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Food Protection Trends

Science and News from the International Association for Food Protection

Salmonellosis Cases

Genetically Engineered Salmon

IAFP 2008

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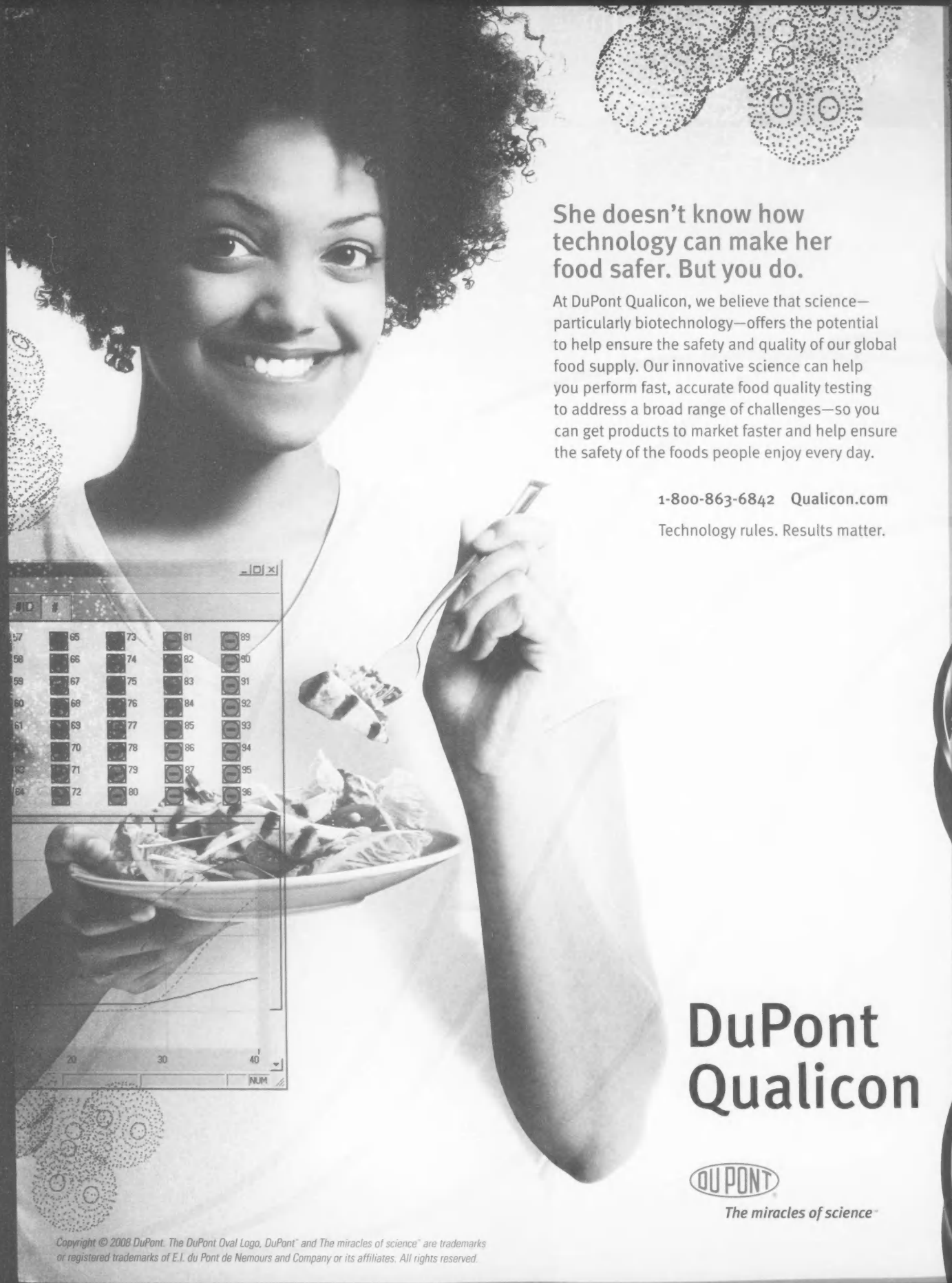

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International Association for Food Protection

FOOD PROTECTION TRENDS

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SCIENCE AND NEWS FROM THE INTERNATIONAL ASSOCIATION FOR FOOD PROTECTION

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FOOD PROTECTION TRENDS

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"LONE STAR PERSPECTIVE"
FROM YOUR PRESIDENT

By GARY ACUFF
PRESIDENT

"IAFP provides a unique opportunity for the sharing of ideas and data"

When I was a graduate student starting my career in food microbiology, I remember taking my first food microbiology class and beginning to realize that this field was something special. That class was taught by Dr. Carl Vanderzant, who was also my advisor for two graduate degrees at Texas A&M University. He obviously loved the field, and he taught his class with such passion and conviction that it was impossible to sit through lectures without constructing a mental picture of the pioneers in food microbiology he discussed. All the classic contributions were covered, of course, but the individuals who were most intriguing to me were those whose discoveries and contributions were more recent. For example, I remember being amazed by John Silliker's work with *Salmonella* and how he had used that knowledge to build a commercial laboratory, now internationally established. Dr. Vanderzant talked of Don Splitstoesser at Cornell University and how he studied the ecology of the microflora established during the processing season in produce packing sheds. We learned of Bruce Tompkin's studies in meat microbiology and how he had worked to reduce nitrite levels in cured meats, and of Bill Sperber and his work with HACCP and process control at Pillsbury. Of course, the reason these individuals were highlighted in class was likely because Dr. Vanderzant was impressed with their contributions as well. That is the power of being a professor, I suppose—the opportunity to mold students' thinking. In any case, let's just say I was duly impressed and began to construct a list of my own "food safety heroes."

Sometime after I was well into my graduate studies, there was a lull in laboratory activity. I can't remember why; we were probably just between projects or something. Spring Break arrived, and I was anticipating the opportunity to vegetate for a week and take a vacation from working in the laboratory. Dr. Vanderzant, of course, had something quite different in mind. He caught me in the hallway right before Spring Break began and inquired as to my plans for the approaching holiday. I replied that I might watch a movie or two, read a book, do some cooking… As I spoke and noted his reaction, I knew that I had made a fatal mistake—I should have planned to leave town. He replied that my plans sounded very relaxing, but inquired as to what I would be doing "in the daytime." Surely I didn't intend to spend the entire time doing nothing constructive. Naturally, he had an idea. He was working on the proofs for a book that would soon be published, called *An Evaluation of the Role of Microbiological Criteria for Foods and Food Ingredients*. The title was so long that everyone just referred to it as the "Green Book." This book was a report for the National Research Council and contained a collection of chapters written by people who were icons in the field of food microbiology. Dr. Vanderzant was the Chair of the committee that assembled the report, so he wanted to make sure that every chapter was perfect, that there were no typographical errors, and that the text read clearly. What better way to accomplish that than to have your graduate student read every word to you during Spring Break? And I do mean every word. And every number in every table. Each period and colon in each reference. I spent the entire Spring Break reading that book out loud to Dr. Vanderzant so he could check the proofs. The end result of this, however, was that I learned of more food safety heroes,

and I continued to add to my list of people who impressed me with their contributions to the field. Of course, I had never personally met any of these individuals, so I had to build a mental image of how I expected them to look.

Dr. Vanderzant had a tradition of allowing his senior graduate student to accompany him to Annual Meetings. The tradition was likely due to a shortage of travel funds, but this resulted in the pool of graduate students looking forward to the day when they would get the chance to attend the professional meetings. What an opportunity! A chance to go to the Annual IAMFES Meeting (it was not called IAFP at that time) with Dr. Vanderzant and meet all the individuals I had studied and admired. Of course, in my mind, they all looked like movie stars. The mental image I had constructed of each person was in line with their magnificent contributions to food safety. I specifically remember being surprised to find that I was actually taller than Dr. Splitstoesser, as I had pictured him with a height of at least six feet!

I talked with each individual I met about their research and always mentioned that I had read their publications with great interest and admiration. They seemed surprised. It turns out that all these "food safety heroes" I had wanted to meet were just normal, everyday, average, friendly people. They all encouraged me to continue studying and said they were available to help if I ever needed them. Needless to say, I was on "Cloud Nine!"

Not too long ago at our Annual Meeting, a student approached me and mentioned that he had read about all my work with carcass decontamination. He seemed very excited to meet me and talked for some time about his work and how our research was similar and connected. I realized that he had a list of "food safety heroes" and I was on that list. What an honor!

Now all this may seem a little geeky—"food safety heroes." But I think we all remember when we began to realize this was the field for us, that this was where we wanted to build our careers, that food safety was something we could wrap our arms around. IAFP provides a unique opportunity for the sharing of ideas and data, but it also provides an outstanding opportunity for personal relationships with our colleagues. The older I get, the more I realize that Annual Meetings are not just for attending symposia, but for catching up with old friends, for talking with students who will be the future of our field. For meeting your "food safety heroes."

We all have our group of friends that we look forward to visiting with at Annual Meetings and at other events. Let me encourage you to expand that group of colleagues. Visit with students. Let them know that their choice for a field of study was a good one, that you are available to help and that you welcome them into the group of professionals who are *Advancing Food Safety Worldwide*®. And while you are at it, sign them up for a student membership!

If you haven't made plans yet to attend the IAFP 2008 Annual Meeting in Columbus, Ohio, do so now. Some aspiring new food microbiologist may be looking for you, and the meeting won't be the same without all our "food safety heroes" in attendance.

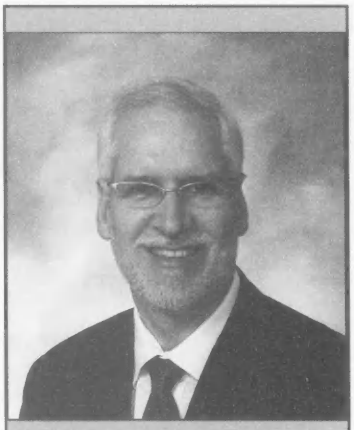
Comments or questions? As always, you can contact me by E-mail at gacuff@tamu.edu.

"COMMENTARY" FROM THE EXECUTIVE DIRECTOR

Look at how IAFP grows! Not too long ago, we announced that IAFP Member dues were being reduced to a base level of $50 per year. By making this substantial change, we sent a message to IAFP Members that we felt it was important to keep you involved with the world's leading food safety organization! We also wanted this message to carry across all borders, to resonate with all nationalities from every corner of our world. To allow access to being an IAFP Member for the same price no matter where you live, no matter who you are; to make participation in IAFP affordable for everyone!

Well, this magic formula is working very well. Without promotion or advertising, just by word of mouth, our Membership has increased by 7%. Now ponder, what is possible if we actually promoted this bargain? Well, we are about to find out!

IAFP has accumulated a substantial amount of contact information for food safety professionals in our database over the years. Some of our information comes from attendance by non-members at IAFP Annual Meetings and sponsored symposia, others from orders received and still more from those Members who have not renewed their Membership in past years. At any rate, we have designed a series of mailings to send to those in our database who are not Members. If just 10% respond by becoming Members, we could increase our active Membership list by another 14%! Wouldn't this be fantastic?



By DAVID W. THARP, CAE
EXECUTIVE DIRECTOR

"IAFP will always be on the lookout for new ideas, ways to adjust to what our Members need and want"

We are sharing this information because we need your help! When your colleagues ask you if you know about IAFP, you can reply with an enthusiastic, YES! When they ask you what you get from IAFP, you can reply with, INFORMATION! That list of information includes, but is not limited to:

1. The latest information on protecting the food supply.
2. Contacts with leading food safety authorities.
3. Cutting-edge research published in the *Journal of Food Protection*.
4. Applied articles based on sound science from *Food Protection Trends*.
5. Short, concise, current information reported in the *IAFP Report*.
6. Face-to-face discussion and interaction at IAFP Annual Meetings.
7. Knowing you are a part of an Association providing leading food safety information to a world-wide audience.

As I said, this is not an all inclusive list by any means, but it provides a tip of the many things that IAFP is known for in the food protection community.

So, if your colleagues begin to receive our mailings, encourage them to join IAFP so they can become a part of the Association that "provides food safety professionals world-wide with a forum to exchange information on protecting the food supply." They will be glad you encouraged them to join and you will feel good about helping your colleagues grow their knowledge and also grow professionally. Even if your colleagues do not receive our mailing, you can encourage their participation and involvement in IAFP!

It has been explained before, but when IAFP changed our dues structure it was done to allow our Members to choose the information they wanted without being forced to receive journals they did not

want or need. Under the current system, Members may choose to receive print copies of either *FPT* or *JFP*. They may choose to receive *JFP* Online and soon will be able to choose *FPT* in a full-copy, Online version. So, the options for Members will increase in the near future.

As we continue to progress, IAFP will always be on the lookout for new ideas, ways to adjust to what our Members need and want, and for new opportunities to bring together food safety professionals in our efforts to continue "Advancing Food Safety Worldwide." Please join with us and do your part to encourage others to become involved with IAFP!

ARTICLES

Food Protection Trends, Vol. 28, No. 5, Pages 304-313

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

International Association for Food Protection

Characterization of 386 Non-typhoidal Salmonellosis Cases in North Dakota from 2000 to 2005

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SUMMARY

The objectives of this study were to compare salmonellosis incidence in North Dakota (ND) to the United States average and to describe food histories as well as to identify factors associated with severe salmonellosis and longer hospitalization. Data on salmonellosis cases (2000–2005) were obtained from the ND Department of Health. Chi-square tests, binary logistic regression, and multinomial logistic regression were used to determine variables that best predicted severe salmonellosis and long duration of hospitalization. There were 386 cases from 45/53 ND counties, with incidence rates ranging from 1 to 21/10,000. Forty-five *Salmonella* serotypes were reported, including *S.* Typhimurium (33.1%), *S.* Enteritidis (14.2%), *S.* Heidelberg (11.7%) and *S.* Newport (11.4%). Among foods associated with salmonellosis, fresh produce ranked first. Traveling, contact with farm animals, and consumption of milk products were exposure factors that were associated with development of severe salmonellosis, whereas cramps or diarrhea were symptons that predicted severity of disease. In addition, the odds of longer hospitalization increased for persons older than 60, and for those with fever, nausea, or vomiting. Salmonellosis incidence in ND (1/10,000) was lower than the national average (1.5/10,000). This information is vital in guiding health providers and consumer educators in their efforts to raise risk factor awareness of the public, food processors, and service industries in order to target achievable salmonellosis control strategies.

A peer-reviewed article

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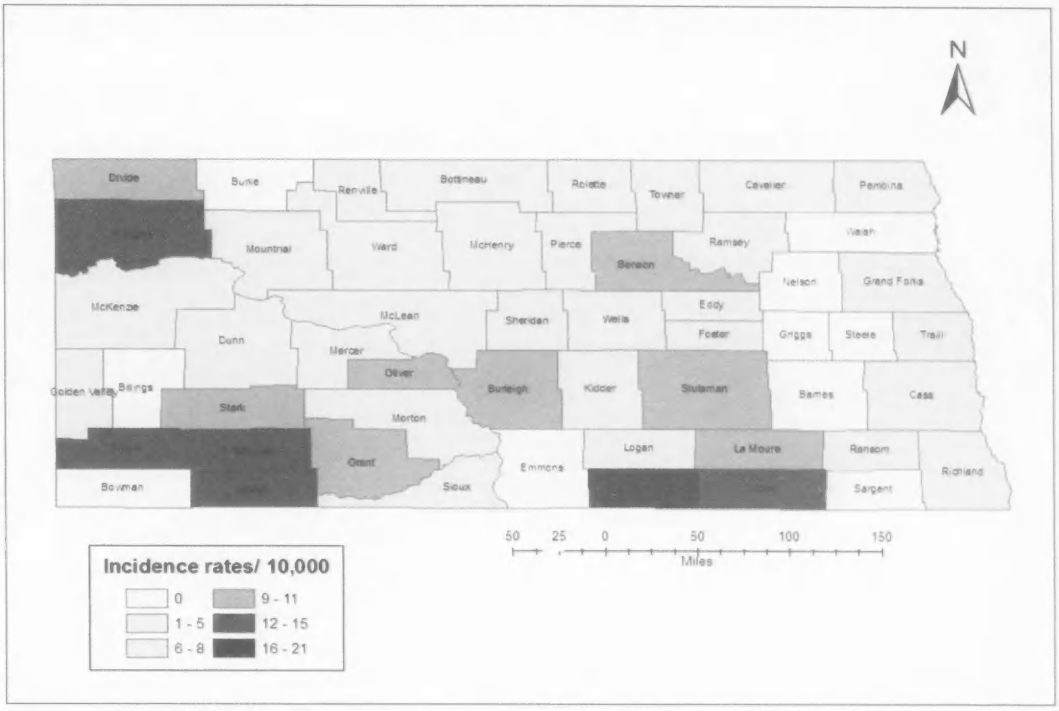
FIGURE 1. Incidence rates of human salmonellosis in North Dakota: 386 cases (2000–2005)



INTRODUCTION

Non-typhoidal salmonellosis is a common foodborne illness in humans in the United States *(7)*. National surveillance for *Salmonella* infections was established in 1962 following recognition of the importance of *Salmonella* organisms as the cause of a potentially preventable infectious disease. All health care providers and laboratories in the US are mandated by law to report a positive associated case of this disease to the health department, which then reports to the Centers for Disease Control and Prevention (CDC) *(1)*. In spite of an efficient surveillance system, many cases may still not be reported because the ill persons do not seek medical care because of the self-limiting nature of the disease or because health-care providers do not obtain a specimen for diagnosis. In addition, the laboratories may not perform the necessary diagnostic tests, or the laboratory findings may not be communicated to public health officials, resulting in underreporting of cases. Nevertheless, CDC estimates that 1.4 million people in the US are affected annually by salmonellosis alone, of which approximately 40,000 are reported every year, and that about 600 of these die each year *(15)*.

Most persons infected with *Salmonella* develop diarrhea, fever, and abdominal cramps 12 to 72 hours after infection. The illness usually lasts 4 to 7 days, and most persons recover without treatment *(9)*. However, in some persons the diarrhea may be so severe that the patient needs to be hospitalized. In these patients, the *Salmonella* infection may spread from the intestines to the blood stream and then to other body sites, and death can result unless the person is treated promptly with antibiotics. The elderly, infants, and those with impaired immune systems are particularly likely to have a severe illness *(20)*.

Salmonella organisms can be found in many environments, including water, soil, insects, factory and kitchen surfaces, animal feces, and the unwashed hands of food handlers *(9)*. *Salmonella* is also widespread in live animals *(16, 24)*; in North Dakota (ND), there are reports of *Salmonella* infection contracted from an iguana that was kept as a pet *(2)*. Additionally, *Salmonella* was isolated from a hamster that was purchased from a pet store in ND *(17)*; fortunately, no human case of salmonellosis was associated with *Salmonella* from the hamster. Furthermore, a variety of foods, including contaminated breast milk, ice cream, raw meats, poultry, eggs, sea foods, and fresh produce *(5, 6, 8, 11, 12, 22, 23, 26, 27)*, have been implicated in human *Salmonella* infections. In North Dakota, a positive case of salmonellosis was associated with eating improperly cooked turkey meat *(18)*.

This study was designed based on the hypothesis that salmonellosis incidence rates in North Dakota are comparable to the national average rates and that consumption of certain foods is particularly highly associated with human salmonellosis. Similarly, it was hypothesized that one or a combination of exposure factors and development of certain symptoms determine severity of salmonellosis or duration of hospitalization. The objectives of this study were to compare salmonellosis incidence rates in North Dakota to the national average, and to describe the food history and other exposure factors associated with salmonellosis infections in humans in North Dakota. In addition, the study sought to develop models that would best predict severe salmonellosis and duration of hospitalization based on symptoms and exposure factors.

MATERIALS AND METHODS

Data sources

Salmonellosis cases were extracted from the enteric disease investigation database of the North Dakota Department of Health (NDDoH) for the period 2000 to 2005. The extracted variables included food history, symptoms, and several exposure factors. The NDDoH was using a similar standardized surveillance tool (questionnaire) for investigation of all enteric diseases. This form required entry of information on exposure factors two weeks prior to onset of illness in order to capture data on listeriosis, which has a much longer incubation period than most enteric organisms. The NDDoH field epidemiologists are trained to know how far back to go in history for each organism, and for the most part, they try to obtain a 3-day history. For salmonellosis investigation, therefore, data were collected on the food history for 3 days prior to illness (Goplin J, Foodborne Surveillance Epidemiologist, North Dakota Department of Heath, personal communication, January, 2007). The food items in this analysis were categorized as red meats (beef, pork, and lamb), turkey meat, eggs, chicken, cold cuts (unspecified type of red meat, turkey or chicken), sea foods (fish, crabs, oysters, and shrimps), fresh produce (vegetables, fruits, juice, and salad), and milk products (milk, ice cream, yogurt, and breast milk).

