Installation, Cleaning, & Sanitizing of Large Parlor Milking Systems
5 Directory of Dairy Farm Building & Milking System Resource People
6 Natural Ventilation for Dairy Tie Stall Barns
7 Sampling Fluid Milk
8 Good Manufacturing Practices for Dairy Processing Plants
9 Fundamentals of Cleaning & Sanitizing Farm Milk Handling Equipment
10 Maintaining & Testing Fluid Milk Shelf-Life
11 Sediment Testing & Producing Clean Milk
12 Tunnel Ventilation for Dairy Tie Stall Barns
13 Environmental Air Control and Quality for Dairy Food Plants
14 Clean Room Technology
15 Milking Center Wastewater
16 Handling Dairy Products from Processing to Consumption
17 Prevention of & Testing for Added Water in Milk
18 Fieldperson's Guide to High Somatic Cell Counts
21 Raw Milk Quality Tests
22 Control of Antibacterial Drugs & Growth Inhibitors in Milk and Milk Products
24 Troubleshooting High Bacteria Counts of Raw Milk
25 Cleaning & Sanitation Responsibilities for Bulk Pickup & Transport Tankers
27 Dairy Manure Management From Barn to Storage
28 Troubleshooting Residual Films on Dairy Farm Milk Handling Equipment
29 Cleaning & Sanitizing in Fluid Milk Processing Plants
30 Potable Water on Dairy Farms
31 Composition & Nutritive Value of Dairy Products
32 Fat Test Variations in Raw Milk
33 Brucellosis & Some Other Milkborne Diseases
34 Butterfat Determinations of Various Dairy Products
35 Dairy Plant Waste Management
36 Dairy Farm Inspection
37 Planning Dairy Stall Barns
38 Preventing Off-Flavors and Rancid Flavors in Milk
39 Grade A Fluid Milk Plant Inspection
40 Controlling Fluid Milk Volume and Fat Losses
41 Milkrooms and Bulk Tank Installations
42 Stray Voltage on Dairy Farms
43 Farm Tank Calibrating and Checking
45 Gravity Flow Gutters for Manure Removal in Milking Barns
46 Dairy Odor Management
48 Cooling Milk on the Farm
49 Pre- & Postmilking Teat Disinfectants
50 Farm Bulk Milk Collection Procedures
51 Controlling the Accuracy of Electronic Testing Instruments for Milk Components
53 Vitamin Fortification of Fluid Milk Products
54 Selection of Elevated Milking Parlors
54S Construction Materials for Milking Parlors
56 Dairy Product Safety (Pathogenic Bacteria) for Fluid Milk and Frozen Dessert Plants
57 Dairy Plant Sanitation
58 Sizing Dairy Farm Water Heater Systems
59 Production and Regulation of Quality Dairy Goat Milk
60 Trouble Shooting Microbial Defects: Product Line Sampling & Hygiene Monitoring
61 Frozen Dessert Processing
62 Resources For Dairy Equipment Construction Evaluation
63 Controlling The Quality And Use Of Dairy Product Rework
64 Control Points for Good Management Practices on Dairy Farms
65 Installing & Operating Milk Precoolers Properly on Dairy Farms
66 Planning A Dairy Complex - "100+ Questions To Ask"
69 Abnormal Milk - Risk Reduction and HACCP
70 Design, Installation & Cleaning of Small Ruminant Milking Systems
71 Farmers Guide To Somatic Cell Counts In Sheep
72 Farmers Guide To Somatic Cell Counts In Goats
73 Layout of Dairy Milk Houses for Small Ruminant Operations
75 Direct Microscopic Exam of Milk from Small Ruminants (training CD)
78 Biosecurity for Sheep and Goat Dairies
80 Food Allergen Awareness In Dairy Plant Operations
83 Bottling Water in Fluid Milk Plants
85 Six Steps to Success - Production of Low SCC Milk (training CD)
90 On-Farm & Small-Scale Dairy Products Processing
91 HACCP - SSOP's and Prerequisites
92 HACCP - Principle Number One: Hazard Analysis
93 HACCP - Principles 2 & 3 Critical Control Points & Critical Limits
97 Direct Loading of Milk from Parlor into Bulk Tankers
98 Milking Procedures for Dairy Cattle
100 Food Safety in Farmstead Cheesemaking
101 Farmers Guide To Somatic Cell Counts In Cattle
102 Effective Installation, Cleaning & Sanitizing of Tie Barn Milking Systems
103 Approving Milk and Milk Product Plants for Extended Runs
105 Sealing Bulk Milk Truck Tanks
106 On Farm Anaerobic Digesters "100+ Questions to Ask

