

DAIRY, FOOD AND ENVIRONMENTAL

SANITATION

JUNE 1994



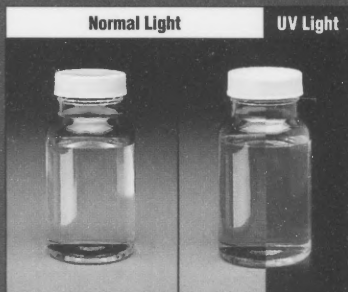
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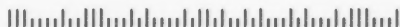
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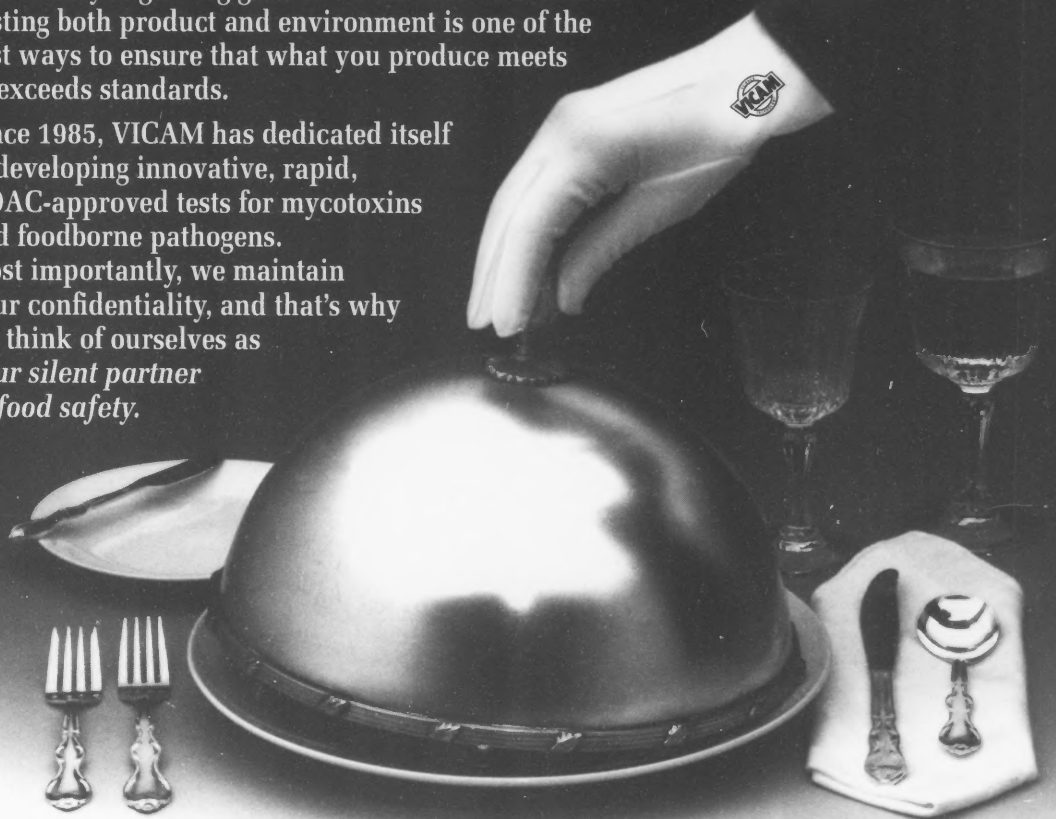
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Thoughts From the President . . .



By
Harold Bengsch
IAMFES President

Well, here we go again: A very recent national news broadcast focused on issues of food safety. During that program, a great deal was said about the futility of washing vegetables and fruits to render them free from pesticide residue.

In the next few days I observed, with more than passing interest, news reports that produced statements such as — washing your veggies does no good — government officials change their minds about washing vegetables — to wash or not to wash, that is the question!

Interestingly enough, at no time did I ever hear the national broadcast discourage washing. Because of questions our department is receiving, it is obvious many consumers are concerned, confused and worried. In an attempt to address the consumer concerns, what follows is the text of the press release put out by our department.