Information on symptoms and onset dates and times of each symptom was obtained from reviewing the medical chart, if available. This information was then confirmed by interviewing the patients (in case of adults) or caretakers (in case of children). (Goplin J, Foodborne Surveillance Epidemiologist, North Dakota Department of Heath, personal communication, January, 2007). The symptoms included fever, diarrhea, vomiting, headache, cramps, nausea, chills, blood in stool, and other complications (blood in urine, anorexia, back pain, arthritis, heart pain, or weight loss). Demographic factors included age and sex of a patient; exposure factors included animal contact (dog, cat, reptile, or farm animal), travel within or outside the US (30 days prior to onset of illness), eating in a restaurant (or commercial food establishment or group gathering) within 14 days prior to onset of illness, and drinking well water. Other information included county of residence; antibiotic use for salmonellosis; year and month of onset of illness; and date of admission and discharge from the hospital. If the interview was completed before the patient was discharged, NDDoH staff did not always go back to get information on the discharge date. Therefore, hospitalization dates but no discharge dates were available for some patients. The variable "month" was further categorized into seasons such as fall (September, October, and November), winter (December, January, and February), spring (March, April, and May) and summer (June, July, and August). Severity of salmonellosis was the outcome variable, and a severe case of salmonellosis was defined as a person with *Salmonella* infection who was hospitalized or received antibiotics as an outpatient. Duration of hospitalization as an outcome variable was derived from the difference between the discharge date and the admission date.

Statistical analysis

Data were entered into Microsoft Excel and analyzed by use of SAS, version 9.1 (SAS Institute). Mapping the spatial distribution of cases and incidence rates by county were performed with the Geographical Information Systems (GIS). The significance of various relationships between independent and outcome variables was assessed by use of a chi-square test. Independent variables were treated as binary (factor exists = 1 or factor does not exist = 0), and a univariate logistic regression analysis for each independent variable was conducted with $P < 0.05$ being the criterion for the significance of the independent variable to the outcome variable. The severity of salmonellosis infection as an outcome variable was predicted by use of a binary logistic regression model (severe = 1 or not severe = 0), and longer duration of hospitalization was predicted with a multinomial logistic regression method. Days of hospitalization either were zero or ranged from a few hours to 15 days, and these were categorized as no hospitalization = 0, less than a day = 1, 1 to 4 days = 2, and more than 4 days = 3. Further, independent variables were grouped into two broad categories: symptoms and risk factors (food history and exposure factors); separate models were developed for symptoms and risk factors that were significantly associated with severity of salmonellosis and with duration of hospitalization. To select variables for the final models (binary logistic regression model and multinomial logistic regression model), a stepwise strategy (to avoid multicollinearity) was used, with a $P- < 0.25$ being the criterion for acceptance into the model. The variables that ended up in the final model are those that maintained a $P- < 0.05$. In addition, the odds ratio (OR) and a 95% confidence interval (CI) were used to determine the significance of the variable in the model.

RESULTS

Salmonellosis cases by county

A total of 386 cases of salmonellosis were diagnosed from 43 of the 53 counties of ND in the period 2000–2005. Eight of the 43 counties (19%) contributed 262 (68%) of all cases of salmonellosis: Burleigh 67 (17.8%), Cass 62 (16.5%), Ward 27 (7.2%), Grand Forks 23 (6.1%), William 24 (6.4%), Stack 22 (5.8%), Stutsman 20 (5.3%) and Morton 17 (4.5%). Ten counties (Barnes, Billings, Bowman, Burke, Emmons, Griggs, Nelson, Sargent, Steele and Walsh) did not have any diagnosed salmonellosis case. Incidence rates were calculated to account for the population variability among counties. Figure 1 shows that McIntosh County registered the highest incidence rate of 21/10,000 (twenty-one salmonellosis cases among ten thousand people), followed by Williams, Hettinger, Adams, Slope, and Dickey, with a range of 12/10,000 to 15/10,000. The rest of the counties, with relatively high incidence rates of 9/10,000 to 11/10,000, were Divide, Oliver, Burleigh, Stark, Grant, Stutsman, La Moure, and Benson.

Salmonellosis cases by person

Salmonellosis cases were comprised of 191 (50.1%) males and 190 (49.9%) females. The majority of the cases (217, 56%) did not indicate whether they were married or not. However, among those who reported marital status, there was a slightly higher proportion of unmarried cases (90/169, 53.3%) presenting with salmonellosis. The ages of cases/patients ranged from a few months to 94 years (mean ± standard deviation was 35 ± 24 years). Salmonellosis case distribution by age group showed that patients 21–40 years had the highest percentage (93 cases, 24.1%), followed by those aged

TABLE 1. Exposure factors that predicted severity of human salmonellosis in North Dakota: 386 cases (2000–2005)

Exposure Factors (0.15)	Severity cases/Total cases	Univariate Odds Ratio (95% CI)	Univariate *P*-value (0.05)	Stepwise *P*-value
Travel	63/75 (84.0)	5.8 (3.0–11.1)	< 0.0001	0.0002
Restaurant	93/125 (74.4)	3.6 (2.2–5.7)	< 0.0001	.
Well water	24/34 (70.6)	2.1 (0.9–4.6)	0.0494	.
Cat	45/58 (77.6)	3.4 (1.8–6.5)	0.0002	0.0101
Dog	80/109 (73.4)	3.1 (1.9–5.0)	< 0.0001	.
Reptiles	13/21 (61.9)	1.4 (0.6–3.4)	0.4946	0.2441
Farm animals	33/40 (82.5)	4.4 (1.9–10.3)	0.0005	0.0029
Meats	54/77 (70.1)	2.3 (1.3–3.9)	0.0027	.
Fresh produce	91/125 (72.8)	3.1 (2.0–5.0)	< 0.0001	.
Cold cuts	17/27 (62.9)	1.4 (0.6–3.2)	0.3712	0.0982
Sea foods	26/32 (81.3)	4.0 (1.6–9.6)	0.0031	.
Turkey	9/10 (90.0)	7.8 (0.9–61.8)	0.0511	0.2308
Eggs	70/87 (80.5)	4.6 (2.6–8.3)	< 0.0001	0.1837
Chicken	48/65 (73.9)	2.7 (1.5–5.0)	0.0009	0.1825
Milk products	34/43 (79.1)	3.5 (1.6–7.6)	0.0012	0.0233

41–60 years (92 cases, 23.8%), over 60 (63 cases, 16.3%), 3–12 years (58 cases, 15%), 13–20 years (46 cases, 11.9%) and last 0–2 years (34 cases, 8.9%).

Salmonellosis cases by time

The distribution of annual salmonellosis cases showed that 2005 (96, 24.9%) had the highest number of cases, followed by 2001 (73, 18.9%), 2000 (73, 18.9%), 2002 (53, 13.7%), 2004 (46, 11.9%), and last 2003 (45, 11.7%). The number of salmonellosis cases higher in 2000 and 2001, dropped during the period 2002–2004, but then rose again in 2005. The annual distribution of salmonellosis cases was significantly different ($P < 0.0001$). The distribution by season showed that the largest number of salmonellosis reported cases occurred in summer (153, 39.6%), followed by fall (83, 21.5%), winter (77, 20%) and spring (18.9%) ($P < 0.0001$).

Salmonellosis cases by food history

Patients sought medical assistance from primary care physicians without any evidence of a causative vehicle. Overall, 177 (45.9%) of the cases did not report the food items that they had eaten. Among those who mentioned a food item they had eaten, 188/209 (90%) mentioned more than one food. Turkey meat consumption was reported by 10 (2.6%) cases, cold cuts by 27 (7%), seafood by 32 (8.3%), milk and milk products by 43 (11.1%), meats by 77 (20%), chicken by 65 (16.8%), and eggs by 87 (22.6%); the greatest percentage had eaten fresh produce (125, 32.4%).

Salmonellosis cases by serotype

Forty-five different serotypes were recovered from 71.8% (277/386) of the patients. The four major ones, contributing over 70% of the cases, were *S.* Typhimurium (93, 33.1%), *S.* Enteritidis (40, 14.2%), *S.* Heidelberg (33, 11.7%) and *S.* Newport (32, 11.4%). The rest of the serotypes were *S.* Saintpaul and *S.* Montevideo from eight cases each; *S.* Thompson from five cases; *S.* Hadar from four cases; and *S.* Stanley, *S.* Poona, *S.* Mbandaka, *S.* Javiana, *S.* Braenderup and *S.* Bredeney from three patients each. *S.* Reading, *S.* Oranienburg, *S.* Hillington, *S.* Derby, *S.* Urbana, and *S.* Albany were recovered from 2 cases each. One case each was associated with *S.* Agona, *S.* Berta, *S.* Bleadon, *S.* Blockley, *S.* Chameleon, *S.* Ealing, *S.* Edinburgh, *S.* Havana, *S.* Ibadan, *S.* Indiana, *S.* Infantis, *S.* Istanbul, *S.* Lexington, *S.* Litchfield, *S.* Manhattan, *S.* Marina, *S.* Miami, *S.* Mississippi, *S.* Muenchen, *S.* Newport, *S.* Othmarschen, *S.* Sandiego, *S.* Schwarzengrund, *S.* Senftenberg, *S.* Sepsis, *S.* Syrsis, *S.* Tripoli, *S.* Uppsala, and *S.* Weltevereden.

Salmonellosis cases by symptoms

Symptoms that were recorded from patients seeking medical attention included cramps by 221 (57.3%) of the cases, diarrhea (206, 53.4%), fever (154, 39.9%), nausea (122, 31.6%), blood in the stool (77, 19.6%), vomiting (71, 18.4%), headache (21, 5.4%), chills (21, 5.4%), and other complications (16, 4.1%). When univariate logistic regression is used, the results show that age was not significantly different for patients who had fever, diarrhea, cramps, headache, blood in the stool or chills. The 21–40

TABLE 2. Demographic characteristics that predicted severity of human salmonellosis in North Dakota: 386 cases (2000–2005)

Demographic characteristics	Severity cases/Total cases	Univariate Odds Ratio (95% CI)	Univariate *P*-value (0.05)	Stepwise *P*-value (0.15)
Age: 0–2	18/34 (52.9)	0.8 (0.4–1.9)	0.8963	0.0214
Age: 3–12	27/58 (46.6)	0.7 (0.3–1.3)	0.2208	0.0106
Age: 13–20	23/46 (50.0)	0.8 (0.4–1.5)	0.5525	0.0066
Age: 21–40	53/93 (57.0)	Ref	Ref	Ref
Age: 41–60	52/92 (56.5)	1.1 (0.5–1.8)	0.6046	0.6840
Age: > 60	38/63 (60.3)	1.1 (0.6–2.2)	0.2693	0.0909
Sex: Female	109/192 (56.8)	Ref	Ref	Ref
Male	100/191 (52.4)	0.8 (0.6–1.2)	0.3794	.

TABLE 3. Symptoms that predicted severity of human salmonellosis in North Dakota: 386 cases (2000–2005)

Symptoms	Severity cases/Total cases	Univariate Odds Ratio (95% CI)	Univariate *P*-value (0.05)	Stepwise *P*-value (0.15)
Fever	117/154 (75.9)	4.6 (3.0–7.3)	< 0.0001	.
Diarrhea	153/206 (74.3)	6.1 (3.9–9.4)	< 0.0001	0.0004
Vomiting	60/71 (84.5)	5.9 (3.0–11.7)	< 0.0001	0.0663
Cramps	164/221 (74.2)	7.2 (4.5–11.4)	< 0.0001	<0.0001
Nausea	99/122 (81.2)	5.8 (3.5–9.8)	< 0.0001	0.0006
Headache	16/21 (76.2)	2.7 (1.0–7.8)	0.0458	.
Blood in stool	61/77 (79.2)	4.0 (2.2–7.3)	< 0.0001	0.0669
Chills	19/21 (90.5)	8.6 (2.0–37.3)	0.0039	0.1226
Complications	12/16 (75.0%)	2.0 (0.8–8.1)	0.1065	0.0467

year age group had reduced odds of vomiting (OR = 0.4; 95% CI = 0.2–0.9) and reduced odds of other complications (OR = 0.2; 95% CI = 0.03–0.9) compared to 13–20 years old.

Severity of salmonellosis

A severe case of salmonellosis was defined as one in which a person with *Salmonella* infection was hospitalized or received antibiotics as an outpatient. The number of cases that reported taking antibiotics for the treatment of salmonellosis was 168 (43.5%), and the number hospitalized for salmonellosis was 119 (30.8%). Overall, the number of cases that reported either taking antibiotics or getting hospitalized for the disease (severe salmonellosis) was 211 (54.7%). Table 1 shows that severe salmonellosis was reported in 63 of 75 (84%) cases that had traveled, 93/125 (74.4%) that had eaten in a restaurant, 24/34 (70.6%) that had drunk well water, 45/58 (77.6%) that had been in contact with a cat, 9/10 (90%) that had eaten turkey, and 91/125 (72.8%) that had consumed fresh produce.

Severe salmonellosis, as shown in Table 3, was diagnosed in 117 cases out of 154 (75.9%) who had fever, 153 of 206 (74.3%) who had diarrhea, 60 of 71 (84.5%) who had vomiting, 164 of 221 (74.2%) who had cramps, 99 of 122 (81.2%) who had nausea, and 19 of 21 (90.5%) who had chills. Univariate logistic regression analysis (_ = 0.05), shows that the odds of having severe salmonellosis increased 4.6 times if a case had fever (95% CI = 3.0–7.3) compared to one without fever, and increased 6.1 times if a case had diarrhea (95% CI = 3.9–9.4), vomiting (OR = 5.9; 95% CI = 3.0–11.7), cramps (OR = 7.2; 95% CI = 4.5–11.4), nausea (OR = 5.8; 95% CI = 3.5–9.8), chills (OR = 8.6; 95% CI = 2.0–37.3), and blood in the stool (OR = 4.0; 95% CI = 2.2–7.3) (Table 3).

TABLE 4. Exposure factors that predicted longer duration of hospitalization of human salmonellosis cases in North Dakota: 386 cases (2000–2005)

Exposure Factors	Admission duration/ Total cases	Univariate Odds Ratio (95% CI)	Univariate *P*-value (0.05)	Stepwise *P*-value (0.15)
Travel	25/75 (33.3)	1.4 (0.8–2.4)	0.2219	.
Restaurant	47/125 (37.6)	1.6 (1.0–2.6)	0.0323	.
Well water	10/34 (29.4)	1.0 (0.5–2.2)	0.9765	.
Cat	20/58 (34.5)	1.3 (0.8–2.4)	0.3097	.
Dog	42/109 (38.5)	1.8 (1.1–2.9)	0.0124	0.0818
Reptiles	5/21 (23.8)	0.8 (0.3–2.1)	0.6183	0.1673
Farm animals	15/40 (37.5)	1.4 (0.7–2.8)	0.3173	.
Meats	28/77 (36.4)	1.4 (0.8–2.4)	0.2036	.
Fresh produce	47/128 (36.7)	1.8 (1.1–2.8)	0.0144	.
Cold cuts	10/27 (37.0)	1.4 (0.6–3.2)	0.3691	.
Sea foods	13/32 (40.6)	1.7 (0.8–3.5)	0.1615	.
Turkey	3/10 (30.0)	0.9 (0.3–3.9)	0.9942	0.1780
Eggs	31/87 (35.6)	1.5 (0.9–2.4)	0.1332	.
Chicken	27/65 (41.5)	1.8 (1.1–3.2)	0.0272	.
Milk products	21/43 (48.8)	2.1 (1.1–4.0)	0.0201	0.0782

A model that best predicted severe salmonellosis

Symptoms and risk factors were binary (factor exists = 1 or factor does not exist = 0), and the probability of developing severe salmonellosis (π) could be estimated by use of an individual factor or a combination of factors that are significant ($P < 0.05$). A binary logistic regression model, stepwise strategy was used with the assumption that some factors were not significant or some factors were correlated with others and would drop out of the model; for instance, travelers normally eat from restaurants, and hence travel is highly correlated with eating in a restaurant; a person who is in contact with one pet can also be in contact with another; and eating one food item does not mean that a person will not eat the other.

The exposure factors that best predicted severity of salmonellosis in the final model as shown in Table 1 were consumption of milk products ($P = 0.0233$), travel ($P = 0.0002$), contact with farm animals ($P = 0.0029$), and contact with a cat ($P = 0.0101$). The demographic characteristic that best predicted severity of salmonellosis in the final model as shown in Table 2 was age: 21–40 years compared with ages 3–12 years ($P = 0.0106$) or ages 13–20 years ($P = 0.0066$). The symptoms that best predicted severity of salmonellosis in the final model as shown in Table 3 were development of cramps ($P < 0.0001$), diarrhea ($P = 0.0004$), nausea ($P = 0.0006$), and other complications ($P = 0.0467$).

Duration of hospitalization

Overall, 274 (71%) salmonellosis cases were not hospitalized. The number of cases hospitalized for less than a day was 9 (2.3%), the number hospitalized from one to four days was 80 (20.7%), and the number of cases hospitalized for more than four days was 23 (6%). Table 4 shows that of the 75 cases who had traveled, 25 (33.3%) were hospitalized with severe salmonellosis; 47 out of 125 (37.6%) that had eaten in a restaurant were hospitalized, 47/128 (36.7%) of cases who had consumed produce were hospitalized, and 3/10 (30%) of the cases who had consumed turkey meat were hospitalized. Table 5 shows that the age of many patients hospitalized for salmonellosis was over 60 years (28/66, 42.4%).

A univariate logistic regression with duration of hospitalization as an outcome variable was developed. The odds of staying in hospital longer (Table 6) increased 3.9 times if a case had fever (95% CI = 2.5–6.1) compared to one without fever, and 3.6 times if the case had diarrhea (95% CI = 2.2–5.8) compared to one without diarrhea. The odds of staying in hospital longer (Table 6) increased by 3.9 times if a case was vomiting (95% CI = 2.4–6.6) compared to one who was not vomiting, 3 times if the case had cramps (95% CI = 1.9–4.9), 3.4 times if the case had nausea (95% CI = 2.1–5.3), 2.5 times if the case had a headache (95% CI = 1.1–5.8), and 1.9 times if the case had blood in the stool (95% CI = 1.1–3.2), compared to cases without those symptoms.

Models that best predicted duration of hospitalization

Symptoms and risk factors were binary (factor exists = 1 or factor does not exist = 0), and a multinomial logistic

TABLE 5. Demographic characteristics that predicted longer duration of hospitalization of human salmonellosis cases in North Dakota: 386 cases (2000–2005)

Demographic characteristics	Admission duration/ Total cases	Univariate Odds Ratio (95% CI)	Univariate *P*-value (0.05)	Stepwise *P*-value (0.15)
Age: 0–2	10/34 (29.4)	1.3 (0.5–3.1)	0.8721	0.3624
Age: 3–12	13/58 (22.4)	0.9 (0.4–1.9)	0.2270	0.0294
Age: 13–20	11/46 (23.9)	0.9 (0.4–2.1)	0.3803	0.1321
Age: 21–40	23/93 (24.7)	Ref	Ref	Ref
Age: 41–60	27/92 (29.3)	1.4 (0.7–2.6)	0.5560	0.5133
Age: > 60	28/63 (44.4)	2.3 (1.2–4.5)	0.0056	0.0018
Sex: Female	54/190 (28.4)	1.0 (0.6–1.6)	0.8821	.
Male	55/191 (28.8)	Ref	Ref	Ref

regression, stepwise strategy was used. Table 5 shows that patients over 60 years of age had a higher likelihood ($P = 0.0018$) than did 21–40 year olds of staying longer in hospital. Table 6 shows the factors that best predicted hospitalization: fever ($P < 0.0001$), nausea ($P = 0.0147$), and vomiting ($P < 0.0001$). The probability of duration of hospitalization in any of the models could be estimated with use of an individual factor or a combination of factors.