IAFP has agreed with The Dairy Practices Council to distribute their guidelines. DPC is a non-profit organization of education, industry and regulatory personnel concerned with milk quality and sanitation throughout the United States. In addition, its membership roster lists individuals and organizations throughout the world.

For the past 38 years, DPC's primary mission has been the development and distribution of educational guidelines directed to proper and improved sanitation practices in the production, processing, and distribution of high quality milk and milk products.

The DPC Guidelines are written by professionals who comprise six permanent task forces. Prior to distribution, every guideline is submitted for approval to the state regulatory agencies in each member state. Should any official have an exception to a section of a proposed guideline, that exception is noted in the final document.

The guidelines are renown for their common sense and useful approach to proper and improved sanitation practices. We think they will be a valuable addition to your professional reference library.

If purchased individually, the entire set would cost \$442.00. We are offering the set, packaged in five looseleaf binders for \$330.00.

IF PURCHASED ON CD, take a 10% discount plus FREE shipping world wide.

To purchase this important source of information, complete the order form below and mail or fax (515-276-8655) to IAFP.

Please enclose \$330.00 plus \$17.00 shipping and handling for each set of guidelines within the U.S. Outside U.S., shipping will depend on existing rates. Payment in U.S. \$ drawn on a U.S. bank or by credit card.

I would like to order: Hard Copy ☐ CD ☐

Name ____________ Phone No. ____________

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Journal of Food Protection®

ISSN: 0362-028X
Official Publication

International Association for Food Protection.

Reg. U.S. Pat. Off.

Vol. 71 | September 2008 | No. 9

Research Notes

Review

*Asterisk indicates author for correspondence.

AUDIOVISUAL LIBRARY ORDER FORM

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

International Association for
Food Protection®

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E-Mail: info@foodprotection.org
Web Site: www.foodprotection.org

Member # ______________________

First Name ______________________ M.I. ______ Last Name ______________________

Company ______________________ Job Title ______________________

Mailing Address ______________________

Please specify: ❏ Home ❏ Work

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Postal Code/Zip + 4 ______________________ Country ______________________

Telephone # ______________________ Fax # ______________________

E-Mail ______________________ Date Needed ______________________

PLEASE CHECK BOX NEXT TO YOUR VIDEO CHOICE

(Allow 4 weeks minimum from date of request.)

DAIRY

- ❏ D1010 The Bulk Milk Hauler: Protocol & Procedures
- ❏ D1030 Cold Hard Facts
- ❏ D1031 Dairy Plant
- ❏ D1040 Ether Extraction Method for Determination of Raw Milk
- ❏ D1050 Food Safety: Dairy Details
- ❏ D1060 Frozen Dairy Products
- ❏ D1070 The Gerber Butterfat Test
- ❏ D1080 High-Temperature, Short-Time Pasteurizer
- ❏ D1090 Managing Milking Quality
- ❏ D1100 Mastitis Prevention and Control
- ❏ D1105 Milk Hauling Training
- ❏ D1110 Milk Plant Sanitation: Chemical Solution
- ❏ D1120 Milk Processing Plant Inspection Procedures
- ❏ D1125 Ohio Bulk Milk Hauling Video
- ❏ D1130 Pasteurizer: Design and Regulation
- ❏ D1140 Pasteurizer: Operation
- ❏ D1150 Processing Fluid Milk
- ❏ D1180 10 Points to Dairy Quality