FOR IMMEDIATE RELEASE Springfield/Greene County Health Department

From: The Office of the Director
Subject: Department statement on washing fruits and vegetables.

In the last few days our department has received calls from consumers regarding recent news stories about the merits of washing fruits and vegetables before consumption. Our information indicates these concerns arose out of a recent national news story on food safety.

As we understand the news report, the subject addressed was chemical residue from pesticides. In that report, the focus was on problems of chemical removal through washing due to waxing and chemical sticking (adhesive) agents used in application of the pesticides. Unfortunately, a distinction was not made between chemical residue and microbial contamination. While it may be true that chemical residue is difficult in many cases to remove, the washing procedure is still valid and recommended for reducing the microbial load on vegetables or fruit.

Unfortunately, many consumers are either confused or are under the impression that washing of fruits and vegetables is no longer recommended. We want to strongly emphasize this is not the case.

The official recommendation of our department to the consumer regarding washing of fruits and vegetables is as follows:

Raw fruits and vegetables should be thoroughly washed in running water to remove soil and other contaminants before being cut, combined with other ingredients, cooked, served or offered for human consumption in ready-to-eat form.

In a previous president's column, I discussed with you many thoughts about and the possible opportunities the news media present in getting the correct message on food safety to the public. Let me take this opportunity to invite you to share with us any successful experiences you have had in this regard.

Simply send to our IAMFES Executive Office in Des Moines, Iowa, a brief description of your experience. Possibly out of that response we can compile a list of successful experiences that may serve as a reference for our membership.

Until next month!

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ABOUT THE COVER . . . Photo courtesy of Moraine Park Technical College. Photo taken by Terry Leininger, staff photographer at the Moraine Park Fond du Lac Campus, Fond du Lac, WI. Brenda Panko, student in Food Science Department at the Fond du Lac campus, performs an ELISA test for Listeria.

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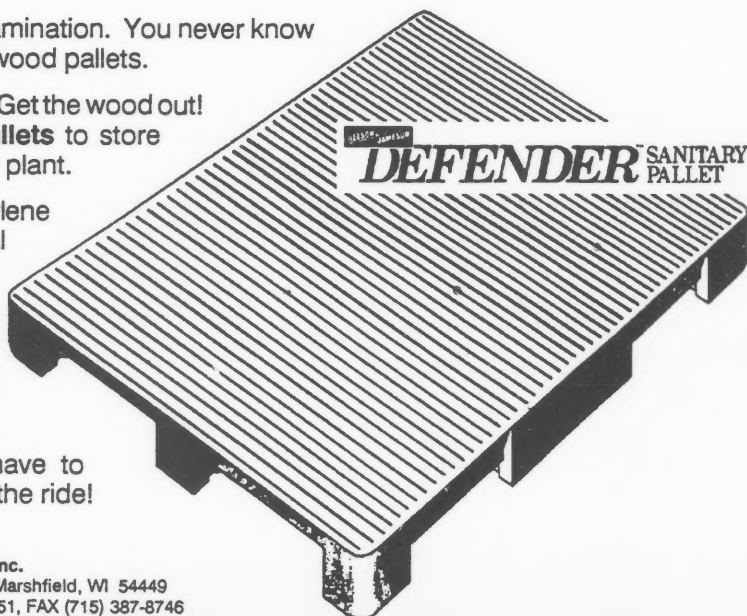
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On My Mind . . .



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Our mission statement notwithstanding, people sometimes find it hard to believe that we are an international association. Maybe it is because we are headquartered in Des Moines instead of Paris. Maybe it is because our journals are printed in English. Maybe it is because we don't have hundreds of thousands of members. Maybe it is because most of our meetings are held in the United States. Maybe it is because the term "sanitarian" is not used internationally. Maybe . . . Maybe . . . Maybe . . .

There are just as many reasons why we should be considered "international." For example, we have 453 members in 49 countries and send journals to 17 other countries. Nearly a third of the copies of the *Journal of Food Protection* are going outside the U.S. About 20% of the papers published in *JFP* are written by international authors. This means that nearly every issue will have two papers from authors living outside the U.S.