DISCUSSION

NDDoH received 386 salmonellosis case reports distributed over 6 years (2000–2005). With a population of 642,200 *(28)*, the state had a calculated annual salmonellosis incidence rate of approximately 1/10,000, compared with the United States rate, which is approximately 1.5/10,000 *(1)*. This could be due to the short summer season that the state has compared with most states; a considerable number of outbreaks occur in summer *(21)*. A plausible explanation for the higher number of cases in summer than in other seasons could be the frequency of outdoor activities that are associated with leaving food unrefrigerated for a relatively long time *(21)*. This practice exposes food to degradation due to heat, rendering it favorable for microbial proliferation *(21)*.

Further reports from the NDDoH show that no cases of salmonellosis were reported in 6 years from 10 of North Dakota's 53 counties. The majority of cases were contributed by the most populated counties. For instance, the Bismarck metro area is located in Burleigh County; Fargo, the largest city in North Dakota, is in Cass County; the Grand Forks metro area is in Grand Forks County; the Dickinson metro area is located in Stark County; and Jamestown is located in Stutsman County. Cities are known to have higher human traffic, which is normally associated with more travel and with a higher number of restaurants and social activities that expose large numbers of people to the same contamination source *(13)*. However, these counties did not register the highest incidence rates; instead, counties that are less populated, such as McIntosh, Adams, Hettinger, Dickey, and Slope County, showed higher incidence rates. For instance, there was only one salmonellosis case in Slope County, but because the population is as low as 700 people, that put the incidence rate at 14/10,000, in comparison with Cass County, which had 64 salmonellosis cases but which has a population of 123,138, resulting in an incidence rate of 5/10,000.

The number of reported cases was higher in 2005 than in the other years. This increase was attributed to a cluster of *Salmonella* cases identified in Williams County; two salmonellosis outbreak clusters of four and eleven cases, respectively, were reported to be linked epidemiologically by time and place or by matching DNA patterns with pulsefield gel electrophoresis (PFGE) at the Division of Microbiology. Ten of the 15 *S.*Typhimurium cases reported in this time frame had 100% matching DNA patterns; the other five matched within 90% *(19)*. In addition, NDDoH implemented an electronic laboratory reporting system in 2004, which greatly improved reporting of cases. Prior to that, disease reports were in paper form or cards that were completed and mailed to the NDDoH. In 2004, a web-based electronic patient database and electronic laboratory reporting systems were initiated, which improved and speeded up reporting from health care facilities (Goplin J, Foodborne Surveillance Epidemiologist, North Dakota Department of Heath, Personal Communication, 2005).

The limitation of the study was that the food was not available for culture to confirm or rule out its role as the vehicle for *Salmonella* infection. Also, there was a high probability of recall bias associated with data on food history, as patients could not possibly remember all the foods that they had eaten in the past three days. This is a wide time period, given that the clinical course of human salmonellosis is usually of acute onset *(9)*. This limitation of a wide time period (3 days) during which data were collected also applied to people who had traveled, making it difficult to associate occurrence of salmo-

TABLE 6. Symptoms that predicted longer duration of hospitalization of human salmonellosis cases in North Dakota: 386 cases (2000–2005)

Symptoms	Admission duration/ Total cases	Univariate Odds Ratio (95% CI)	Univariate *P*-value (0.05)	Stepwise *P*-value (0.15)
Fever	70/154 (45.5)	3.9 (2.5–6.1)	< 0.0001	<0.0001
Diarrhea	83/206 (40.3)	3.6 (2.2–5.8)	< 0.0001	0.2267
Vomiting	40/71 (56.3)	3.9 (2.4–6.6)	< 0.0001	<0.0001
Cramps	85/221 (38.5)	3.0 (1.9–4.9)	< 0.0001	.
Nausea	59/122 (48.4)	3.4 (2.1–5.3)	< 0.0001	0.0147
Headache	12/21 (57.1)	2.5 (1.1–5.8)	0.0361	0.1726
Blood in stool	30/77 (39.0)	1.9 (1.1–3.2)	0.0135	.
Chills	8/21 (38.1)	1.6 (0.7–3.9)	0.2846	.
Complications	8/16 (50.0)	2.1 (0.8–5.7)	0.1242	.

nellosis with a specific source of infection. The NDDoH plans to address this issue by improving the food history section of the form by, for instance, including dates and times for consumption of each food item entered on the form and requesting that particular food items eaten at restaurants and events be listed.

Fresh produce ranked highest among food items reported among salmonellosis cases. This observation was not a total surprise as there has been a registered increase in fresh produce-related human infections in the United States in recent years *(23)*. The CDC estimates that contaminated fresh produce currently accounts for 12% of foodborne illnesses and 6% of foodborne outbreaks in the United States *(4)*. Also, *Salmonella* and *E. coli* O157:H7 were reported as the two most common etiological agents responsible for fresh produce-related outbreaks in the past 10 to 15 years, in various states *(12)*. Several reasons for the increase in fresh produce-related human infections have been proposed, including changes in dietary habits, high per capita consumption of fresh or minimally processed fruits and vegetables, and advanced methods of microbial detection and surveillance, as well as modifications in agronomic practices, processing and packaging technologies *(29)*.

In addition to contaminated food, as etiological agents, contact with cats, dogs, and farm animals increased the odds of acquiring severe salmonellosis; human salmonellosis occurs when individuals have contact with infected animals *(2, 30)*. For decades, pets such as dogs, cats and reptiles have been known to harbor *Salmonella* spp. However, numerous animal owners remain unaware that animal contact places them and other household members, including children, at greater risk for salmonellosis. *Salmonella* is found in the intestinal tract of animals and is transmitted by ingestion of feces, which might occur from eating contaminated foods or through contact with animals or their environments. Domestic animals acquire the infection in the same way as humans, that is, through consumption of contaminated raw meat, poultry or poultry-derived products *(25)*. However, studies carried out on cats and dogs show that the risk of transmission of salmonellosis from these pets seems to be rather low *(10, 14)*. Severe salmonellosis due to contact with cats and dogs could probably be a confounding factor owing to the high incidence of dog and cat ownership in this country.

The clinical course of human salmonellosis is usually characterized by acute onset of fever, cramps, diarrhea, and sometimes vomiting *(9)*. These symptoms were the most reported ailments, were common among cases that developed severe salmonellosis and increased the odds of staying longer in hospital. However, serious complications such as anorexia, weight loss, and arthritis occur in a small proportion of cases *(10)*, as was seen in this study. However, it was surprising that these complications were not significantly associated with severe salmonellosis. Because the symptoms in this study were self reported after considerable time, the information is subject to possible recall bias and other sources of information bias, depending on the time, place, age or mood of patient and the data collector.

The association between serotype and symptom or between serotype and risk factor, including foods consumed, was not linked in the study, because the serotype-food item/risk factor relationship was not investigated at the time of data capture. However, the distribution of the most commonly reported serotypes (*S.* Enteritidis, *S.* Typhimurium, *S.* Heidelberg, and *S.* Newport) was similar to what has been reported at the national level *(3, 5)*. Of the 5,942 (92%) *Salmonella* serotypes isolated from humans in the United States, five serotypes accounted for 56% of infections: *S.* Typhimurium, 1,170 (20%); *S.* Enteritidis, 865 (15%); *S.* Newport, 585 (10%); *S.* Javiana, 406 (7%); and *S.* Heidelberg, 304 (5%) *(5)*.

In summary, there were 386 salmonellosis cases reported from 45 of the 53 North Dakota counties, with incidence rates ranging from 1 to 21/10,000. The overall incidence of salmonellosis in ND (1/10,000) during the study

period was lower than the national average (1.5/10,000); cases were distributed throughout the year but peaked in summer. Forty-five serotypes were recovered, of which the four major ones were *S.* Enteritidis, *S.* Typhimurium, *S.* Heidelberg, and *S.* Newport, in that order. Traveling, contact with farm animals or a cat, consumption of milk products, and development of cramps or diarrhea were associated with severe salmonellosis, whereas the odds of staying in the hospital longer increased if a person was older than 60 or had a fever, nausea or vomiting. Fresh produce, eggs, red meats and chicken ranked highest, in that order, among food items reported among salmonellosis cases.

CONCLUSIONS

Salmonellosis incidence rates in North Dakota were lower than the national average. Fresh produce ranked highest among food items reported by salmonellosis cases. Additionally, exposure factors and symptoms associated with severe disease and increased odds of longer hospitalization among salmonellosis cases in North Dakota were identified. This information is vital in guiding public health providers and consumer educators in identifying the target population, as well as raising the risk factor awareness of the general population, food processors, and service industries. This would enhance the development of achievable salmonellosis control strategies for the state.

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Male/Female Opinions of Genetically Engineered Salmon: Marketing Implications

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SUMMARY

Genetically engineered (GE) fast growing salmon is likely to be the first GE animal approved by FDA. Our research objectives were to (a) assess men's and women's opinions of GE salmon, (b) identify possible differences in their opinions and the reasoning behind detected differences and (c) assess willingness to consume GE salmon based on factual information provided. Twelve focus groups, six with each sex, were conducted with volunteers, who ate or bought salmon, recruited from non-science units at a university and the surrounding community. Participants voiced opinions after viewing factual information on GE salmon production. Data were analyzed by use of constant comparison to develop thematic findings. Both sex groups identified some similar consequences and concerns about regulatory approval of GE salmon. However, women's groups expressed greater concern about fish welfare, the naturalness of GE salmon production, unknown adverse effects on human health and regulatory sufficiency, whereas men's groups were more concerned about adverse environmental impacts and industry motives, reflecting established outrage factors. Willingness to consume was influenced by personally relevant consequences and concerns, trust of regulators and choice provided by labeling. Four options are identified that could help marketers of GE animal products reduce outrage.

INTRODUCTION

Despite fifteen years of production, United States consumers remain relatively uninformed about GE crops and their uses *(28, 29, 46, 52, 53)*, in contrast to the higher awareness among consumers in Europe *(3, 25, 42)*. However, this has not hindered opinion (attitude) formation, because assessments often weigh values and perceptions more than facts *(30, 36)*. Indeed, a number of studies indicate that risk perceptions influence the acceptance of and purchase intent for genetically engineered (GE) foods *(21, 32, 52, 63)*.

Although Europeans generally oppose GE foods for various reasons *(23)*, attitudes in the United States are more favorable *(3)*. However, European and United States consumers do share more negative attitudes toward use of genetic engineering in animals than toward its use in bacteria or plants *(16, 28, 29, 59)*. When consumers received descriptions that specify the modification outcome (e.g., crops with built-in pesticide resistance) rather than general statements (e.g., genetic engineering of plants for food production purposes), perceptions became more complicated as consumers weighed risk, benefit and need *(15, 16)*. Hence, attitudes differ toward specific applications such as GE herbicide-resistant rice vs. GE golden rice *(15, 27, 38)*; a consumer benefit appears to make the application more acceptable.

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Attitudes also differ by sex. Quantitative studies indicate that women associate more risk with new technologies *(12, 58)*, believe that the risks of genetic engineering are greater than the benefits *(27, 43, 50)* and are less accepting of various GE foods *(40)* than men. In recent surveys in the United States, women were less approving and more concerned about the safety of GE foods than men *(46, 47)*, regardless of religious affiliation *(48)*, and this difference persisted in the face of detailed risk/benefit information *(49)*. Frewer, Hedderley, Howard and Shepard *(15)* found that women had greater personal objections than men to GE animal applications described in general terms but that this sex difference disappeared when specific descriptions of modification outcomes were provided. However, other studies employing descriptions of GE foods that indicated specific consumer benefits *(33, 39)* or that focus on a specific GE application such as growth hormone use in milk production *(19)* found that sex was a significant predictor of risk perception and of acceptance.

Attitudes influence purchase intent *(5)*. Both attitude toward the GE food product *(61, 62)* and attitude toward the genetic engineering process itself *(4, 22, 37)* are predictors of purchase intent. Surveys both in Europe *(7, 62)* and in the United States *(32, 41, 44)* found that compared with men, women had a lower intent to purchase GE foods *(62)*, were more willing to pay a premium to avoid GE foods *(7, 41)* and were specifically less willing to consume food derived from GE animals *(32, 44)*.

Women's aversion to GE foods is part of a broader pattern in which women express higher levels of concern about technology and the environment than men across many risky situations *(13, 34, 58)*. Reasons for this are unclear *(13)*. In studies of environmental risk, three hypotheses to explain sex differences in risk perception have received the strongest research support: (a) *Safety concerns* – safety and health are more salient to women than to men based on women's care provider role; (b) *Institutional trust* – women are more distrustful of governmental and scientific institutions than men are and (c) *women's parental role*, regardless of employment status *(11)*. How these apply to GE applications has not been settled.

We hypothesized that male/female distinctions in risk-benefit perceptions and purchase intent might be revealed if men and women were to consider a single specific GE product rather than GE foods in general. To learn *why* risk perception might differ and how it would influence purchase intent, we conducted focus groups with men and with women separately on the subject of GE salmon, the first GE animal application under review by the US Food and Drug Administration (FDA).

FDA's regulatory review of GE salmon was initiated in 2000 by a petition from Aqua Bounty Technologies *(51)*. The Aqua Bounty salmon is produced by introducing, through microinjection of fertilized Atlantic salmon eggs, a trans-gene composed of a Chinook salmon growth hormone gene attached to the antifreeze protein promoter sequence taken from an ocean pout *(31)*. The resulting GE salmon produce growth hormone throughout the year instead of seasonally (as wild fish do), have improved feed conversion efficiency, and reach market weight in half the time required for non-GE salmon *(9)*. To reduce the ecosystem impact of fish escaping ocean pens, Aqua Bounty proposed to sell only triploid females, at least 99% of which would be sterile *(10)*.

European attitudes to fast growing GE salmon have been evaluated in three studies. In two qualitative studies *(24, 36)*, GE salmon was less acceptable than GE plant applications and was associated with perceptions of 'unnatural,' 'uncertainty,' 'unhealthy' and 'tampering with nature', all common outrage factors *(56, 57)*. However, participants were all or predominantly female, so male viewpoints were not clear. In a quantitative study *(39)*, moral and ethical issues outweighted 'better taste' and 'lower price,' depressing willingness to purchase, and women felt that GE salmon (as well as GE pork) was less beneficial, less healthful, and more unethical and represented more tampering with nature than men did. However, in-depth examination of reasons for their opinions was lacking. No data on American views of GE salmon are available.

Our research objectives were to (a) assess men's and women's opinions of GE salmon, (b) identify possible differences in their opinions and the reasoning behind detected differences and (c) access willingness to consume GE salmon based on factual information provided. Two variables were of specific interest: (a) the *consequences* of approval of GE salmon, since risk perceptions are based on the risks and benefits associated with perceived consequences *(4)*; and (b) *concerns* about this application and its approval, since concerns usually reflect outrage factors that can magnify risk perception *(56)*. Both variables influence purchase intent *(4)*.

METHODS

Focus groups, a qualitative method, were used because social scientists have criticized quantitative surveys used to assess consumer risk perceptions and attitudes about GE foods as these often provide little or no background on GE foods and disconnect responses from the everyday food-buying context *(30, 54)*. In contrast, qualitative studies can explore the basis of risk perceptions *(26)* and reveal the reasons behind differences in perceptions found *(18)*. Focus groups are particularly useful when dealing with a poorly understood, complex subject, in which situation *participant interaction* is more likely than individual interviews to produce rich qualitative data *(35, 60)*. The University Office of Research Protections approved all study procedures.

Our sample was recruited from staff of the Pennsylvania State University and from the surrounding community. To avoid group dominance by those with higher education or genetic engineering background, all university students and faculty as well as staff within basic biological science units were excluded. Volunteers were recruited through in-person and media contacts and screened for the following criteria: (a) age 21–65 years; (b) ate, caught or purchased salmon at least once a month (in order to tap the group most likely to affect GE salmon success); (c) not using genetic engineering techniques in present job; (d) not a student or faculty member; and (e) could attend focus group at one of times offered. Dates likely to secure the most participants were chosen; qualifying volunteers were notified of date, location and time; and those attending became our sample. Sample characteristics are shown in Table 1 and discussed in Results.

Six focus groups were conducted with each sex according to Krueger and Casey *(35)*, using a script of open-ended questions (see Table 2). After providing in-

TABLE 1. Characteristics of participants

Participant characteristics	Women (N = 38)	Men (N = 39)	Total (N = 77)
Number of focus groups	6	6	12
Mean age	43.1 ± 10.6	42.5 ± 10.7	42.8 ± 10.6
Educational level attained			
High school	5 (13.2%)	4 (10.3%)	9 (11.7%)
Associate degree	6 (15.8%)	3 (7.7%)	9 (11.7%)
Bachelors degree	11 (28.9%)	16 (41.0%)	27 (35.1%)
Masters degree	14 (36.8%)	14 (35.9%)	28 (36.4%)
Doctoral degree	2 (5.3%)	2 (5.1%)	4 (5.2%)
Intake of salmon			
No. times salmon consumed/yr	26.8 ± 26.6[a]	28.0 ± 26.0[a]	27.4 ± 26.2
No. times eat in restaurant/yr	7.2 ± 10.9[a]	4.2 ± 6.0[a]	5.7 ± 8.9
No. times purchase in grocery/yr	22.1 ± 23.2[a]	20.5 ± 22.4[a]	21.3 ± 22.7
Age group of children in family[1]			
≤ 6 yrs	4 (10.5%)	5 (12.8%)	9 (11.7%)
7–17 yrs	12 (31.6%)	12 (30.8%)	24 (31.2%)
≥ 18 yrs	13 (34.2%)	9 (23.1%)	22 (28.6%)
None	11 (28.9%)	18 (46.2%)	29 (37.7%)
Missing	2 (5.3%)		2 (2.6%)
Self assessment questions			
How much do you feel you know about the technique of genetic engineering?[2]	2.2 ± 1.1[a]	2.8 ± 1.1[b]	2.5 ± 1.1
How much do you feel you know about genetic engineering applications within food production?[2]	2.2 ± 0.9[a]	2.8 ± 0.9[b]	2.5 ± 1.0
I am concerned about the regulation of applications of genetic engineering within food production[3]	3.6 ± 0.9[a]	3.4 ± 0.9[a]	3.5 ± 0.9
I am concerned about the lack of labeling of genetically engineered foods[3]	3.6 ± 0.9[a]	3.4 ± 1.1[a]	3.5 ± 1.0

[1]Some have more than one child so total number of children does not equal total number of participants

[2]Likert scale (1 = nothing at all, 2 = not much, 3= some, 4 = more than most, 5 = a great deal)

[3]Likert scale (1 = strongly disagree, 2 = disagree, 3= not sure, 4 = agree, 5 = strongly agree)

[a,b]Different letters indicate significant differences at $P \leq 0.05$

formed consent, participants completed a short demographic and opinion questionnaire before discussion began. Previous work had indicated that consumers with little knowledge of genetic engineering and its food applications are more likely to ask questions than provide opinions, wih the result that one knowledgeable participant could dominate the discussion *(6)*. So, after initial assessment of awareness of GE foods and GE salmon, all participants viewed a factual 16-minute informational power point presentation about classic genetic inheritance, basic genetic engineering technique and the production of GE salmon. Afterwards, our questions probed opinions and willingness to consume. Data were tape recorded and transcribed verbatim.

Quantitative demographic data were summarized as frequencies and means. Significant differences were determined using *t*-tests, Chi-square and analysis of variance. Significance was set at $P \leq 0.05$. Thematic analysis of the qualitative data was based on constant comparison *(17)*. Two researchers each independently developed a thematic coding list from the first men's group transcript, which was merged into an initial coding list. This initial list was expanded into a final coding list for each sex by comparison and discussion through further independent coding of five more group transcripts (2 men's and 3 women's). Each researcher used the final list of ten mutually exclusive themes and associated codes (ranging from 4 to 32) for each sex to code the remaining three respective group transcripts (6 total). The

TABLE 2. Focus group script

Icebreaker

- Describe a memorable salmon meal you experienced for the group.

Warm-up

- What have you heard about genetic engineering?
- What have you heard about genetically engineered food?
- What have you heard about genetically engineered salmon?

Power Point presentation: GE salmon

Outline basic genetics, genetic engineering and production of GE salmon

Discussion

- With that background, what is your opinion of GE salmon?