ENVIRONMENTAL

- ❏ E2012 Better TEDs for Better Fisheries
- ❏ E3010 The ABC's of Clean – A Handwashing and Cleanliness Program for Early Childhood Programs
- ❏ E3020 Acceptable Risks?
- ❏ E3030 Air Pollution: Indoor
- ❏ E3031 Allergy Beware
- ❏ E3040 Asbestos Awareness
- ❏ E3055 Effective Handwashing – Preventing Cross-Contamination in the Food Service Industry
- ❏ E3060 EPA Test Methods for Freshwater Effluent Toxicity Tests (Using Ceriodaphnia)
- ❏ E3070 EPA Test Methods for Freshwater Toxicity Tests (Using Fathead Minnow Larva)
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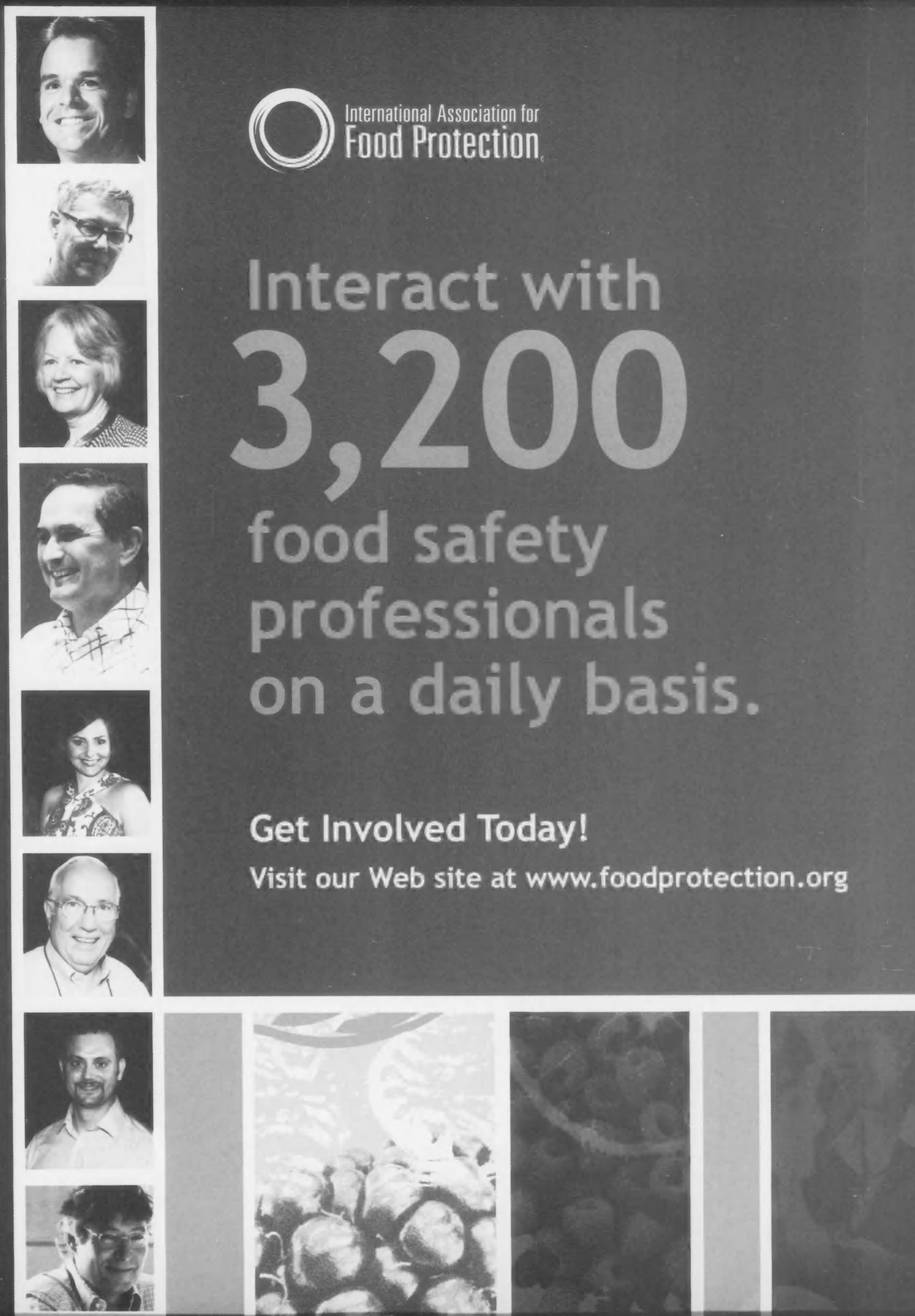
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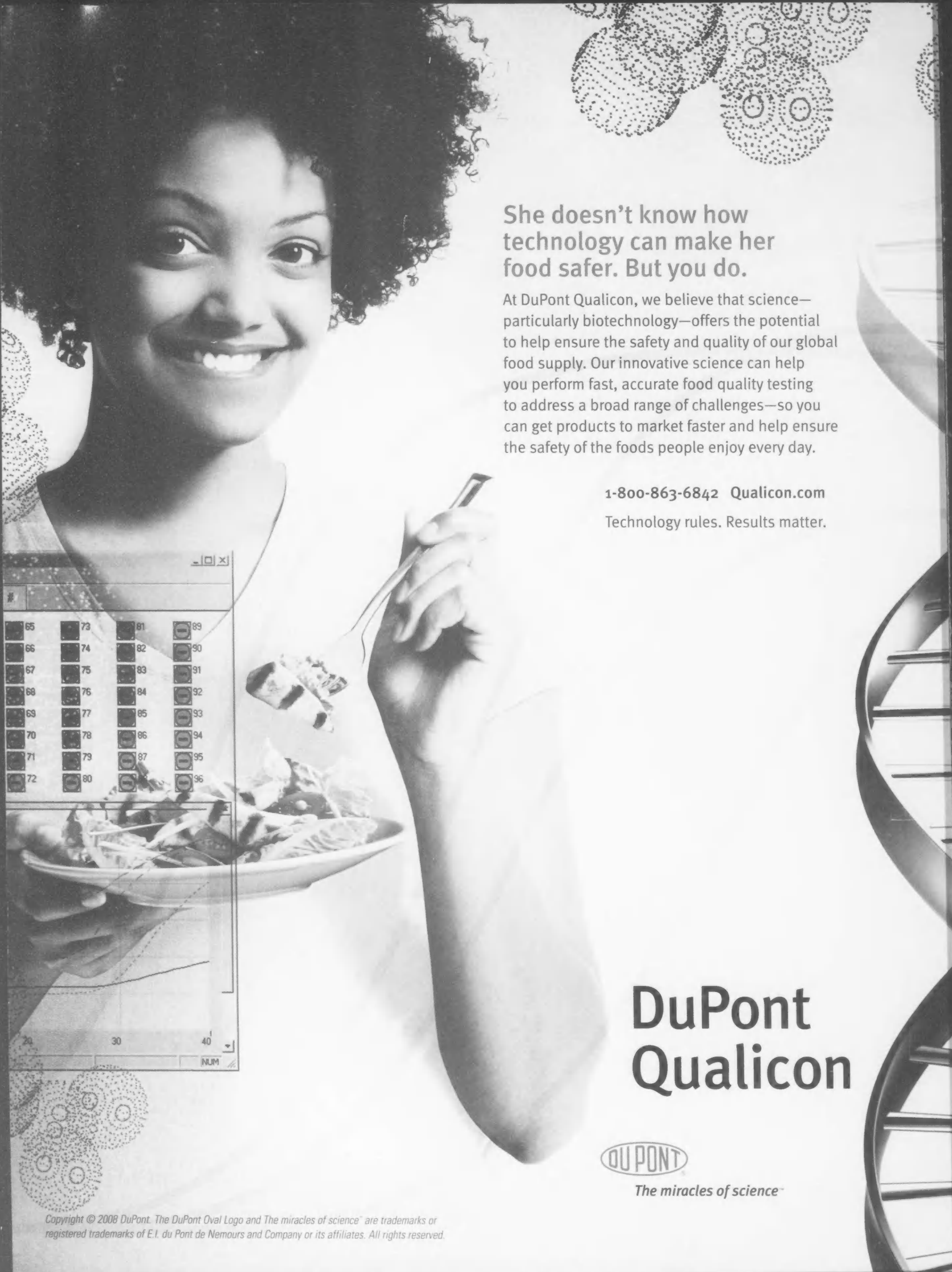
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