We had 21 international presenters from 9 different countries at our 1993 Annual Meeting in Atlanta. In total, there were 111 people representing 23 foreign countries registered for the meeting. We expect that many, and perhaps more, international guests at the 1994 Annual Meeting in San Antonio.

Our very successful 1992 Annual Meeting was held in Toronto. In 1996, Michael Brodsky will be the IAMFES president — the second Canadian to hold the position. You could argue that Canada isn't really a foreign country. I would have to disagree with you — any country that lists Budweiser as an import beer is close enough to being foreign to satisfy me.

Just last week we received a request from Croatia to allow them to subscribe to *JFP* until the end of 1994 (instead of the usual one year). We bent our "rules" to allow this but at the same time arranged for back issues of the journal to be sent thereby giving them the full volume.

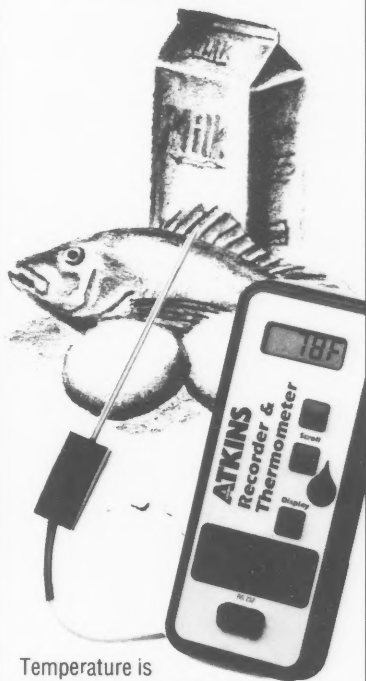
Each year we distribute 25 volumes of *JFP* and 25 volumes of *Dairy, Food and Environmental Sanitation* to developing nations through the offices of R. J. Dawson at the United Nations Food and Agriculture Organization in Rome, Italy.

In scanning the activity report from our FAX machine, I see that a healthy portion of our faxes are going to international destinations. I don't know what we did before fax machines, but they are indispensable for international correspondence. You can send them anytime; they get there immediately; they are cost effective; and you know that the message has been received. It must work for others also in that there is at least one fax on our machine every morning from an international source.

And last, but not least, a number of our U.S. members have worked internationally. Past President Harry Haverland does extensive work "overseas" in such places as the Philippines, Yalta and India. Past President Damien Gabis spent time in Nepal last year and is scheduled to go to Guatemala shortly. Secretary Michael Brodsky and Immediate Past President Mike Doyle are scheduled to speak at a food safety conference in France this year. Frank Bryan does a great deal of work overseas. Anna Lammerding just finished some work for the World Health Organization (WHO) in Brazil. These are just the ones that quickly come to mind. I am sure that there are many, many more than this.

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Human Campylobacteriosis: Clinical and Epidemiological Aspects

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As presented at the 80th IAMFES Annual Meeting, Atlanta, Georgia, August 3, 1993, in the symposium
"Microbial Concerns of the International Community Symposium" sponsored by the International Life Sciences Institute

During the two past decades, *Campylobacter jejuni* has become recognized as one of the most common causes of bacterial diarrheal illness in the industrialized world. Although *Campylobacter* is well-known to the medical world, it has remained obscure to the general population. The purpose of this review is to present an update of the epidemiology, the clinical characteristics, the pathogenesis and the antimicrobial chemotherapy of *Campylobacter* infection.

THE NEW FAMILY OF THE CAMPYLOBACTERACEAE

Fourteen species are included in the genus *Campylobacter* and two within the closely related genus *Arcobacter*. Van Damme (1) has recently proposed a new family, the campylobacteraceae, comprising both species. Table 1 presents the Campylobacters of clinical importance, their principal clinical manifestations and their reservoir.