Probes ---

- Any other opinions?
- You mentioned consequences. What other consequences can you think of? Any other benefits? Any other risks?
- What other questions do you have?
- What other concerns might you have?
- What else would you like to know about GE salmon?
- If approved by FDA and placed on the market, how would you feel about eating GE salmon?
- How would you feel about eating it if the price was as cheap as chicken or pork?

mean inter-coder reliability per transcript was 80% (range 76–86%) for 75–88 codes (men and women respectively). Disagreements were resolved by discussion and final coding was assigned to all twelve transcripts. After data sorting by use of Folio Views™, thematic summaries were written. Themes are presented only if discussed in at least two focus groups of one sex. Thematic differences between sex groups were based on at least 2:1 differences in occurrence among focus groups in conjunction with unique discussion within these specific focus groups. Themes reached saturation by the fifth group of each sex. Findings are reported as descriptive summaries or paraphrasing of *group* comments and include direct quotes from individuals as illustrations.

RESULTS

Participants

About 75% (n = 77) of the qualified volunteers participated in the focus groups (see Table 1). Average group size was 6. Participants were white except for one black woman, were college educated (76%), and ate salmon about twice a month; 60% had children. Men and women did not differ in any characteristics recorded except that men rated their knowledge of genetic engineering and its applications in food production significantly higher than did the women. However, there were no significant differences in levels of self-assessed concern between men and women. The proportion of participants without children was distributed similarly across the focus groups of each sex.

Initial familiarity with genetic engineering, GE food and GE salmon

Prior to the presentation, some in all groups were aware of genetic engineering and the debate surrounding its use and could list some GE plants (soybeans, corn, etc.). More men's groups than women's indicated awareness of news-making events (Starlink, Monarch butterfly impact, etc.) and recognition that genetic engineering involved molecular techniques.

In both sex groups, initial opinions about GE foods ranged from optimistic ("could be a very good thing"; "could make a better product"; "fascinated by the potential of GE") to cautious ("we don't know a lot of consequences"; "they are not very regulated"; " The problem with GE food is that we have no long term experiments or research done."). However, men's groups expressed some comfort with risks ("we got to take some risks" in order to advance) and confidence in its management ("the technology is like any technology, you just got to watch out how you use it"). Desire for labeling was expressed in several groups of both sexes.

When asked what they had heard about GE salmon, women's groups reported that they were generally unaware of it, while a few participants in five men's groups recalled media reports about it. Participants in three women's and four men's groups were aware of farm-raised salmon.

Opinions about GE salmon expressed after the presentation

Participant opinions were separated into *consequences*, neutral statements of possible outcomes, and participant-identified *concerns* about real or imagined outcomes.

Consequence themes

Combining results of all same-sex focus groups, both men's and women's groups indicated that FDA approval of GE salmon could (a) *increase Aqua Bounty profits*; (b) *preserve fisheries* by addressing demand without further depleting native (wild) salmon stocks; (c) *alter fish farming* regardless of whether fish farmers do or do not adopt GE salmon; (d) *have ecological impact* as escape of GE fish from ocean pens is inevitable and these fish could have a major effect on costal ecosystems; (e) *expand use of genetic engineering* as GE salmon success will inspire genetic engineering use in other fish and animals; (f) *increase availability of farmed salmon* and, if more affordable, *possibly impact consumer health* as authorities recommend eating more fish and (g) *alter the price of farmed salmon*, although it was unclear in which direction.

Men's and women's groups also identified unique consequences (see Table 3). In *men's groups*, much discussion focused on the broader consequences of GE salmon on expanded technology use, world hunger, consumer marketing efforts needed, expectations of regulators and marketing competition between GE and non-GE salmon. In contrast, in *women's groups* much discussion focused on consequences on fish quality (contaminants, nutrients, taste and texture).

Concern themes

Men's and women's groups shared the following concerns, often voiced as questions, about introducing GE salmon into the US food system.

Is GE salmon (a) *necessary* to meet a legitimate market need or demand or (b) *natural*, i.e., is the mix of Chinook, Atlantic and pout genes producing a natural fish?

Will using the genetic engineering process lead to (a) *unknown effects on the fish* due to unexpected effects of growth hormone or other uncontrolled gene interactions producing undesirable outcomes or (b) *immoral uses* by facilitating the move from acceptable to unethical manipulation? One man said, "I am not comfortable with the ethical situation at all. We alter the fish but for some reason we don't genetically engineer humans. It is trying to play God at this level. This is a lot different than cross-pollination."

Will GE salmon have (a) *negative environmental impacts* when GE salmon escape and compete for food, affecting other fish populations; (b) *unknown adverse effects* (Are we "thinking of all the consequences?" "There is always more to almost everything than what meets the eye." "These are complex organisms. You might not see the effects for decades."); (c) *undesirable effects on humans* due to the trans-genes and Chinook growth hormone surviving cooking and digestion; and (d) *sufficient regulatory oversight?* What is involved in FDA evaluation and is it based on good science? Does FDA require human trials, perform post-entry monitoring, or consider the environmental concerns of added pollution from ocean pens and of escape on fish populations?

Can consumers *trust regulators*? Two themes emerged: (a) *skepticism* — lack of confidence in FDA approval because FDA makes mistakes and responds to financial interests and political pressure; and (b) *trust* — based on taking a "leap of faith" or having "bottom line confidence" that FDA will do a good safety assessment even though under pressure.

Can consumers *expect choice*? Several viewpoints emerged. GE salmon *should* be labeled as such (a) so consumers have a choice, (b) to avoid suspicion when undisclosed 'engineering' is discovered, or (c) because it is the first GE animal product on the market. Alternatively, GE salmon *will not* be labeled because no other GE food is, so that purchase decisions will be based on price. Within men's groups, labeling was often *demanded* as a right for informed choice, while within women's, labeling was *hoped* for.

Concerns expressed also differed in some key ways (see Table 4). *Men's groups* expressed much more concern than women's groups about negative and dreaded environmental impacts and industry motives in producing this fish. Men were twice as likely to discuss these concerns at length. In contrast, *women's groups* expressed more concern than men's about the welfare and the naturalness of GE salmon. They also expressed much more concern about the unknown adverse long-term effects of eating GE salmon on people, especially on children. Underlying this concern was perceived insufficient regulatory oversight.

Eating GE salmon

Participants were asked about willingness to *eat GE salmon themselves.* Four 'behavioral' patterns emerged based on their assumption that GE and non-GE salmon could be distinguished:

Pattern A: They would initially avoid GE salmon based on possible adverse effects, preference for taste and seasonality of wild salmon, a philosophical stance (not needed, not natural) and/or no evidence of benefit (nutritional, quality attributes, contaminant level) over regular salmon.

Pattern B: They required safety evidence based on long-term testing or use (10–20 years) by others before eating GE salmon.

Pattern C: They stipulated that government assurance of safety (via media) was necessary for them to consider eating GE salmon, after which regular use would depend on price or taste.

Pattern D: They had no reservations about eating GE salmon because (a) they implicitly trusted FDA review, needing no assurances; (b) retail product safety was tacitly assumed and/or (c) they saw product benefits. Within this group, many would readily substitute GE salmon for current farmed salmon and continued consumption would be based on taste and texture. For others, the decision to eat would be based primarily on price. A lower price would allow some to eat this fish more often than they now could afford.

Pattern A and C were more common in women's groups than men's. Pattern B was unique to women's groups, where some of this caution reflected the hormone replacement controversy. Pattern D was more common in men's groups than women's. Explicit or tacit trust, price and taste were critical factors in patterns C and D. Labeling was a means of avoidance in pattern A and B vs. a means of new and potentially desirable product identification in pattern C and D.

When asked to consider use of GE salmon if it became as cheap as chicken or pork, three themes emerged. Cheap price could (a) result in more frequent purchase, although quality may be critical; (b) imply inferior quality; and/or (c) diminish salmon's place as a delicacy, making it as mundane as chicken. Theme c) was more prevalent in women's groups than men's.

TABLE 3. Unique consequences voiced by each sex

Unique to Men (Number of focus groups)	Unique to Women (Number of focus groups)
• **Genetic engineering may replace other technologies** (3) Using a gene for growth hormone was a sensible way to avoid addition of growth hormone to feed and produce a "naturally big fish." "It is a marketing tool to say this fish is raised with all natural food."	• **GE salmon may have fewer contaminants** (3) Fish farming will provide better control over contamination with pollutants including heavy metals like mercury.
• **GE salmon may address world hunger** (3) Food shortages in other countries where fish is a dietary staple can be met with GE fish, even if distribution is the root problem. "The world faces hunger situations. Then being able to produce twice the fish in the same amount of time becomes pretty important practical matter."	• **Nutrient composition of GE salmon may differ from that of wild** (4) Genetic engineering may affect the omega 3 fatty acid content by altering its production or structure. The nutritional outcome was unclear – "it could be more nutritious because of the genetic engineering or it could be less nutritious." Some felt farmed salmon was not nutritionally equivalent to wild salmon and GE salmon would be no better.
• **It may take time to gain acceptability** (4) Consumers are conscious of the animal/plant distinction. "Animal is close to us, has a nervous system. It is tough to argue that corn and soybeans are something you can really get into, have a feeling about." People accepted electronics fast but this is an animal product you consume and there is still controversy about rbST. Marketing will be a challenge "because we don't think scientifically in this country. The marketing challenge is how do you demystify that we are splicing genes." The terms used will also affect acceptability. "Genetic engineering connotes playing God and pulling strings. Genetic modification connotes refinements, maybe getting better."	• **Taste and texture of GE salmon may be altered so it is unacceptable** (4) Alterations in tomatoes, zucchini, strawberries and beets have allowed year round production but at the cost of taste and texture. "I use the beet as an example. It is nice and big, but the bigger the beet gets, the worse it is. The woodier it is inside and the taste is not there. And there are many things that we think small equates to better flavor, more tender. I wonder if pumping up this salmon much more quickly to size, would that have a similar effect?"
• **Expectations of regulatory agencies may increase** (4) Type of testing conducted is critical and must be applied uniformly. All three regulatory layers involved must do a good job of safety review and regulate GE salmon in a professional, scientific manner to support consumer confidence.	
• **Market place determines if taste of GE salmon matters** (4) Taste may differ from farmed salmon but could be better. Using the analogy to feed lot beef – the cows that grow fat in feed lots actually become tastier because they are immobilized and do not get tough. If there is a difference in taste, the market place will sort out the taste issue.	
• **GE salmon may increase the market for premium, wild, natural salmon** as consumers avoid GE salmon. (3)	

TABLE 4. Concerns receiving greater or unique discussion by sex

Important to Men (Number men's vs. women's groups)	Important to Women (number men's vs. women's groups)
• **Negative environmental impact** (6 vs. 3) Men considered producing GE salmon that can escape problematic because (a) these may "interact with natural species so, if that is the case, it changes the natural populations. You can't pull that out of the market"; (b) some fertile females "will be introduced into the environment, to where later on, they end up becoming extremely dominant and the rest of the species with their own uniqueness ends up being weeded out"; (c) the focus on one species reduces biodiversity, and (d) the implications of a fish with continual growth hormone production in the ecosystem are unknown.	**Fish welfare** (0 vs. 5) Women considered growth hormone use in animals controversial because of possible broad impacts on the fish immune system, stress and disease resistance, fertility, and life span. Long-term studies are needed about the effects on the fish itself. One said, "My concern is for the salmon. What is that [genetic engineering] doing to that fish? What are we doing to it physiologically? What are we doing to that fish's life?"
• **Unknown adverse effects on the environment** (2 vs. 0) Men worried that "even with everyone acting honorably that down the road we would see the effect that we had not thought of." Referring to problems with PCBs, some felt "the biggest thing is to make sure that you look at the environmental implications." One explained, "Cause populations can't be controlled and kept within certain limits, but considering salmon, cause they do transfer from fresh water, salt water and back to fresh water, the environmental implications are definitely considered very important. To me, it is more important to look at the ramifications [for the environment] than necessarily some of the benefits of GE fish."	**Naturalness of genetically engineering salmon** (0 vs. 2) Women *debated* this concern and two views emerged. On one hand, it was not natural, even if approved by the FDA, since artificial chemical dyes are approved. "This is a very broad change in genetics rather than having years and years to produce." Just because "we toy with something" does not make it a natural process. On the other hand, this was like breeding dogs only faster. Using fish genes to introduce the hormone was more natural than adding growth hormone to feed.
Industry motives (3 vs. 0) Men wondered if faster growth and company profit were the only motivations behind this application. "Are there any other motives – like disease resistance?" Distrust and low acceptance result if consumers perceive (a) the "only people who benefit are the few who patent it and got all the farms to use it" and (b) companies do not acknowledge all the potential dangers since "they want it to work. They are looking for the profit."	**Unknown adverse long term effects of eating GE salmon on adults and children** (0 vs. 6) (a) *Long-term effects are not tested.* People differ so much that even clinical trials are unlikely to detect all the problems. Genetic engineering is not a "tried and true" science despite 20 years of study. Humans have not eaten GE salmon for 20 years and effects on early adopters will not be known for decades. One summed it up: "I would say safety is the biggest thing. I want to be sure what I am eating does not have any adverse effects on me somewhere down the line." (b) *Children are especially vulnerable.* Effects of hormone use in meat and milk production on children's early maturity increased worry about the long-term effects of fish growth hormone on children. One said,

TABLE 4. *(continued)* **Concerns receiving greater or unique discussion by sex**

Important to Men (Number men's vs. women's groups)	Important to Women (number men's vs. women's groups)
	"Is that chemical in the fish and therefore if people consume the fish, are we going to start to get some hormone effects? I think it is different from how they inject hormones into cows, but they talk about all the hormones and antibiotics and things that are in fish. If the FDA is looking at it as a new animal drug, to me that sort of implies it is still in the fish. So that concerns me greatly, especially since people are promoting fish more as a healthy food for children and for everyone, so we serve it to our children."
	(c) *Insufficient regulatory oversight is evident* based on recalls and perceived influence of industry lobbyists on regulatory standards. One summed it up: "You know, the fact that something has come through the regulatory process and is now marketable does not convince me that appropriate studies have been done to provide safeguards or to really adequately profile the safety and long term effect of the product."

DISCUSSION

Using participants who bought/ate salmon made the topic personally relevant and insured interactive discussion. Participants' level of awareness of GE foods was similar to that found by others *(29, 53)*, and they expressed a range of initial opinions about GE foods. Our information presentation was necessary, as most knew little about GE salmon, but their willingness to consume it reflected the weight given perceived consequences and concerns.

Shared consequences and concerns

Both sex groups identified some *similar consequences* composed of benefits (Aqua Bounty profits, preserving native fisheries, increased availability of farmed salmon) and risks (altering fish farming, ecological impact, expanded use of genetic engineering). This balance of consequences contrasted with results of Grunert et al. *(24)*, in which negative consequences dominated. Both sex groups also shared some *similar concerns* about the GE process (unknown effects on fish, immoral use) and the GE product (necessary, natural) and its environmental impacts, unknown adverse effects, and undesirable effects on humans, reflecting well-known outrage factors *(56, 57)*. Samples in four Nordic countries agreed *(24)*. Regardless of sex, regulatory sufficiency was a concern (based on our participant's general ignorance of how FDA regulators establish 'safety') but 'trust of regulators' and 'choice through labeling' appeared to diminish outrage. In contrast, regulatory sufficiency was not a concern in several European qualitative studies of GE salmon *(24, 36)*.

Distinguishing consequences

Each sex group also discussed *unique consequences*. Only men's groups discussed benefits (replaces other technology, addresses world hunger, increases wild salmon market) and challenges (slow acceptability by consumers, increased regulatory expectations) for business and regulators as consequences. In contrast, Swedish men perceived little benefit from GE salmon, although men were somewhat more positive than women *(39)*. Only women's groups discussed two compositional consequences: fewer contaminants such as mercury (a benefit) and unclear effects on nutrient composition. United Kingdom (UK) focus group discussants, who were mainly women, also felt farmed fish would have fewer contaminants, but no concerns about nutrient content were reported *(36)*.

Effects on quality (taste and texture) emerged as distinguishing consequences. Compared to women's groups, men's were more optimistic that, if taste were altered, consumers would determine the role of taste vs. price in acceptance. Benefits do attenuate risk *(1)* and consumers may trade off perceived risk for a cheaper price *(63)*. However, lower price and better taste were not sufficient reason for Swedish consumers to eat GE salmon *(39)*. Some women's groups were more pessimistic about GE salmon quality, on the basis of the poor quality of produce 'improved' by plant breeders, an opinion also voiced by UK discussants *(36)*.

Distinguishing concerns

Compared to women's groups, men's indicated much more concern about negative environmental impacts, especially unknown adverse effects, and skepticism about industry motives and willingness to acknowledge potential problems. Women's groups expressed real concern for fish welfare, not discussed by men's groups and considered unimportant by UK discussants *(36)*. Perhaps reflecting gender roles, women's groups indicated much more concern than men about long-term effects on human health, especially unknown adverse effects, and ambivalence about the naturalness of the GE process used, sentiments shared by Nordic women *(24)*.

The greater concern of men's groups about environmental impacts was unexpected, since others have reported that women have greater concern about environmental risks *(11, 14, 64)*. However, our observed sex difference in concern may reflect how social roles affect views of the GE salmon issue *(26)*. The concern of men's groups about industry motives might have focused their interest on the immediate concrete site of impact, the environment, rather than the more hypothetical downstream risk to human health.

Finally, although groups shared concern about sufficient regulatory oversight, strong distrust of FDA and skepticism about testing adequacy emerged in some women's groups. Still, in most groups, FDA was considered trustworthy, often as the only option. In contrast, UK discussants considered government sources "untrustworthy information providers" *(36)*.

The thematic differences between the sexes suggest two hypotheses proposed to explain sex differences in environmental risk perceptions, *safety concerns* and *institutional trust (11)*, also apply to GE animals. In this sample, women had greater concern than men about long-term safety of eating GE salmon, especially for children, and greater doubts than men about governmental regulation. While women questioned consequences for salmon quality and expressed concern for GE salmon welfare, men noted consequences for business and regulators and expressed greater concern about negative environmental impacts. These findings suggest that social roles contributed to evaluation of consequences and concerns and thus to risk perceptions.

Willingness to consume

Both sexes used their knowledge/experience to evaluate perceived consequences and personal concerns in determining whether to eat GE salmon. Our sample expressed a range of willingness to eat, in contrast to a report that 70% of a United States sample of mostly women would pay 53% more for non-GE salmon to avoid eating GE salmon *(8)*.

The four personal behavioral eating patterns found reflected how trust in regulatory authorities affects intention to consume: Greater trust increased intention while lack of trust decreased intent, partly due to magnified risk perception, relationships observed by others *(20, 32, 44)*. Our data suggest that on the basis of many factors, including trust, men are more likely than women to consume GE salmon, a pattern also found for GE meat products *(45)*. Many of our participants assumed that non-GE and GE salmon would be distinguishable in supermarkets, so the effect of 'no choice' was muted. United States surveys *(29, 52)* indicate that 90% of Americans want GE foods labeled. Views in our focus groups ranged from not caring to feeling that labeling was a consumer right. For some, but not all, lack of labeling would fan outrage. Ultimately, for those willing to consume, incorporation into routine eating patterns would depend on price and taste, findings also reported by UK participants *(36)*.

Limitations

These included a non-representative participant sample that received more factual information than most consumers will initially have upon FDA approval of GE salmon. Most participates were college educated and, as current consumers, were discussing a product that might replace or increase what they already eat. The viewpoint of those who like salmon but cannot now afford it was not represented. However, our sample characteristics favored participant interaction and the rich discussion desired.

Implications

Our results suggest that GE salmon approval may generate sufficient outrage to amplify risk perceptions that limit its market success, a situation other GE animal food applications may also face. Greater consumer acceptability is possible if the GE animal product has or is:

- an obvious *consumer benefit*. Chern et al. *(8)* found that a nutritional benefit could increase intent to purchase GE products 30% compared to products with no such benefit.
- *labeled*. This promotes transparency and diminishes distrust. Meeting demand for credence attributes such as GE labeling builds confidence in products for safety-sensitive consumers *(2, 55)*. Descriptors (genetically engineered or modified) used may be critical.
- *carefully priced*. Our participants, especially women, felt that the price must offer a benefit without suggesting inferior quality.
- accompanied by *factual, balanced information* addressing the concerns reported here.

Consumer reactions should be monitored through post market surveys, consumer panels and perhaps consumer advisory boards. The industry-consumer relationship is a social relationship that relies heavily on trust *(58)*. Responding to consumer concerns indicates social responsibility and builds trust.

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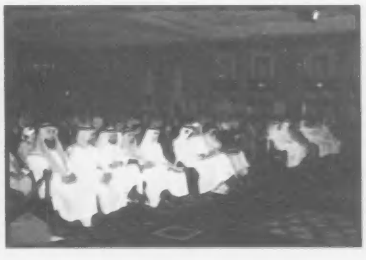
Dubai International Food Safety Conference

The Third Dubai International Food Safety Conference (DIFSC) took place over the dates of February 25 to 27 at the Dubai Convention and Exhibition Centre. Alongside of Gulfood Expo, DIFSC attracted more than 1,000 attendees this year. This is a fantastic achievement considering years one and two attracted 200 and 400 attendees respectively!

DIFSC provides delegates with a good understanding of the current food safety issues, food safety management techniques and the best practices followed in the food industry. The Conference offered unparalleled opportunities to industry professionals to meet with experts from around the world while acting as a platform to resolve food safety issues in the region and provide opportunities for students to learn about food safety.

David Tharp, IAFP Executive Director, was convenor for the general session held on day two. David reported after the conference that he was excited to see so many food safety professionals thirsting for the information provided by the expert speakers. It was also interesting to note, of the eighteen speakers on the program; eight of them are IAFP Members.

IAFP will work with DIFSC organizers from the Dubai Municipality for program development of future conferences. This will allow IAFP unprecedented access to food safety professionals in the region while helping to identify leading food authorities for inclusion on the program. We look forward to our new working arrangements with the Dubai International Food Safety Conference.



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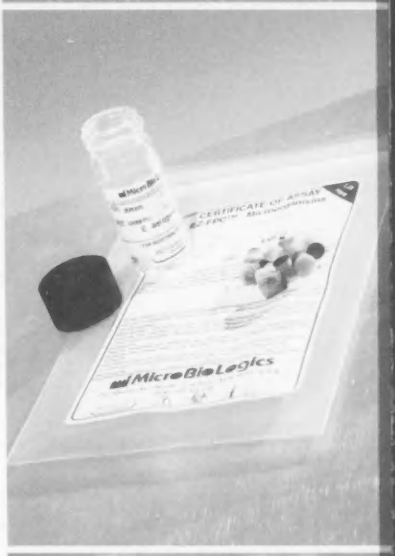

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Isabel Walls Elected IAFP Secretary

The International Association for Food Protection welcomes Dr. Isabel Walls to the Executive Board as Secretary. Dr. Walls will take office at the conclusion of the Awards Banquet at IAFP 2008, the Association's 95th Annual Meeting in Columbus, Ohio. By accepting this position Dr. Walls has made a five-year commitment to the Association and will begin her term as President in 2012.

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

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

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

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

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

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

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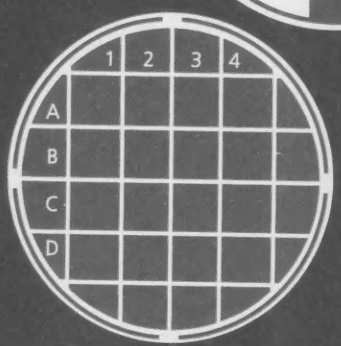

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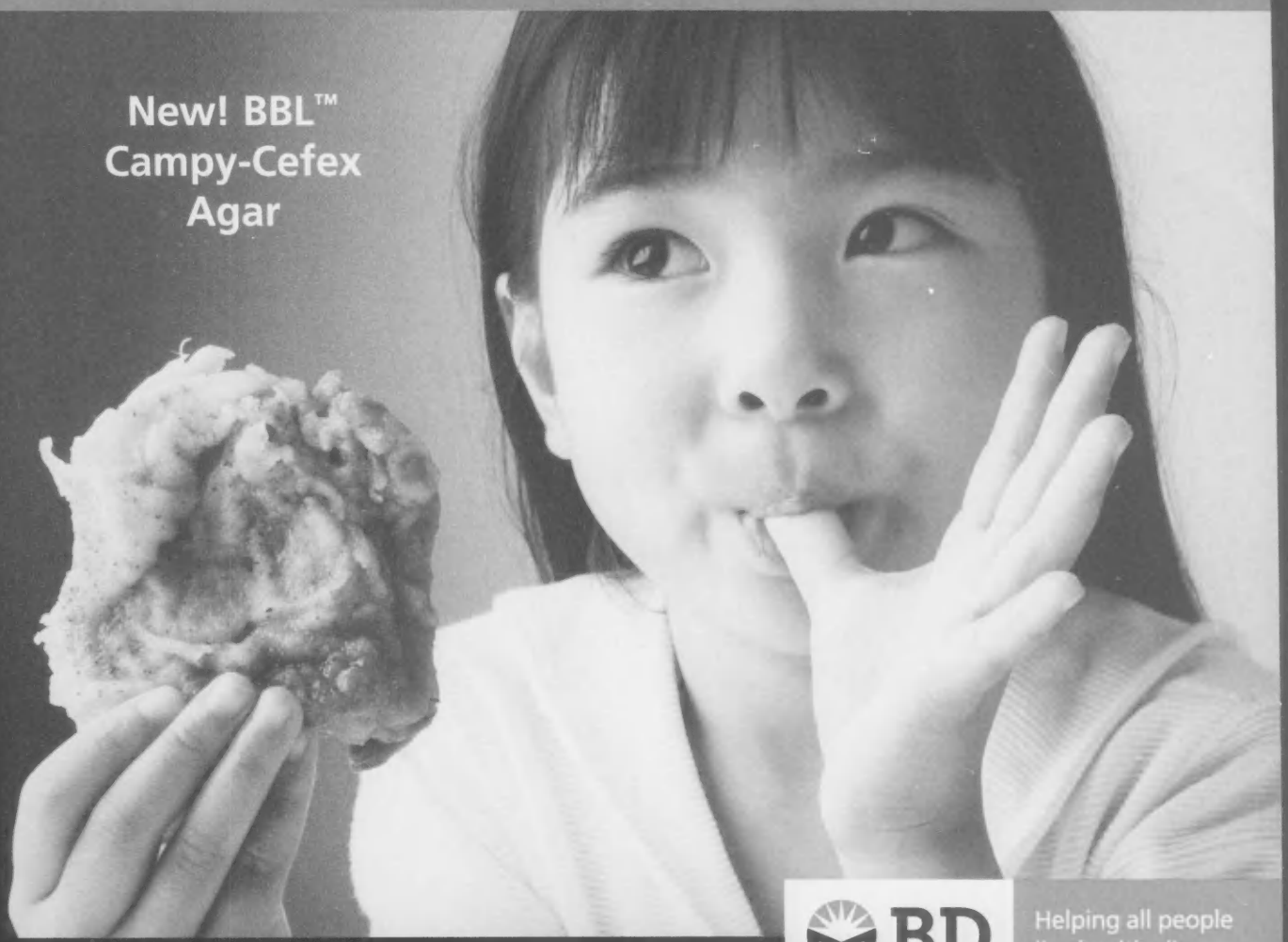

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1. NACMCF Executive Secretariat. 2003. Analytical utility of *Campylobacter* methodologies. U.S. Department of Agriculture Food Safety and Inspection Service, Washington, D.C. Journal Food Protect. 70:241-250.

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NEWS

Guide to Minimize Microbial Food Safety Hazards of Fresh-cut Fruits and Vegetables

The Federal Government provides advice on healthful eating, including consuming a diet rich in a variety of fruits and vegetables, through the Dietary Guidelines for Americans and the related MyPyramid food guidance system. In response, per capita consumption data show that Americans are eating more fresh produce. With $12 billion in annual sales in the past few years, the fresh-cut sector of the produce industry is its fastest growing segment. As the fresh-cut produce market continues to grow, the processors of such produce are faced with the challenge of processing an increasing variety and volume of products in a manner that ensures the safety of this produce. From 1996 to 2006, seventy-two foodborne illness outbreaks were associated with the consumption of fresh produce. Of these produce related outbreaks, 25 percent (18 outbreaks) implicated fresh-cut produce. Many factors may play a role in the incidence and reporting of foodborne illness outbreaks that implicate fresh produce, such as an aging population that is susceptible to foodborne illness, an increase in global trade, a more complex supply chain, improved surveillance and detection of foodborne illness, improvements in epidemiological investigation, and increasingly better methods to identify pathogens.

Processing fresh produce into fresh-cut products increases the risk of bacterial growth and contamination by breaking the natural exterior barrier of the produce. The release of plant cellular fluids when produce is chopped or shredded provides a nutritive medium in which pathogens, if present, can survive or grow. Thus, if pathogens are present when the surface integrity of the fruit or vegetable is broken, pathogen growth can occur and contamination may spread. The processing of fresh produce without proper sanitation procedures in the processing environment increases the potential for contamination by pathogens. In addition, the degree of handling and product mixing common to many fresh-cut processing operations can provide opportunities for contamination and for spreading contamination through a large volume of product. The potential for pathogens to survive or grow is increased by the high moisture and nutrient content of fresh-cut fruits and vegetables, the absence of a lethal process (e.g., heat) during production to eliminate pathogens, and the potential for temperature abuse during processing, storage, transport, and retail display. Importantly, however, fresh-cut produce processing has the capability to reduce the risk of contamination by placing the preparation of fresh-cut produce in a controlled, sanitary facility.

This guidance is intended for all fresh-cut produce processing firms, both domestic firms and firms importing or offering fresh-cut product for import into the United States, to enhance the safety of fresh-cut produce by minimizing the microbial food safety hazards. This guidance does not set binding requirements or identify all possible preventive measures to minimize microbial food safety hazards. We recommend that each fresh-cut produce processor assess the recommendations in this guidance and then tailor its food safety practices to the processor's particular operation. Alternative approaches that minimize microbial food safety hazards may be used so long as they are consistent with applicable laws and regulations.

This guidance primarily addresses microbiological hazards and appropriate control measures for such hazards. However, some chapters in the guidance discuss physical and chemical hazards.

FDA's guidance documents, including this guidance, do not establish legally enforceable responsibilities. Instead, guidances describe the Agency's current thinking on a topic and should be viewed only as recommendations, unless specific regulatory or statutory requirements are cited. The use of the word should in Agency guidances means that something is suggested or recommended, but not required.

FDA Takes Next Step in Establishing Overseas Presence, Agency on Path to Establish Offices in China

In an important development, the US Food and Drug Administration has received approval from the US State Dept. to establish eight full-time permanent FDA positions at US diplomatic posts in the People's Republic of China, pending authorization from the Chinese government.

This is an important step forward in the FDA's plans to hire and place FDA staff in China over

the next 18 months. In addition, the FDA will be hiring a total of five local Chinese nationals to work with the new FDA staff at the United States Embassy in Beijing and the United States Consulates General in Shanghai and Guangzhou.

"In an age when a border is not a barrier, the globalized economy demands nothing less than heightened regulatory interoperability, information exchange, and cooperation, especially on product quality and enforcement matters," said Murray M. Lumpkin, M.D., deputy commissioner for International and Special Programs, FDA. "Along with the important Memoranda of Agreement signed with two FDA counterpart Chinese agencies, our efforts to fill permanent FDA positions in China are a significant step toward ensuring access to safe food, drugs, and medical devices in the global market."

Building the FDA's capacity outside of the United States supports the agency's "Beyond our Borders" initiative. The initiative facilitates the building of stronger cooperative relationships with the FDA's counterpart agencies around the world and enhanced technical cooperation with foreign regulators. The permanent overseas offices in China will also allow greater access for inspections and greater interactions with manufacturers to help assure that products that are shipped to the United States meet US standards for safety and manufacturing quality.

For additional information on the FDA's international programs, please visit: http://www.fda.gov/oia/overview.html. For more information on the historic Memoranda of Agreement signed in December 2007, between the United States and The People's Republic of China, please visit: http://www.hhs.gov/news/press/2007pres/12/pr20071211a.html.

Food Policy Institute Primer on Food Imports and Regulations

Imported foods now make up an estimated 10 to 13 percent of the American diet. The total value of food imported into the United States in 2007 was $70.5 billion, with estimates for 2008 rising to $75 billion. This translates into over nine million entries into the United States of imported food and food-related products annually, passing through one of more than 300 entry points which include ports, border crossings, and postal facilities.

In 2007 multiple instances of contaminated food imported into the United States made news headlines. These incidents raised public questions and concerns regarding the safety and control of food imports. However, understanding the complex set of policies and regulatory procedures related to food imports into the United States can be daunting.

As an aid to understanding the food import system, the Food Policy Institute at the Rutgers New Jersey Agricultural Experiment Station has released a new report, The US Food Import System: Issues, Processes and Proposals.

"We have written this primer to assist reporters, writers, scientists, politicians and the public in understanding both the current rules and proposed changes to the food import system," said Mary Nucci, a research analyst at the Food Policy Institute and lead author of the report. "While there is a great deal of interest in food imports and their safety, the information required to understand the relevant issues is not widely dispersed. This report fills that gap."

The report examines current policies and the procedures followed by the Food and Drug Administration and the United States Dept. of Agriculture in their management of food imports. It provides background history on the existing system, explains some current loopholes in the system and outlines several current proposals for both legislative and policy changes.

Copies of the report are free and available to be downloaded through the Food Policy Institute Web site (www.foodpolicyinstitute.org).

The authors of the report were Mary L. Nucci, Jocilyn E. Dellava, Cara L. Cuite, and William K. Hallman, all affiliated with the Food Policy Institute. The project was funded as part of a National Integrated Food Safety Initiative grant awarded by the Cooperative State Research, Education, and Extension Service of the United States Dept. of Agriculture.

The Food Policy Institute is a research unit of the Rutgers New Jersey Agricultural Experiment Station that addresses food and health policy issues. The institute supports public and private decision makers who shape aspects of the food system within which government, agriculture, industry and the consumer interact.

New Technique Puts DNA Profiling of *Escherichia coli* on Fast Track

Using new genetic techniques, scientists are unlocking the secrets of how *E. coli* bacteria contaminate food and make people sick.

Michigan State University has developed a new technique to test

the DNA of *E. coli* bacteria by examining very small genetic changes called single nucleotide polymorphisms or SNPs (pronounced snips). Using SNPs, scientists analyzed 96 markers, making genetic analysis of pathogenic bacteria possible at a rate never before accomplished.

"It used to take three months to score one gene individually," said Thomas Whittam, Hannah Distinguished Professor at the National Food Safety and Toxicology Center at MSU. "Now, we are working on a new, more rapid system that can do thousands of genes per day."

In a new study released in the edition of the Proceedings of the National Academy of Sciences, "Variation in Virulence Among Clades of *Escherichia coli* O157:H7 Associated with Disease Outbreaks," Whittam and his co-authors looked at the DNA of more than 500 strains of a particularly dangerous member of the *E. coli* family, O157:H7. In collaboration with David Alland of the University of Medicine and Dentistry of New Jersey, Whittam discovered that individual bacteria could be separated into nine major groups, called clades.

E. coli makes people sick because they produce toxins, called Shiga toxins. These toxins block protein synthesis, an essential cellular function, particularly in the kidneys. What Whittam found was that the different clades produced different kinds of Shiga toxins in varying amounts based on their DNA.

"For the first time, we know why some outbreaks cause serious infections and diseases and others don't," Whittam said. "The different *E. coli* groups produce different toxins."

Rapid genetic characterization also opens up a new world of possibilities for identifying the bacterial culprits in outbreaks and finding out where they originated.

E. coli usually come from animal waste contaminating human sources of food or water. Finding out how the bacteria entered the food source always has been a challenge, but now food safety experts can use DNA just like police use DNA at crime scenes. Scientists will be able to identify those bacteria making people sick, find out where they entered the food source and then use this information to reduce contamination.

"This is the first time anyone has been able to classify very closely related groups," Whittam said.

"This is also the first time we can tell the differences in how they cause disease."

Whittam also has plans to use this methodology to study other bacterial strains, like *Shigella*, a major cause of diarrhea around the world. "This new equipment can be used to identify hundreds of thousands of pathogenic bacteria," Whittam said.

Foodborne Outbreaks from Leafy Greens on Rise

Over the past 35 years the proportion of foodborne outbreaks linked to the consumption of leafy green vegetables has substantially increased and that increase can not be completely attributed to Americans eating more salads according to research presented (March 17) at the 2008 International Conference on Emerging Infectious Diseases in Atlanta, GA.

"Consumption of leafy greens has increased over the years, but it does not completely explain the increase in the proportion of foodborne outbreaks due to leafy green consumption," says Michael Lynch of the Centers for Disease Control and Prevention (CDC), a researcher on the study.

Prompted by the high profile *E. coli* outbreaks associated with spinach and lettuce in 2006, Lynch and his colleagues decided to investigate the incidence of foodborne disease outbreaks associated with leafy greens in the past. Using data from the CDC foodborne disease outbreak surveillance system they analyzed over 10,000 foodborne disease outbreaks reported between 1973 and 2006.

For the entire period, approximately 5% of all foodborne outbreaks were linked to leafy greens. Most of these (60%) were caused by norovirus, but some were caused by *Salmonella* (10%) and *E. coli* (9%).

"Given recent experiences that was not a total surprise. What was interesting was when we compared the numbers to consumption data," says Lynch.

Using per capita availability of leafy greens in the United States as a proxy for leafy green consumption, the researchers compared per capita consumption of leafy greens with the proportion of foodborne outbreaks caused by leafy green consumption.

"During the 1986–1995 period US leafy green consumption increased 17% from the previous decade. During the same period, the proportion of all foodborne disease outbreaks due to leafy greens increased 60%. Likewise during 1996–2005 leafy green consumption increased 9% and leafy green-associated outbreaks increased 39%," says Lynch.

Further investigation is necessary in order to determine other factors that may help explain the

increase, says Lynch. While many foodborne outbreaks can be traced to a problem in food preparation, he notes that some outbreaks are fairly widespread, suggesting that contamination took place early in the production process, either on the farm or the processing plant.

"The proportion of outbreaks due to leafy greens has increased beyond what can be explained by increased consumption. Contamination can occur anywhere along the chain from the farm to the table. Efforts by local, state and federal agencies to control leafy green outbreaks should span from the point of harvest to the point of preparation," says Lynch.

BASF Nutrition Ingredients Business Unit Ensures Food Safety

Where does the salmon fillet in the freezer come from? What's in chickenfeed, and possibly also in the barbecued chicken later on? Especially when it's about the food they eat, consumers want to know what they are buying and what ends up on their plate. The requirements to be complied with by feed and food manufacturers are correspondingly high in terms of safety, quality, traceability, and environmentally benign manufacture of individual products and ingredients.

The BASF Nutrition Ingredients business unit has now developed a method that makes all these aspects transparent. "Our S.E.T. initiative allows feed and food manufacturers to trace exactly which ingredients were used and which conditions applied in the manufacture of a product," says Dr. Christoph Günther, the man in charge of the initiative in the Nutrition Ingredients unit.

S.E.T. stands for Sustainability, Eco-Efficiency and Traceability and is based on the TÜV-certified (TÜV stands for Technical Standards Organization, a body that conducts technical safety checks, especially those specified by national laws or regulations) eco-efficiency analysis. Eco-efficiency analysis analyzes the life cycle of a product or manufacturing process "from cradle to grave." The process hence includes aspects such as environmental pollution and carbon dioxide (CO_2) emissions by the products themselves and their precursor products. This method is also used by the Eco Institute in Freiburg, Germany.

"In S.E.T., we apply this principle to our food ingredients and feed additives, making sustainability tangible," says Günther. "The data generated in eco-efficiency analysis of our products are available to our customers from the feed and food industry as required." That way, customers can see any time whether and to what extent the starting materials they use to manufacture their products are sustainable. The data are accessible to all customers anywhere in the world via GTNet® (Global Traceability Network), a global platform used in the food industry for targeted sharing of product information material. "In this manner, we help our customers to meet consumers' growing expectations in terms of the sustainability and traceability of food products," Günther continued.

BASF's Nutrition Ingredients business unit is a leading supplier of food ingredients and feed additives. The product portfolio for human nutrition includes vitamins, carotenoids, omega-3s and others. BASF offers products of outstanding quality produced with modern, state-of-the-art technologies. BASF also combines technical services and scientific expertise to meet the highest demands and to deliver the best value to the industry. Premium formulations are a key strength that has made BASF a leader in the industry. Further information is available at www.nutrition.basf.com.

CFA Welcomes Revised FSA Advice Not to Re-Wash Ready-to-Eat Leafy Salads

The Chilled Food Association (CFA) welcomes FSA's recommendation, endorsed by ACMSF at its meeting on March 11, 2008, to change its advice to consumers regarding the rewashing of pre-washed ready to eat (RTE) leafy salads before consumption.

CFA has long argued that advice to consumers to re-wash is unnecessary and introduces the possibility of cross contamination in the kitchen. Research has also suggested that additional washing of fresh produce provides little additional benefit in reducing contamination.