CAMPYLOBACTER OF CLINICAL IMPORTANCE

Family: Campylobacteraceae

Species	Pathogenicity	Animal Reservoir
<i>C. fetus</i> subsp. <i>fetus</i>	systemic campylobacteriosis	cattle, sheep
<i>C. jejuni</i> subsp. <i>jejuni</i>	diarrhea	poultry, cattle, . . .
<i>C. jejuni</i> subsp. <i>doylei</i>	diarrhea	none known
<i>C. coli</i>	diarrhea	pigs, poultry, . . .
<i>C. lari</i>	diarrhea, septicemia	gull, dogs, cats, . . .
<i>C. hyointestinalis</i>	diarrhea, bacteremia	pigs, cattle
<i>C. upsaliensis</i>	diarrhea	dogs, cats
<i>C. butzleri</i>	diarrhea	pigs, cattle, . . .

Campylobacter butzleri is actually related to the *Arcobacter* genus. *Campylobacter fetus* subsp. *fetus* is currently associated with bacteremia in the elderly but may be a quiet inhabitant of the gut. The other species are associated with diarrhea.

The role of *Campylobacter jejuni* subsp. *jejuni* will be

further discussed. Infection with *C. jejuni* is mainly a foodborne disease and poultry meat plays a major role in its transmission in industrialized countries.

Campylobacter jejuni subsp. *doylei* has been isolated in antral biopsies and stools from diarrheic children.

Campylobacter coli behaves similarly to *C. jejuni*: its frequency varies from one country to the other, it seems to be more frequently isolated in the developing world and it is more frequently resistant to currently used antibiotics like the macrolides.

Campylobacter lari is sometimes associated with septicemia. It is commonly isolated in healthy gulls.

Campylobacter hyointestinalis is a possible cause of proliferative enteritis in pigs; it has been reported as an important cause of diarrhea in homosexual men and compromised patients.

Finally, *Campylobacter upsaliensis*, originally isolated in dogs in Uppsala, is now recognized as a frequent cause of human diarrhea. It appears to be less sensitive to macrolides than *C. jejuni* subsp. *jejuni*.

The relative frequency of these species has been studied at the Saint-Pierre Hospital. Besides *C. jejuni* (74% of the isolates), only *C. coli* (12%) and *C. upsaliensis* (13%) seem to play an important clinical role (2).

EPIDEMIOLOGY

In the United States, the overall symptomatic infection rate is estimated to be 1%, which means over 2 million symptomatic infections occur per year. One in every 18 patients has a sufficiently severe enough disease to consult a physician. The case fatality rate, 2.4/1,000 culture confirmed cases, should cause 200 deaths/year in the U.S. (3).

In Belgium, the highest isolation rate according to age is observed in children, mainly in the second year of life (personal unpublished data). In other countries, like the U.S., a higher isolation rate is observed in young adults and may reflect specific exposures in that age group as feeding practices or travel (3).

In Sweden, it has been demonstrated that the highest I.R. of domestic infections is observed in children and the highest rate of travel acquired infections is observed in

young adults (4).

In all temperate regions, the seasonal distribution of *Campylobacter* shows a peak from May to August.

It is important to recognize that the vast majority of the infections are sporadic cases not associated with outbreaks. The sporadic cases are almost always associated with preparing and eating poultry. Outbreaks of *Campylobacter* infections may be spectacular: they peak in May and October and are related to contaminated water and raw milk.

CLINICAL CHARACTERISTICS

Acute enterocolitis is the most common presentation of *C. jejuni* infection. Symptoms and signs are not distinctive from the illness caused by other organisms like *Salmonella* or *Shigella*. Digestive complications of *C. jejuni* infections include: appendicitis and cholecystitis (sometimes requiring surgical procedures) pancreatitis, hepatitis and toxic megacolon. Extra-intestinal complications include: erythema nodosum and arthritis (relatively frequently reported) carditis, meningitis and septicemia.

Over the past few years, a strong association between *C. jejuni* infection and two neurologic diseases has emerged, the Guillain-Barré syndrome (GBS) and a closely-related syndrome, the Chinese paralytic syndrome, more recently called the acute motor axonal neuropathy. Chinese paralytic syndrome is a disease occurring during the summer months among children in rural parts of Northern China (5,6).

In serologic studies, it has been demonstrated that 35% of patients with GBS had recent *C. jejuni* infection. Japanese studies have associated GBS with serotype PEN 19 L10 7. It has been suggested that antibodies directed against infrequent serotypes of *C. jejuni* may cross-react with peripheral nerves proteins.