Using published data and information provided by CFA, FSA and ACMSF have reviewed the evidence and decided that its advice to consumers may not be appropriate. In coming to its decision the FSA and ACMSF took into account:

- the excellent safety record of RTE leafy salads;
- industry's implementation of strict controls to assure safety;
- produce safety being primarily assured by using the correct field controls to prevent contamination at source;

- washing mainly removing soil which harbors micro-organisms,
- re-washing professionally pre-washed leaf does not remove appreciably more microorganisms.

In their report to the ACMSF, the FSA acknowledged the role of CFA, in particular its Microbiological Guidance for Produce Suppliers to Chilled Food Manufacturers (MGG2) and its Best Practice Guidelines for the Production of Chilled Food, which were developed by CFA in conjunction with retailers, distributors and Government scientists, many of whom are microbiology experts. MGG2 sets out in detail the procedures to be followed to ensure safety and quality and include the introduction of HACCP and risk assessment systems, microbiological assessment of irrigation water, hygiene provision for field workers, hygiene training of harvest staff, hygienic facilities for harvesting, handling, chilling, packaging and distribution, assigning a short shelf life and providing a chilled supply chain to minimize potential for microbiological growth. The Best Practice Guidelines cover intake of raw materials to the production of leafy salads.

In welcoming the decision, Kaarin Goodburn, CFA's Secretary General said, "We are very pleased that FSA advice is to be changed. Safety is CFA members' first priority and our members operate to the highest standards as laid down in our Guidelines which are mandatory for all our members. We welcome the change in emphasis in FSA's approach to recognizing the key food safety role of field hygiene to minimize potential for contamination at source. We call on FSA to support the introduction of such standards throughout the fresh produce supply base, including herbs and wholesale."

Slaughter Inspection 101

USDA's Food Safety and Inspection Service (FSIS) is responsible for ensuring the safety and wholesomeness of meat, poultry, and processed egg products and ensures that it is accurately labeled.

FSIS enforces the Federal Meat Inspection Act (FMIA), the Poultry Products Inspection Act (PPIA) and the Egg Products Inspection Act. These laws require federal inspection and regulation of meat, poultry, and processed egg products prepared for distribution in commerce for use as human food.

FSIS employs about 7,800 inspection program personnel. They inspect more than 6,200 federally inspected establishments. These establishments vary greatly in size and type of activity conducted.

Inspection Basics

- Industry is accountable for producing safe food.
- Government is responsible for:
- setting appropriate food safety standards,
- verifying through inspection that those standards are met, and
- Maintaining a strong enforcement program to deal with plants that do not meet regulatory standards.
- Slaughter facilities cannot operate if FSIS inspection personnel are not present.
- Only federally inspected establishments can produce products that are destined to enter commerce.
- To receive federal inspection, an establishment must apply for and receive an official Grant of Inspection. To obtain this, an establishment must:

- Have written Sanitation Standard Operating Procedures;
- Conduct a hazard analysis;
- Develop and validate a Hazard Analysis Critical Control Point (HACCP) Plan; and
- Agree to abide by all FSIS regulations.
- FSIS conducts carcass-by-carcass inspection at all federally inspected slaughter facilities and ensures that establishments follow all food safety and humane handling regulations.
- FSIS inspection program personnel verify that the establishment maintains proper sanitation procedures; it follows its HACCP plan and complies with all FSIS regulations pertaining to slaughter and processing operations.
- If the establishment fails to maintain sanitation, does not follow its HACCP plan or violates other regulations, FSIS inspection program personnel will issue a citation to the establishment in the form of a noncompliance record to document the noncompliance. If necessary, they could also take regulatory control action.
- Livestock slaughter and processing establishments must maintain written procedures for removing, segregating and disposing of specified risk materials (SRMs) so they do not enter the food supply.

- SRMs are high-risk tissues that pose the greatest risk of exposure to bovine spongiform encephalopathy (also known as BSE or "mad cow disease").
- Some examples of SRMs are the brain, skull, eyes, trigeminal ganglia, spinal cord, vertebral column, and dorsal root ganglia of cattle 30 months of age and older; the tonsils of all cattle; and the distal ileum of all cattle.

Ante Mortem or before slaughter

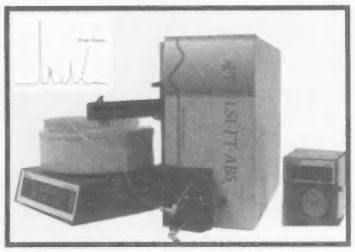
- Establishments are required to notify FSIS inspection program personnel when animals arrive at the establishment.
- Inspection at a slaughter establishment begins in the ante mortem area or pen where FSIS inspection program personnel inspect live animals before moving to slaughter.
- It is the establishment's responsibility to follow the Humane Methods of Slaughter Act. Egregious violations to humane handling requirements can lead to suspension of inspection activity within an establishment. This will stop the plant from operating.
- Noncompliance records for humane handling also can be issued when the violation is less than egregious, such as not having water available in pens.
- During this inspection, FSIS inspection program personnel observe all animals at rest and in motion.
- They are trained to look for abnormalities and signs that could indicate disease or health conditions that would prohibit the animal from entering the food supply.
- The establishment must identify the animals and maintain that identity throughout the slaughter process.
- If an animal goes down or shows signs of illness after receiving and passing ante mortem inspection before slaughter, the establishment must immediately notify the FSIS veterinarian to make a case-by-case disposition of the animal's condition.
- These animals are labeled as "US.Suspect" and are segregated until the animal has received additional inspection.
- FSIS veterinarians and other inspection personnel are not stationed in the ante mortem area for the entire day. They do return randomly to verify humane handling, as well as during the stunning and bleeding process.
- Other inspection activities are also conducted off-line when ante mortem inspections have been completed. These off-line FSIS inspection program personnel move through the different areas of the establishment while performing their duties. This gives them the ability to be random during their inspections.

Post Mortem or after slaughter

- Post mortem inspection occurs in the slaughter area after the animal has been stunned and bled.
- FSIS inspection program personnel perform carcass-by-carcass post mortem inspections. Agency inspection personnel are stationed at fixed positions along the slaughter line, and are known as on-line inspectors.
- Inspectors look for signs of disease or pathological conditions that would render a carcass unwholesome or otherwise unfit for human consumption.
- Any carcass in need of further diagnosis or disposition is segregated and the veterinarian summoned.
- The establishment must maintain the identity of every carcass and ensure that the retained carcasses do not enter the food supply until it is released by FSIS inspection program personnel.
- After further inspection, if a carcass has no signs of disease or pathological conditions, it is passed without restriction and may enter the food supply.
- Off-line FSIS inspection program personnel also observe those parts of the slaughter area not directly related to carcass inspection, such as where the hides are removed.

www.foodprotection.org

INDUSTRY PRODUCTS



Lambda Solutions Dimension, Inc.

New Ultra High Performance Flow-Through Raman System! The Lambda Solutions Dimension FT–ABS

FT-ABS represents the first true high sensitivity on-line Raman System for critical fluid-phase monitoring.

The XL-FT features provide exceptional sensitivity and stability. The quartz-teflon cell design offers solvent/acid/base resistance and LSI RealTime monitoring software and optional integrated UV-Vis absorption extend analytical capability.

Wide ranging applications make the XL-FT ideal for semi-conductor wet chemistry, petrochemical production and formulation, fermentation and chemical reaction monitoring.

This Flow Through System offers High Performance and Robustness with proven 24/7 operation, coverage from 50 cm-1 to 3000 cm-1 and resolution to 1.5 pixels/cm-1.

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

bioMérieux Extends Food Testing Capabilities with New AOAC RI Approval

bioMérieux, an industrial microbiology and diagnostics company, recently increased its food testing capabilities through a new AOAC Research Institute approval. bioMérieux received Performance Testing Method (PTM) approval for the food matrix extension for the VIDAS® *Listeria* Species Xpress (LSX) test with Ottaviani Agosti Agar (OAA).

"The data from this evaluation demonstrated equivalent or better performance of the VIDAS LSX test with OAA Agar to the US FDA and USDA reference methods," said Dr. Sharon Brunelle, technical consultant, AOAC Research Institute. "The VIDAS LSX test now covers a broader food matrix claim."

Originally, the VIDAS LSX test covered a select group of meats, dairy products and environmental surfaces. The recent AOAC approval expands this group by adding green beans, cauliflower, pasteurized crabmeat, frozen cod fillets, raw unpeeled shrimp, chicken franks and raw ground chicken.

"bioMérieux is excited to receive this additional approval for the VIDAS LSX test from the AOAC Research Institute," said Herb Steward, executive vice president, bioMérieux, Inc.

The VIDAS LSX Solution combines the use of an innovative media (*Listeria* Xpress broth) for optimized *Listeria* enrichment and the VIDAS LSX assay. The LX broth reduces lag time and boosts organism recovery. The LSX assay utilizes a combination of polyclonal and monoclonal antibodies, which increases sensitivity and specificity. Results for environmental surfaces are available in about 26–28 hours, while meat and dairy results are available in about 30–34 hours after sampling.

bioMérieux
800.634.7656
Hazelwood, MO
www.biomerieux.com

Sterilex Introduces Drain Program for the Removal of Biofilm and Food Pathogens in Drains and Trunk Lines

Sterilex has introduced an exciting drain and trunk line sanitation program involving the use of Sterilex biocides in an easy-to-use device that applies thick foam to drains and down into trunk lines. This program is cost effective and allows users to kill bacteria, remove dangerous biofilms, kill mold and mildew, and remove organic contaminants from their drains and trunk lines. The Sterilex drain program is the first and only program in the US that has been EPA approved to remove biofilm and kill dangerous pathogens that live in drains and trunk lines.

The Sterilex drain program has attracted widespread interest in the food processing, food service and janitorial industries. Drains and trunk lines have been shown to be a breeding ground for resistant pathogens which like to form protective biofilms in wet environments.

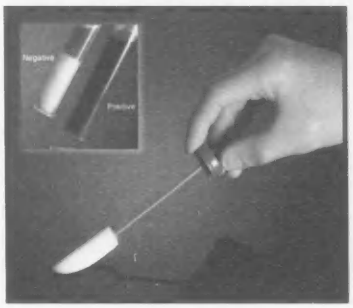
Be sure to mention, "I read about it in *Food Protection Trends*"!

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.

Sterilex offers a revolutionary new formula to combat dangerous biofilms and prevent cross contamination.

Sterilex products have received widespread recognition and are recommended by QA/QC managers at leading food processing companies. Sterilex was awarded a USDA National Research Initiative grant to demonstrate the efficacy of its products against *Listeria monocytogenes* in meat and poultry plants. Sterilex was the first company to receive biofilm removal claims for industrial and public health applications by the US EPA, and was also the proud recipient of "Bio Product of the Year" award from the Technology Council of Maryland.

Sterilex® Corporation
800.511.1659
Owings Mills, MD
www.sterilex.com



SDI-LIB *Listeria*: The Easiest *Listeria* Test Available from Hardy Diagnostics

Presumptive results are available for the most common *Listeria* spp. within 30 hours. *Listeria* Indicator Broth (SDI-LIB) is intended to be used in the food processing environment on food contact surfaces to detect the presence of *Listeria* species. Simply swab the surface, add the *Listeria* Indicator Broth to the sample and incubate. No complicated sub-culturing, or specimen transfers required, thus reducing any chance of cross contamination. A color change from yellow to brown or black is considered presumptive positive. The *Listeria* Indicator Broth contains a patented formula of antibiotics, growth enhancers and color-changing compounds. The antibiotics function synergistically to inhibit most non-*Listeria* microorganisms. Growth enhancers provide recovery nutrients to support the growth of sublethally injured *Listeria*. Indicator compounds will turn the broth from yellow to black by utilizing the β-glucosidase enzyme produced by *Listeria* species. A brown or black color after 30 hours at 37°C indicates a presumptive positive test for *Listeria* spp. The SDI-LIB media has recently earned AOAC approval. Compared to UVM and BLEB, the new SDI-LIB provides equivalent or superior recovery and faster detection as low as 10–50 heat injured *Listeria monocytogenes* organisms per mL within 24 to 30 hours of incubation. This testing method is 98% sensitive and 99% specific, and provides comparable results to the USDA methods. The SDI-LIB can be used as an economical pre-screen for environmental *Listeria* instead of performing expensive PCR or other more complicated assays on every sample.

Hardy Diagnostics
800.266.2222
Santa Maria, CA
www.hardydiagnostics.com

Maintaining, Monitoring and Mapping Pharmaceutical Manufacturing from Dickson Instruments

In the highly regulated world of pharmaceutical manufacturing, tracking and logging temperature and humidity is a necessity. Constant monitoring of environmental conditions is required where a slight change in temperature can affect production and compromise the quality of drugs being produced. The goal is to produce high quality pharmaceuticals in a regulated environment ensuring efficacy of all the drugs being manufactured.

Quality Control professionals at one pharmaceutical manufacturing company use a combination of Dickson data loggers to help them maintain, monitor, and map the environmental conditions in their manufacturing facility. The Quality Control professionals at this facility were looking for a solution that gives instant graphical history of the temperature and humidity. They also needed to be able to download the data to view and analyze any abnormal readings. This facility, like many pharmaceutical manufacturing sites, is under strict guidelines from governing agencies to maintain specific conditions leading to the safe production of pharmaceuticals.

This pharmaceutical company solves their needs with two different Dickson instruments. Dickson's Graph-at-a-Glance Paperless Chart Recorder (FH325) provides the QC department with both immediate and historical data. The large graphical display allows them a quick glance at current data and gives the flexibility of downloading the data

with either a Flash memory card or a USB connection. The easy-to-use interactive screen gave officials the proper mix of instant and past readings.

Constant monitoring at this facility does not stop because an area is too small or cumbersome. For these hard-to-reach yet critical areas, the QC department is using the economical Dickson TK500. This coin-sized logger allows for maximum monitoring while still giving valuable data needed to comply with governing regulations. The lightweight design allows for the opportunity to gain maximum information with minimal effort.

When regulated industries such as pharmaceutical manufacturing need to maintain, monitor, and map environmental conditions they turn to Dickson. The impeccable accuracy, ease-of-use and maximum flexibility give Pharmaceutical QA officials the very best monitoring instruments to ensure they manufacture high quality in pharmaceuticals.

Dickson Instruments
800.323.2448
Addison, IL
www.DicksonData.com

Charm Sciences Announces the First Lateral Flow Quantitative Test to be Approved for Official Testing of Ochratoxin in the US National Grain Inspection System

The ROSA® Ochratoxin Quantitative kit is the eighth Charm mycotoxin test to have received approval from USDA GIPSA (Grain Inspection, Packers and Stockyards Administration). The ROSA Ochratoxin kit (Rapid One Step Assay) delivers fast, economical, accurate detection for Ochratoxin A in a convenient single strip. It has the flexibility to meet domestic and export requirements with quantitative readings and a detection range from 0 to 12 ppb (10 – 150 ppb with dilution).

Following a methanol extraction on wheat, the diluted sample is added to the ROSA OCHRA strip and read after 10 minutes. The ROSA-M reader stores Ochratoxin results electronically for record keeping and reporting. Optional mycoSOFT™ software delivers flexible and intuitive functionality with customized data trending reports.

The ROSA Ochratoxin lateral flow tests require minimal equipment and user involvement. Multiple samples can be prepared and tested at the same time. The ROSA Ochratoxin kit uses the same extraction as the GIPSA approved quantitative ROSA methods for aflatoxin and zearalenone. The ROSA Ochratoxin kit shares the same equipment and comparable assay formats as the ROSA methods for aflatoxin, DON, fumonisin and zearalenone.

Ochratoxin is produced by some species of *Aspergillus*, such as *A. ochraceus*, mainly in tropical regions and by *Penicillium verrucosum* in cooler climates. Ochratoxin A is associated with porcine nephropathy and various symptoms in poultry. Ochratoxin is found in wheat, barley, corn, oats, sorghum, soybeans, coffee beans, grapes, and raisins.

Charm Sciences, Inc.
978.687.9200
Lawrence, MA
www.charm.com

WLD–TEC

WLD–TEC Gmbh Introduces the Sensorturn and Sensorturn Pro

These new turntables are designed for inoculation of petri dishes up to 150 mm in diameter. They utilize touch-free IR-Sensor technology which guarantees extremely simple operation with the movements of the hand. Alternatively these new units can be operated with an optional foot pedal.

These units offer flexible start-stop functions or the second timer control with variable rotational periods from 1 – 25 seconds. For longer applications the time can be extended to 125 seconds.

The Sensorturn features a continuously variable rotational speed control with a range of 14 to 110 rpm. The Sensorturn pro range is 14 to 210 rpm. This control ensures uniform plating of the petri dishes up to a diameter of 100 mm (optional: up to 150 mm).

The highest degree of sterility is ensured by the device's stainless steel construction and its flame-sterilizability.

WLD-TEC
310.589.3709
Chicago, IL
www.WLD-TEC.com

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

AgraQuant® DON ELISA Test Kit Granted USDA/ GIPSA and AOAC Approval

Romer Labs® is pleased to announce that its AgraQuant® DON ELISA Test Kit for the detection of Deoxynivalenol (Vomitoxin) was recently granted Performance Tested Status by the AOAC Research Institute (AOAC-RI No. 110701).

Additionally the USDA's Grain Inspection, Packers and Stockyards Administration (GIPSA) has verified the performance of the AgraQuant® DON Test Kit and approval was granted for official use at US National Grain Inspection Facilities. (FGIS 2008-101)

The AgraQuant® DON is a simple ELISA test kit that quantifies Deoxynivalenol within a range of 0.25 and 5 ppm in grain and other commodities.

The *Fusarium graminearum* fungus is the principal producer of deoxynivalenol, also known as DON or vomitoxin, in grains. It survives on old, infected residue left on the field from the previous growing season. DON is a known immunosuppressant and may cause kidney problems in humans. In addition, it often affects swine by causing a decrease in grain consumption. DON is one of the most widely regulated mycotoxins in the world.

Romer Labs Inc.
636.583.8600
Union, MO
www.romerlabs.com

BAX® System Eight-Hour Assay for Detecting *Listeria* Certified by AOAC-RI

A new BAX® system assay from DuPont Qualicon that uses innovative technology for rapid *Listeria* detection has been certified as Performance Tested℠ Method No. 030801 by the AOAC Research Institute (RI) of Gaithersburg, MD.

Validation studies compared BAX® system performance to the standard culture method used by the US Dept. of Agriculture Food Safety and Inspection Service. AOAC-RI found that the automated BAX® system performed significantly better than the culture method for detecting *Listeria* on stainless steel surfaces. Moreover, by using advanced technology called reverse-transcriptase polymerase chain reaction (RT-PCR) to jump-start the reaction, results are available just eight hours after sampling.

Food processing companies around the world rely on the BAX® system to detect pathogens or other organisms in raw ingredients, finished products and environmental samples. The automated system uses leading-edge technology, including polymerase chain reaction (PCR) assays, tableted reagents and optimized media, to also detect *Salmonella*, *Listeria*, *E. coli* O157:H7, *Enterobacter sakazakii*, *Campylobacter* and *Staphylococcus aureus*.

DuPont Qualicon
800.863.6842
Wilmington, DE
www.qualicon.com

Eriez Offers Cost-Effective Line of ProGrade® Products for the Sanitary Industries

Eriez® ProGrade® Rare Earth and ProGrade Xtreme™ Series Magnetic Separators are economical, effective and powerful enough to meet the high purity demands of the food, chemical and pharmaceutical grade industries. Available in plate, grate, tube and sanitary trap assemblies, ProGrade Rare Earth and ProGrade Xtreme™ Series Magnetic Separators offer solutions for practically every sanitary industry process application.

ProGrade Rare Earth power helps prevent product contamination and tramp metal damage. Rare Earth powered separators are designed to remove small ferrous contaminants such as pins, clips and other fine ferrous contaminants. Assemblies feature stainless steel construction, utilize high-power Rare Earth magnets and are constructed with demanding attention to welds and finish.

ProGrade Xtreme Rare Earth power is the ultimate in process purity. These assemblies combine the finest materials and construction techniques with the industry's most powerful magnetic circuits to remove weakly magnetic fine ferrous contamination.

Eriez
888.300.3743
Erie, PA
www.eriez.com

WTI INC.
WORLD TECHNOLOGY INGREDIENTS

281 Martin Luther King Jr. Ave – Jefferson, GA 30549-1447
800-827-1727 – ph 706-387-5150 – fax 706-387-5159
www.wtiinc.com

WTI – A World Leader in Food Safety and Functional Food Ingredients

World Technology Ingredients Company, Inc. (WTI, Inc) is a specialty ingredients company founded in 1978 to provide ingredients and technology to the meat, poultry and seafood industries. Since 1988, World Technology Ingredients has been issued 12 patents in ingredient and food process technology.

WTI manufactures dry and liquid ingredients for use by food manufacturers to enhance finished product performance and inhibit a broad range of bacteria, yeast and molds. All ingredients manufactured and sold by World Technology Ingredients are approved for use in USDA and FDA regulated products. All WTI ingredients are Generally Recognized As Safe (GRAS), nonallergenic and safe for direct contact.

WTI opened its new state of the art production facility in Jefferson, Georgia in December 2005 with additional capacity to do Custom Blending and Contract Packaging. The facility, carefully designed to exceed all Good Manufacturing Practices (GMP's) requirements received a SUPERIOR rating by the AIB on its very first inspection.

WTI is committed to providing safe, new and innovative technologies for its customers. Through leading edge research and technical initiatives, WTI is able to meet the needs of its customers, both large and small. Our goal is simple – to continuously identify and develop new ingredients/technology which provides our customers the tools to profitably succeed.

WTI Products Portfolio

The World Technology Ingredients products portfolio consists of six different brands of product, each designed to profitably enhance selected performance attributes of a wide variety of foods. The brands are: *IONAL, Myosol, MOstatin, TenderIn, Marinal and FlavorIn.*

IONAL Products

The *IONAL* brands of antimicrobials consist of three basic product lines: *IONAL, IONAL Plus* and *IONAL LC* – all based upon blends of buffered citrates alone or in combination with diacetate or acetate. Since it's approval as an antimicrobial for meats and poultry in 1995 extensive research has been conducted into the use of buffered citrates to inhibit the growth of microorganisms in/on raw and ready to eat meats and poultry.

IONAL

IONAL is straight buffered sodium or potassium citrate. As the name implies it increases ionic strength. In muscle protein systems this equates to increased marinade/brine retention and yield during processing with less moisture migration and purge in the finished package.

IONAL Plus

IONAL Plus products are buffered citrates with diacetate or acetate. They are used to increase the shelf life of perishable foods, especially raw marinated meats, fish and poultry. Typically incorporation of *IONAL Plus* into a food system will double the products shelf life.

IONAL LC

IONAL LC products are buffered citrates with diacetate or acetate which have been specifically formulated to inhibit the growth *Listeria monocytogenes* in/on foods, especially ready-to-eat meats (RTE). In RTE meats, *IONAL LC* has also been shown an effective means of preventing the outgrowth of *Clostridium perfringens* spores.

Myosol Products

Myosol brand phosphates are supersaturated tetrapotassium pyrophosphate solutions which are pH optimized to meet your specific needs. *Myosol* and *Myosol Plus* are performance enhanced functional ingredients designed to improve product/process yield and meat tenderness. They are readily soluble in cold water and instantaneously reactive in meat systems.

MOstatin Products

MOstatins are all natural, consumer friendly, clean label ingredients designed to inhibit the growth of microorganisms in/on food. MO for microorganism; statin for stasis or no growth. *MOstatins* have been successfully validated as an all natural CCP for *Listeria* for RTE meats, soups and salads.

MOstatin LV

MOstatin LV is an all natural blend of lemon juice concentrate and vinegar designed to enhance the organoleptic properties of foods while inhibiting a broad spectrum of bacteria, yeast and molds. *MOstatin LV* increases the water holding capacity of muscle protein systems. At low concentrations *MOstatin LV* does not have any flavor impact on the finished product. At higher concentrations, its slight citric taste enhances the natural flavors of meats, fish, poultry and vegetables.

MOstatin V

MOstatin V is a vinegar based product designed as a surface treatment to inhibit a broad spectrum of microorganisms.

MOstatin VE

MOstatin VE is a vinegar based system with native starches designed to increase marinade retention in ready to eat muscle foods while inhibiting a broad spectrum of bacteria, yeast and molds. At low concentrations *MOstatin VE* does not have any flavor impact on the finished product. At higher concentrations it yields a slight vinegar taste and odor.

FlavorIn Products

FlavorIns are all natural flavor systems derived from fruit, vegetable and vinegar based ingredients designed to enhance the organoleptic attributes of food systems. They are available in both a dry and liquid form depending upon the desired functionality in the finished product.

TenderIn Products

TenderIns are all natural, consumer friendly, clean label alternatives to phosphates for use in muscle foods. *TenderIns* are derived from fruit juices and vegetable bi-products. They are species specific products – each formulated to accommodate the different functional characteristics encountered by different muscle foods: a.k.a. beef, chicken, pork, turkey or fish.

TenderIn DL

TenderIn DL is processed lemon juice concentrate dried onto a rice flour carrier designed to increase the cook yield of ready to eat meats and overall viscosity of food systems. The rice flour is a specialty blend formulated to deliver the optimum amylose and amylopectin concentrations. Its unique properties in cooked systems make *TenderIns* a viable alternative to phosphates.

TenderIn L

TenderIn L is the liquid form of *TenderIns*, each custom blended to meet the specific performance requirements of a wide range of food systems.

Marinal Products

Marinal brand marinades are customized systems designed to deliver performance at an affordable cost. They are specially formulated to maximize the interactions between substrate, process and packaging in order to achieve the customers' desired performance objectives.

95th Annual Meeting

IAFP 2008

Columbus, Ohio • August 3–6

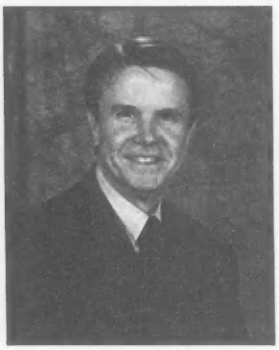
Ivan Parkin Lecture

Sunday, August 3

6:00 p.m.

Utility of Microbiological Testing for Food Safety Assurance: The Good, the Bad, and the Ugly

Dr. Russell S. Flowers
Silliker Group Corporation
Homewood, Illinois



Dr. Russell S. Flowers, Jr. is Chairman and Chief Scientific Officer of Silliker Group Corporation in Homewood, Illinois, where he spearheads strategic growth opportunities and assures that Silliker remains on the forefront of science and technology.

Dr. Flowers earned his BS and MS degrees from North Carolina State University, and his Ph.D. from the University of Illinois. He began his career with Silliker as a Laboratory Director in 1979, advancing to President in 1990. At that time, Silliker expanded to a global network with more than 45 locations, offering analytical and advisory services related to food safety and quality. He assumed his present position in January 2007.

Dr. Flowers has been an active researcher, author and speaker in the field of food microbiology, with particular emphasis on the development and validation of rapid analytical methods, and laboratory performance. He was the study director for the validation of the first Enzyme Immuno-Assay and Nucleic Acid Hybridization Assay approved by AOAC, and many subsequent studies that have led to industry-wide method implementation for the detection of pathogens in foods and food environments. Dr. Flowers also chaired the Food Laboratory Accreditation Working Group, which developed specific ISO accreditation criteria adopted by AOAC and A2LA for food testing laboratories.

The recipient of numerous industry awards and honors, Dr. Flowers is an active member of IAFP and several other professional organizations and societies, including the International Commission on Microbiological Specifications for Foods (ICMSF); AOAC International; Institute of Food Technologists (IFT); and the International Dairy Foods Association (IDFA).

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JOHN H. SILLIKER LECTURE

WEDNESDAY, AUGUST 6

4:00 P.M.

FROM WILD PIGS IN SPINACH TO TILAPIA IN ASIA: THE CHALLENGE OF THE FOOD SAFETY COMMUNITY

DR. MICHAEL P. DOYLE
University of Georgia
Griffin, Georgia

Dr. Michael P. Doyle is a Regents Professor of Food Microbiology and Director of the Center for Food Safety at the University of Georgia. He is an active researcher in food safety and security, working closely with the food industry on issues related to the microbiological safety of foods.

Dr. Doyle is a graduate of the University of Wisconsin-Madison, where he earned his BS in Bacteriology, and MS and Ph.D. in Food Microbiology. The author of more than 400 scientific publications, Dr. Doyle has given more than 600 invited presentations at national and international scientific meetings, and has received several research awards from academic and national scientific organizations. He is a Fellow of IAFP, the American Academy of Microbiology, and the Institute of Food Technologists (IFT), and is a member of the National Academy of Sciences-Institute of Medicine.

In addition to current service on the food safety committees of several scientific organizations, Dr. Doyle has also served as a scientific advisor to many of them, including the World Health Organization (WHO); the National Academy of Sciences-Institute of Medicine and National Research Council; the International Life Sciences Institute-North America (ILSI); the Food and Drug Administration (FDA); the US Department of Agriculture (USDA); the US Department of Defense; and the US Environmental Protection Agency (EPA).

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IAFP 2008 PRELIMINARY PROGRAM

SUNDAY, AUGUST 3

Opening Session – 6:00 p.m. – 7:00 p.m.

Ivan Parkin Lecture – Utility of Microbiological Testing for Food Safety Assurance: The Good, the Bad, and the Ugly — Russell S. Flowers, Ph.D., Chairman and Chief Scientific Officer, Silliker Group Corp., Homewood, IL

MONDAY, AUGUST 4

Morning – 8:30 a.m. – 12:00 p.m.

Symposium Topics

- S1 2008 Foodborne Disease Outbreak Update: *Salmonella* in Processed Foods
- S2 Coming Out of the *Campylobacter* Closet: International Strategies for Reducing Human Campylobacteriosis
- S3 Globalization of Acceptance Criteria for Microbiological Methods: Separating the Science from the Politics

Roundtable Topic

- RT1 Eating Seafood – Is It Worth the Risk?

Technical Sessions

- T1 Pathogens, Beverages and Water
- T2 Antimicrobials and General Microbiology

Poster Session

- P1 Produce, Toxicology and Sanitation

Afternoon – 1:30 p.m. – 5:00 p.m.

Symposium Topics

- S4 Bacterial Physiology — A Forgotten Theme That is Critical for the Food Microbiologist
- S5 Sampling and Sample Prep: Unglamorous but Very Necessary
- S6 New and Innovative Ways to Derive Risk-Based Management Options
- S7 Food Safety Issues in Food Transportation – Keeping It Cold and Keeping It Clean

Roundtable Topics

- RT2 Occurrence and Control of Norovirus: *Is Public Vomiting Public Enemy #1?*
- RT3 Does Internalization of Pathogens Occur in Fresh Produce During Commercial Production and Processing?

Technical Session

- T3 Toxicology, Seafood and Meat and Poultry

Poster Session

- P2 Meat and Poultry, Microbial Food Spoilage, Beverage and Dairy

TUESDAY, AUGUST 5

All Day – 8:30 a.m. – 5:00 p.m.

Interactive Session

The Sequel to the Mystery Outbreak – What to Do When It Happens to You!

Session 1: 8:30 a.m. – 10:00 a.m.
Session 2: 10:30 a.m. – 12:00 p.m.
Session 3: 1:30 p.m. – 3:00 p.m.
Session 4: 3:30 p.m. – 5:00 p.m.

Morning – 8:30 a.m. – 12:00 p.m.

Symposium Topics

- S8 Validating Heat Processes for Reducing *Salmonella* in Low Water Activity Foods
- S9 Advancements in Retail Food Safety
- S10 From Fish to Table
- S11 Best Practices in Global Food Export and Import

Roundtable Topic

- RT4 Global Perspectives and Novel Approaches for Effective Food Safety Communication within Culturally Diverse Audiences

Technical Session

- T4 Risk Assessment and Produce

Poster Session

- P3 Applied Laboratory Methods, Education and Epidemiology

Afternoon – 12:15 p.m. – 1:00 p.m.

IAFP Business Meeting

Afternoon – 1:30 p.m. – 5:00 p.m.

Symposium Topics

- S12 Back to the Future: How Clinical Microbiology Findings Today Predict the Food Microbiology Headaches for Tomorrow
- S13 Pathogen Data Sharing to Advance Food Safety
- S14 Food Safety and Regulatory Issues Associated with Non-Thermal Processing of Foods and Beverages
- S15 Harmonization of Irrigation Water Practices
- S16 Spores in the Dairy Industry – A Growing Concern – What Can You Do?

Technical Session

- T5 Applied Laboratory Methods and Novel Laboratory Methods

Poster Session

- P4 Pathogens and Novel Laboratory Methods

WEDNESDAY, AUGUST 6

Morning – 8:30 a.m. – 12:00 p.m.

Symposium Topics

- S17 Dairy Pasteurization in Today's Risk-Based Food Safety Environment – International Perspectives on the Use of Risk Assessment Tools
- S18 Innovative Applications of Bacteriophages in Rapid Enrichment, Detection and Identification of Foodborne Pathogens
- S19 Chemical Contaminants Testing in Foods

Roundtable Topics

- RT5 Comparative International Approaches to Regulating Unsafe Food
- RT6 Water: Potability vs. Drinkability

Technical Session

- T6 Education and Sanitation

Poster Session

- P5 Risk Assessment, Antimicrobials, Seafood and General Microbiology

Afternoon – 1:30 p.m. – 3:30 p.m.

Symposium Topics

- S20 Food Defense Educational Programs and Opportunities: Status, Focus and Future
- S21 Is It Overdone? Examining the Meat and Cancer Hypothesis and Its Impact on Food Safety
- S22 What is the 'Real' Issue with MDR?
- S23 The Greening of Food Packaging: Safety of Biodegradable, Reused, and Recycled Food Packaging
- S24 Food Allergens: Scientific Advances and Control Measures

Technical Session

- T7 Spoilage and Epidemiology

4:00 p.m. – 4:45 p.m.

John H. Silliker Lecture – From Wild Pigs in Spinach to Tilapia in Asia: The Challenges of the Food Safety Community, Michael P. Doyle, Ph.D., University of Georgia, Griffin, GA

Program subject to change

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IAFP 2008 NETWORKING OPPORTUNITIES

IAFP FUNCTIONS

WELCOME RECEPTION

Saturday, August 2 • 5:00 p.m. – 6:30 p.m.

Reunite with colleagues from around the world as you socialize and prepare for the leading food safety conference. Everyone is invited!

COMMITTEE MEETINGS

Saturday, August 2 • 3:00 p.m. – 4:30 p.m.
Sunday, August 3 • 7:00 a.m. – 5:00 p.m.

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

STUDENT LUNCHEON

Sunday, August 3 • 12:00 p.m. – 1:30 p.m.

Sponsored by Texas A&M University, Center for Food Safety

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

EDITORIAL BOARD RECEPTION

Sunday, August 3 • 4:30 p.m. – 5:30 p.m.

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

OPENING SESSION AND IVAN PARKIN LECTURE

Sunday, August 3 • 6:00 p.m. – 7:00 p.m.

Join us to kick off IAFP 2008 at the Opening Session. Listen to the prestigous Ivan Parkin Lecture delivered by Dr. Russell S. Flowers.

CHEESE AND WINE RECEPTION

Sunday, August 3 • 7:00 p.m. – 9:00 p.m.

Sponsored by Kraft Foods

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

IAFP JOB FAIR

Sunday, August 3 through Wednesday, August 6

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

COMMITTEE AND PDG CHAIRPERSON BREAKFAST

Monday, August 4 • 7:00 a.m. – 9:00 a.m.

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

EXHIBIT HALL LUNCH

Monday, August 4 • 12:00 p.m. – 1:00 p.m.

Sponsored by JohnsonDiversey

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

Sponsored by SGS North America

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

EXHIBIT HALL RECEPTIONS

Monday, August 4 • 5:00 p.m. – 6:00 p.m.

Sponsored by DuPont Qualicon

Tuesday, August 5 • 5:00 p.m. – 6:00 p.m.

Sponsored in part by The Kroger Co., Q Laboratories, Inc., Quality Assurance Magazine, and Springer

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

PRESIDENT'S RECEPTION

Monday, August 4 • 6:00 p.m. – 7:00 p.m.

Sponsored by Fisher Scientific

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

BUSINESS MEETING

Tuesday, August 5 • 12:15 p.m. – 1:00 p.m.

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

JOHN H. SILLIKER LECTURE

Wednesday, August 6 • 4:00 p.m. – 4:45 p.m.

The John H. Silliker Lecture will be delivered by Dr. Michael Doyle.

AWARDS RECEPTION AND BANQUET

Wednesday, August 6 • 6:00 p.m. – 9:30 p.m.

Bring IAFP 2008 to a close at the Awards Banquet. Award recipients will be recognized for their outstanding achievements and the gavel will be passed from Dr. Gary R. Acuff to Incoming President, Dr. J. Stan Bailey.

95th Annual Meeting

IAFP 2008

Columbus, Ohio • August 3–6

IAFP 2008 General Information

REGISTRATION INCLUDES

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

Full Registration includes:

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

PRESENTATION HOURS

Sunday, August 3	
Opening Session	6:00 p.m. – 7:00 p.m.
Monday, August 4	
Symposia & Technical Sessions	8:30 a.m. – 5:00 p.m.
Tuesday, August 5	
Symposia & Technical Sessions	8:30 a.m. – 5:00 p.m.
Wednesday, August 6	
Symposia & Technical Sessions	8:30 a.m. – 3:30 p.m.
Closing Session	4:00 p.m. – 5:00 p.m.

GOLF TOURNAMENT

Saturday, August 2

Golf Tournament at Golf Club of Dublin 6:00 a.m. – 2:00 p.m.

Join your friends and colleagues for an exciting round of golf before IAFP 2008. Golf the Golf Club of Dublin (Ohio) and you may envision yourself playing in Dublin, Ireland. The new Golf Club of Dublin was designed with the spirit of golf from the British Isles and will leave you thinking that you have just played Turnberry or Carnoustie. It is the first course in the region to be built with authentic links features such as stacked sod bunkers, rectangular teeing grounds, fescue covered dunes, stone walls and enormous greens. With 18-holes, a driving range, an Irish pub and a banquet hall on site–the Golf Club of Dublin offers a first-class resort style experience.

The Golf Club of Dublin was ranked one of the "Top 25 in America" by Golf Magazine and "Must Play Golf Courses" by ESPN just to name a few. For a true championship test and memorable experience you must play the Golf Club of Dublin. Price includes transportation, greens fees with a cart, range balls, breakfast, lunch and prizes.

REGISTER ONLINE

Register online at **www.foodprotection.org**

EXHIBIT HOURS

Sunday, August 3	7:00 p.m. – 9:00 p.m.
Monday, August 4	10:00 a.m. – 6:00 p.m.
Tuesday, August 5	10:00 a.m. – 6:00 p.m.

HOTEL INFORMATION

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

The IAFP Annual Meeting Sessions, Exhibits and Events will take place or depart from the Hyatt Regency Colubmus. Official hotels for IAFP 2008 are as follows:

Hyatt Regency Columbus	$129 per night
Crowne Plaza	$129 per night
Drury Inn and Suites	$129 per night

CANCELLATION POLICY

Registration fees, less a $50 administration fee and any applicable bank charges, will be refunded for written cancellations received by July 18, 2008. No refunds will be made after July 18, 2008; however, the registration may be transferred to a colleague with written notification. Refunds will be processed after August 11, 2008.

Event and extra tickets purchased are nonrefundable.