PATHOGENESIS

The lack of a universally accepted small animal model that is representative of natural infection has impeded rapid understanding of the pathogenesis mechanisms. Volunteer studies were led to establish the basic features of the infection and the illness. Rates of infections increased with the doses but development of illness did not show a clear dose relation and even low doses of *C. jejuni* (8×10^2 CFU) resulted in diarrhea with fecal leukocytes and blood. Moreover, of the two used strains, one produced a higher attack rate and more definite illness, suggesting variability in virulence.

Rechallenging volunteers after 28 days with the homologous strain showed a protective immunity (7). Different mechanisms by which *Campylobacter* may induce illness have been postulated:

- adherence and production of toxin inducing secretory diarrhea (cholera-like toxin);
- invasion and proliferation within the intestinal epithelium inducing cell damage and inflammatory response; and
- translocation which should allow the extra-intestinal manifestations of *Campylobacter* infection.

A cytotoxin is consistently found in *C. jejuni* isolates; however, its role in producing illness is not well established (8).

Studies performed on rabbit ileal loop model have

shown that no cholera-like toxins are produced in the loop model and it is suggested that host derived mediators of secretion may be important in the pathogenesis (9). Other studies have indicated that mobility and functional flaggellin are required for invasion (10).

ANTIMICROBIAL CHEMOTHERAPY

Rising resistance to fluoroquinolones is a relatively recent observed phenomenon and has emerged worldwide.

In contrast, macrolides resistance seems to stay at the same level throughout the years. However, it should be noticed that in some countries, like in Thailand, up to 11% of *C. jejuni* are resistant to erythromycin (11).

In immunocompromised patients with prolonged and relapsing *C. jejuni* infection, emergence of polyantimicrobial resistant strains has been observed.

In the Netherlands, Endtz and co-workers have put in parallel increasing resistance to quinolones in poultry and in human isolates: a spectacular rising is observed similarly in *Campylobacter* of both origin. A causality between large veterinary use of quinolones and the modifications of the susceptibility patterns in humans is suggested (12).

Clinical trials with macrolides have been performed: when treatment is initialized early in the illness, the bacteriological and the clinical cures are accelerated (13).

Large and well-designed trials have demonstrated the effectiveness of fluoroquinolones when treating diarrheal diseases; however, acquisitions of resistance during treatment have been observed and quinolones accumulation in post-treatment isolates was shown to be diminished (14).

CONCLUSION

- New *Campylobacter* species have emerged as causes of gastrointestinal infections (mainly *C. upsaliensis*).
- *Campylobacter* is the most frequent cause of sporadic bacterial diarrheal illness.
- Guillain-Barré syndrome and acute motor axonal neuropathy are strongly associated with *C. jejuni* infections.
- Mechanisms of *Campylobacter* virulence still need further investigation.
- Emergence of antibiotic resistance has become a major concern.
- An integrated approach is needed to prevent foodborne *Campylobacter* sporadic infections which are caused by handling and consumption of poultry meat.

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Campylobacters — Epidemiological Markers

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As presented at the 80th IAMFES Annual Meeting, Atlanta, GA, August 3, 1993, in the symposium "Foodborne Microbial Pathogens" sponsored by the International Life Sciences Institute

The term *Campylobacter* was introduced in 1963 by Sebald and Veron to denote a new genus, which included members of a group called microaerophilic vibrios, organisms known since the beginning of the century as *Vibrio fetus* for the simple reason that on staining some bacteria resembled the "comma" shaped *Vibrio cholerae*.

The story of Campylobacters begins more than 100 years ago in Germany where the renowned bacteriologist Theodore Escherich described in 1886 the finding in the diarrheal stools of children suffering from diarrhea, or *Cholera infantum* and also in the stools of kittens with diarrhea, a nonculturable, spiral shaped microorganism he named *Vibrio felinus*.

In the period following the description of Escherich, a number of similar observations were made in Germany, but it was not until 1913 when McFadyean and Stockman in England were able to isolate these organisms from domestic animals and implicated these as causal agents of abortion in sheep.