International Association for Food Protection®

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

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IAFP 2008 REGISTRATION FORM

3 Ways to Register

ONLINE	FAX	MAIL
www.foodprotection.org	515.276.8655	6200 Aurora Ave., Suite 200W Des Moines, IA 50322-2864, USA

Member Number: _____

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

Employer _____ Title _____

Mailing Address (Please specify: ❒ Home ❒ Work) _____

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

Telephone _____ Fax _____ E-mail _____

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

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

PAYMENT MUST BE RECEIVED BY JULY 1, 2008 TO AVOID LATE REGISTRATION FEES

REGISTRATION FEES	MEMBERS	NONMEMBERS	TOTAL
Registration	$ 415 ($ 465 late)	$ 630 ($ 680 late)	_____
Association Student Member	$ 80 ($ 90 late)	Not Available	_____
Retired Association Member	$ 80 ($ 90 late)	Not Available	_____
One Day Registration* ❒ Mon. ❒ Tues. ❒ Wed.	$ 225 ($ 250 late)	$ 350 ($ 375 late)	_____
Spouse/Companion* (Name): _____	$ 60 ($ 60 late)	$ 60 ($ 60 late)	_____
Children 15 & Over* (Names): _____	$ 25 ($ 25 late)	$ 25 ($ 25 late)	_____
Children 14 & Under* (Names): _____	FREE	FREE	_____
*Awards Banquet not included			
Additional Awards Banquet Ticket – Wednesday, 8/6	$ 50 ($ 60 late)	$ 50 ($ 60 late)	_____
Student Luncheon – Sunday, 8/3	$ 10 ($ 15 late)		_____
GOLF TOURNAMENT		**# OF TICKETS**	
Golf Club of Dublin, Saturday, 8/2	$ 140 ($ 150 late)	_____	_____
WORKSHOPS – PRE-MEETING			
Better Process Cheese Control School	$ 575 ($ 650 late)	$ 675 ($ 750 late)	_____
The Art of Fungal Characterization and Identification: A Hands-on Workshop	$ 620 ($ 695 late)	$ 720 ($ 795 late)	_____
Hands-on Workshop on Microbial Risk Assessment Modeling and Interpretation	$ 270 ($ 345 late)	$ 370 ($ 445 late)	_____
ABSTRACTS			
Annual Meeting Abstracts (citable publication to be mailed Oct. 1)	$ 25	$ 25	_____

Payment Options: ❒ **VISA** ❒ **Master Card** ❒ **American Express** ❒ **Discover**

❒ **Check Enclosed**

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

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IAFP 2008 WORKSHOPS

WORKSHOP 1	WORKSHOP 2	WORKSHOP 3
Better Process Cheese Control School	The Art of Fungal Characterization and Identfication: A Hands-on Workshop	Hands-on Workshop on Microbial Risk Assessment Modeling and Interpretation
Friday and Saturday August 1–2 8:00 a.m. – 5:00 p.m.	**Friday and Saturday August 1–2 8:00 a.m. – 5:00 p.m.**	**Saturday August 2 8:00 a.m. – 5:00 p.m.**

REGISTRATION – (Payment must be received by July 18, 2008 to avoid late registration rates).
Cancellations received by July 18, 2008 will be refunded, less a $50.00 administrative fee. No refunds will be made after this date.

	Early Late	Late Rate
Member	$575.00	$650.00
Non-Member	$675.00	$750.00

	Early Rate	Late Rate
Member	$620.00	$695.00
Non-Member	$720.00	$795.00

	Early Rate	Late Rate
Member	$270.00	$345.00
Non-Member	$370.00	$445.00

Workshop 1 – Better Process Cheese Control School – Processing Controls for Shelf-Stable Pasteurized Process Cheese Product Manufacture – Friday and Saturday, August 1–2

Current regulations for Low Acid Canned Foods (LACF) require that "Operators of systems shall be under the operating supervision of a person who has attended a school approved by the Commissioner for giving instruction appropriate to the preservation technology involved and who has been identified by that school as having satisfactorily completed the prescribed course of instruction." The Better Process Control School (BPCS) training course currently available does not include process cheese formulation as a preservation technology.

This 2-day course is designed to cover LACF regulations as they pertain to shelf-stable process cheese manufacture, microbiology and control of *Clostridium botulinum*, thermal processing/pasteurization, formulation control, process instrumentation, HACCP, and production and packaging controls. Examinations will be given at the completion of each section. Satisfactory completion of this course will fulfill the regulatory certification requirements for operators of process cheese manufacturing systems.

Topics:

- Introduction to LACF Regulations for Shelf Stable Process Cheese
- Microbiology – Basic Microbiology, Factors Affecting Growth
- Thermal Processing – Microbial Death, D, Z, and F Values, Factors Affecting Thermal Resistance, Pasteurization, Commercial Sterilization, Sterilization
- Botulism and Control of *C. botulinum* – Disease, Risks, Methods to Control Toxin Production
- Formulation Control for Shelf Stable Process Cheeses – Ingredients That Affect Safety, FRI Studies, Additional Factors for Safety
- Process Controls for Process Cheese – Cheese Processing Overview, Preparations Prior to Cooking, Batch Cooking, Continuous Cooking, Testing
- Food Plant Sanitation and GMPs – Basic Principles of Sanitation, Good Manufacturing Practices
- HACCP and Production Controls – Principles of HACCP, Critical Control Points for Shelf Stable Process Cheese, Other Production Controls for Shelf Stable Process Cheese
- Packaging for Process Cheese – Package Development Process, Examples of Packaging, Development and Qualification Testing
- Records and Record-Keeping – Reasons for Record-Keeping, Proper Documentation on Records, Record Retention and Availability, Product Recalls, Processing Records

Instructors:

Kathy Glass, University of Wisconsin-Madison, Madison, WI, USA
Loralyn Ledenbach, Kraft Foods, Glenview, IL, USA
Virgil Metzger, Kraft Foods, Glenview, IL, USA
Don Zink, FDA-CFSAN, College Park, MD, USA

Organizer:

Loralyn Ledenbach, Kraft Foods, Glenview, IL, USA

INTENDED AUDIENCE

Operators, supervisors, and management in process cheese manufacturing facilities. Food safety professionals and regulatory officials involved in LACF filing for process cheese products

This workshop is dedicated to Dr. Nobi Tanaka, whose work at the Food Research Institute, University of Wisconsin-Madison has been instrumental in assuring the safety of shelf stable process cheese products.

Workshop 2 – The Art of Fungal Characterization and Identification: A Hands-on Workshop – Friday and Saturday, August 1–2

Mitigating the risks of yeasts and mold contamination remains a constant battle within certain segments of the food and beverage industry. Molds and yeasts cause significant pre- and post-harvest food spoilage losses and mycotoxigenic molds pose significant food safety/regulatory hazards. Fungal identification is a scientific challenge requiring both art and technical expertise. There are a limited number of scientists who understand and have developed the art of fungal identification to a sound science. This workshop provides a unique opportunity to interact with and learn first-hand from a group of experts the best practice for isolation and the basics of classical identification methods, along with current molecular methods being used. Fifty-percent of the workshop will involve live demonstration and a direct hands-on experience in a laboratory setting.

Topics:

- Classical and Molecular Methods of Identification of Yeast and Molds
- Basic Isolation and Analytical Methods of Fungal Contaminants
- Safe Handling of Fungal Cultures
- Environmental Sampling of Processing Plant

Instructors:

Anthony Armstrong, PepsiCo, Barrington, IL, USA
Frank Burns, DuPont Qualicon, Philadelphia, PA, USA
Maribeth Cousin, Purdue University, West Lafayette, IN, USA
Dave Pincus, bioMérieux, Inc., Hazelwood, MO, USA
Emilia Rico-Munoz, BCN Research Laboratories, Rockford, TN, USA

Organizers:

Frank Burns, DuPont Qualicon, Philadelphia, PA, USA
Dave Pincus, bioMérieux, Inc., Hazelwood, MO, USA
Patricia Rule, bioMérieux, Inc., Hazelwood, MO, USA

Laboratory Host – Ahmed Yousef, The Ohio State University, Columbus, OH, USA

INTENDED AUDIENCE

Microbiologists in quality assurance and quality control performing routine analysis as well as investigational work for the recovery and identification of yeast and mold from food or beverage

Workshop 3 – Hands-on Workshop on Microbial Risk Assessment Modeling and Interpretation – Saturday, August 2

Microbiological risk assessments (MRA) have received much interest in the last decade but require particular multi-disciplinary skills for successful development. This hands-on workshop should help create awareness of the principles of risk assessment/management, the skill requirements, and experience gained regarding the utility and validity of MRA studies. The lecturers will present several of the valuable resources available for risk assessors and managers and provide insights in the challenges to interpret and utilize risk assessment studies. Case studies will help participants to understand the principles of risk assessment and risk management and there will be an opportunity given to participants to propose cases relevant to them ahead of the workshop that may be dealt within plenary or one on one. The workshop will also cover a recent development, the establishment of a broad conceptual framework for risk governance by the International Risk Governance Council. This addresses the fact that the success with which risks are managed in society depends on a complex system of risk governance.

Topics:

- Different MRA Types and Scopes: From Risk Profiles to Probabilistic Approaches to Risk Assessment
- Interpreting Outputs from Different MRA Types for Risk Management Decision-making
- Detailed Example MRA Case Studies
- Learnings for Industry and Governments from Existing Risk Assessments
- Guidance on Utility and Validity of Microbiological Risk Assessments
- The Risk Governance Framework Developed by the International Risk Governance Council (IRGC)
- Risk Assessment Software and Decision Support Systems for Risk Evaluation and Risk Ranking (from ComBase, over Risk Ranger to FAO/WHO Web-Based MRA Tools)

Instructors:

Leon Gorris, Unilever, SEAC, Sharnbrook, UK
Tom Ross, Centre for Food Safety, Tasmanian Institute of Agricultural Research, School of Agricultural Science, University of Tasmania, Hobart, Tasmania, Australia
Ewen C. D. Todd, Michigan State University, East Lansing, MI, USA
Richard C. Whiting, FDA-CFSA, College Park, MD, USA

Organizers:

Leon Gorris, Unilever, SEAC, Sharnbrook, UK
Ewen C. D. Todd, Michigan State University, East Lansing, MI, USA

INTENDED AUDIENCE

Risk assessment and management staff from government, industry and academia interested in microbiological food safety management

TO REGISTER, GO ONLINE TO WWW.FOODPROTECTION.ORG.

IAFP 2008 Special Contributors

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To donate an item go to our Web site at www.foodprotection.org and complete the Silent Auction Donation Form or contact Donna Gronstal at dgronstal@foodprotection.org 515.276.3344; 800.369.6337.

IAFP FOUNDATION

COMING EVENTS

JUNE

- **1–5, American Society for Microbiology 108th General Meeting,** Boston Convention and Exposition Center, Boston, MA. For more information, call 202.737.
- **7–11, AFDO 112th Annual Educational Conference,** Crowne Plaza Resort Hotel, Anaheim, CA. For more information, call 717.757.2888; E-mail: afdo@afdo.org.
- **9–11, 2008 Midwest Section of AOAC International Annual Meeting and Exposition,** Bozeman Best Western – GranTree Inn, Bozeman, MT. For more information, contact Heidi Hickes at 406.994.3383 or go to www.midwestaoac.org/2008meeting.html.
- **10, Ontario Food Protection Association Professional Development Day and Golf Tournament,** Springfield Golf Course, Guelph, Ontario, Canada. For more information, contact Gail Seed at 519.463.5674; E-mail: seed@golden.net.
- **10–11, Principles of Inspecting and Auditing Food Plants,** Chicago, IL. For more information, contact AIB at 785.537.4750 or go to www.aibonline.org.
- **11–12, Pharmaceutical Technology Transfer,** New Brunswick, NJ. For more information, go to www.cfpa.com.
- **11–14, 4th Med-Vet-Net Annual Scientific Meeting,** at the Palais du Grand Large, St. Malo, Brittany, France. For more information, call 44.(0)1908.698810; E-mail: mvnconf08@medvetnetorg.
- **13–20, Twenty-Eighth International Workshop/Symposium–Rapid Methods and Automation in Microbiology,** Kansas State University, Manhattan, KS. For more information, contact Dr. Daniel Y.C. Fung at 785.532.1208; E-mail: dfung@ksu.edu.
- **17–19, HACCP Train-the-Trainer,** GMA Conference Center, Washington, D.C. For more information, call Dr. Yuhuan Chen at 202.639.5974; E-mail: ycychychen@gmaonline.org.
- **18–20, 9th Joint CSL/JIFSAN Symposium,** York, UK. For more information, contact Helen Crevald at csl-jifsan@csl.gov.uk or go to www.csl.gov.uk.
- **22–25, NEHA 72nd Annual Education Conference,** Tuscan, AZ. For more information, call 303.756.9090 or go to www.neha.org.
- **23–27, Nucleic Acid-Based Detection Methods for Foodborne Pathogens and Spoilage Organisms Workshop,** Colorado State University, Fort Collins, CO. Sponsored by Silliker Food Science Center, Colorado State University and Cornell University. For more information, go to www.ansci.colostate.edu/content/view/601/42/.
- **24–25, HACCP Workshop** (Intermediate Level), Chipping Campden, Gloucestershire, United Kingdom. For more information, go to www.campden.co.uk.
- **24–26, New Zealand for Food Protection *Listeria* Workshop in Association with New Zealand Institute of Food Science and Technology (NZIFST) Annual Meeting,** Rotorua, New Zealand. For more information, contact Lynn McIntyre at 64.3.351.0015; E-mail: lynn.mcintyre@esr.cr.nz.
- **25–26, 5th International Thermal Processing Conference,** Chipping Campden, Gloucestershire, UK. For more information, call 44.(0).1386.842104 or go to www.campden.co.uk/training/training.htm.
- **28–July 1, IFT 08 Annual Meeting,** New Orleans, LA. For more information, call 312.782.8424 go to www.ift.org/ift08.

JULY

- **8, HACCP – The Basics,** Chipping Campden, Gloucestershire, United Kingdom. For more information, go to www.campden.co.uk.
- **20–23, Canadian Institute of Public Health Inspectors Conference,** St. John's, New Foundland. For more information, go to www.ciphi.nl.ca.
- **21–24, Australian Association for Food Protection Annual Meeting,** Sydney Convention and Exhibition Centre, Sydney, Australia. For more information, contact Patricia Desmarchelier at 61.7.32142032; E-mail: patricia.desmarchelier@csiro.au.
- **21–25, HACCP – Advanced,** Chipping Campden, Gloucestershire, United Kingdom. For more information, go to www.campden.co.uk.

AUGUST

- **1–2, IAFP 2008 Workshops,**
  Workshop 1 – Better Process Cheese Control School
  Workshop 2 – The Art of Fungal Characterization and Identification: A Hands-on Workshop
  Workshop 3 – Hands-on Workshop on Microbial Risk Assessment Modeling and Interpretation
  For more information, contact Julie Cattanach at 800.369.6337; E-mail: jcattanach@foodprotection.org. See our workshop information on page 352.
- **3–6, IAFP Annual Meeting, Hyatt Regency Columbus,** Columbus, OH. contact Julie Cattanach at 800.369.6337; E-mail: jcattanach@foodprotection.org. See our registration form on page 351.

SEPTEMBER

- **1–4, Food Micro 2008 – The 21st International ICFMH Symposium,** Aberdeen Exhibition and Conference Centre, Aberdeen, Scotland. For more information, go to www.foodmicro2008.org/.
- **7–9, 5th International Whey Conference,** Paris, France. For more information, go to www.iwc-2008.org/home.asp.

IAFP UPCOMING MEETINGS

AUGUST 3-6, 2008
Columbus, Ohio

JULY 12-15, 2009
Grapevine, Texas

AUGUST 1-4, 2010
Anaheim, California

COMING EVENTS

- **9–12, ASTHO-NACCHO Joint 2008 Conference,** Sacramento Convention Center, Sacramento, CA. For more information call 703.964.1240 or go to www.naccho.org.
- **14–17, 2008 TAPPI PLACE Conference,** Renaissance Portsmouth Hotel, Portsmouth, VA. For more information, call 800.332.8686 or go to www.tappi.org/08place.
- **15, ASIS International – 54th Annual Seminar and Exhibits**, Atlanta, GA. For more information, call 800.465.3717 or go to www.qmi.com.
- **16–18, New York Association for Food Protection 85th Annual Conference,** Doubletree Hotel, East Syracuse, NY. For more information, contact Janene Lucia at 607.255.2892; E-mail: jgg3@cornell.edu.
- **21–24, AACC International Annual Meeting,** Hawaii Convention Center, Honolulu, Hawaii. For more information, call 651.454.7250 or go to http://meeting.aaccnet.org.
- **21–24, 122nd AOAC International Annual Meeting,** Dallas Texas. For more information, go to www.aoac.org.
- **24–25, 2nd Annual China International Food Safety and Quality Conference and Expo,** The Landmark Hotel & Towers, Beijing, China. For more information, go to www.chinafoodsafety.com.
- **29–1 Oct., Indiana Environmental Health Association Fall Educational Conference,** Belterra Hotel and Conference Center, Belterra, IN. For more information, contact Kelli Whiting at 317.221.2256; E-mail: kwhiting@hhcorp.org.

OCTOBER

- **9–11, Current Developments in Food and Environmental Virology Symposium,** Pisa, Italy. For more information, call 39.050.2213644 or go to www.cost929-environet.org.
- **19–22, 28th Food Microbiology Symposium "Current Concepts in Foodborne Pathogens and Rapid and Automated Methods in Food Microbiology,** University of Wisconsin-River Falls, River Falls, WI. For more information, call 715.425.3704 or go to www.uwrf.edu/food-science.

NOVEMBER

- **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.

ADVERTISING INDEX

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Research Notes

* Indicates author for correspondence.

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- ❒ 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
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- ❒ 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

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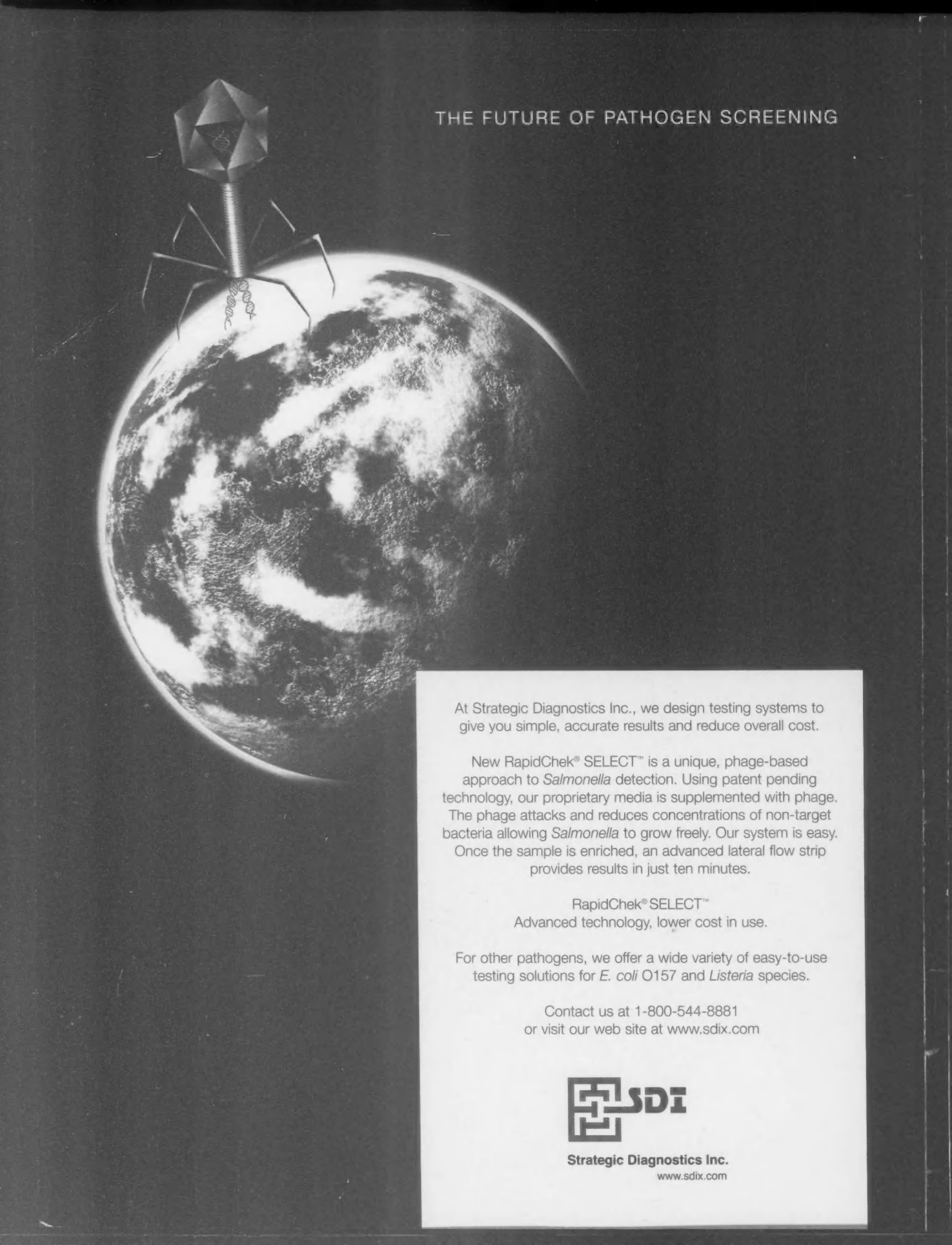

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