In 1918, Smith in the United States reported the association of these organisms with bovine abortion and were named *Vibrio fetus* by Smith and Taylor in 1919.

In 1927, Smith and Orcutt described the isolation of microaerophilic vibrios from calves with diarrhea and noted that the calf diarrhea strains were serologically different from *Vibrio fetus*. Jones et al. in 1931 named these organisms *Vibrio jejuni* and in 1944 Doyle named microaerophilic vibrios isolated from swine dysentery, *Vibrio coli*.

For many years after, these vibrios were considered to be mainly of veterinary importance in spite of a large institutional milkborne outbreak, which affected 350 people described by Levy in 1946.

The development of selective media in the early 1970s allowed the isolation of Campylobacters from human diarrheal stools by a filtration technique described by Butzler and colleagues in Belgium (2). In 1977, Skirrow in England described a selective agar medium, which simplified the isolation and provided laboratories with a technique, which led to the recognition of Campylobacters as the leading cause of diarrhea around the world.

Campylobacters have been associated with very large milk- and waterborne outbreaks in several countries (12,35). Consumption of raw milk has been shown to be a major risk factor in several large outbreaks in United Kingdom (14), and

recently pasteurized milk bottles have been found contaminated by Jackdaws and Magpies (13,37). Campylobacters have been for many years the object of investigations because of their colonization of poultry and turkey flocks which have become major reservoirs for human infections. Campylobacters have been isolated from cattle fecal material and also from pig feces (40).

Since the early classification of Veron and Chatelain in 1973, by the middle of the 1980s, the genus *Campylobacter* contained species with many diverse characteristics which led to the restructuring of the genus (46).

The proposed family of Campylobacteraceae (45) includes three genera:

1. *Campylobacter*
2. *Helicobacter*
3. *Arcobacter*

Genus *Campylobacter*.

Sixteen species and subspecies presently identified in the genus *Campylobacter* have been isolated from human and/or animal disease. A recent addition to the list is the description of a new species of *Campylobacter*, *Campylobacter helveticus* isolated from domestic animals, dogs and cats (38) (Table 1).

TABLE 1. *Campylobacters: Human and non-human sources.*

<i>C. coli</i>	<i>C. lari</i>
<i>C. concisus</i>	<i>C. mucosalis</i>
<i>C. curvus</i>	<i>C. rectus</i>
<i>C. fetus</i> subsp. <i>fetus</i>	<i>C. sputorum</i> biovar <i>fecalis</i>
<i>C. hyointestinalis</i>	<i>C. sputorum</i> biovar <i>sputorum</i>
<i>C. jejuni</i> subsp. <i>jejuni</i>	<i>C. upsaliensis</i>
<i>C. jejuni</i> subsp. <i>doylei</i>	<i>C. helveticus</i>

Certain species, such as *Campylobacter jejuni* spp. *jejuni* and *Campylobacter coli*, are most common causes of bacterial diarrheal disease in most countries around the world. *Campylobacter jejuni* spp. *jejuni* have been also isolated from cases of bacteremia, appendicitis and recently have been

associated with the Guillain-Barré syndrome. Guillain-Barré syndrome (acute inflammatory polyneuropathy) is one of the most serious sequelae of infection with *Campylobacters* (6,11). Other species, such as *Campylobacter lari* and *Campylobacter upsaliensis*, an emerging pathogen (8), have been isolated from sporadic and outbreak cases.

Campylobacter fetus spp. *fetus*, a species known for many years as an important animal pathogen involved in abortion of sheep and cattle has been associated with disease in humans, such as bacteremia in the elderly with chronic underlying disease or in patients receiving immunosuppressive therapy, septic abortion, meningitis peritonitis, salpingitis and also from diarrhea.

In the United States, Canada and the United Kingdom the isolation rates for *Campylobacters* from diarrheal disease is estimated to be about 50-60/100,000, (22,35,42) while in some developing countries the rates may be 30-50 times higher (42).

In Canada, the number of isolates reported increased from about 2,000 in 1983 to 12,815 laboratory reports in 1992 (Fig. 1 and 2) and since 1989 surpassed *Salmonella* as the most common agent of diarrheal disease (Fig. 3).

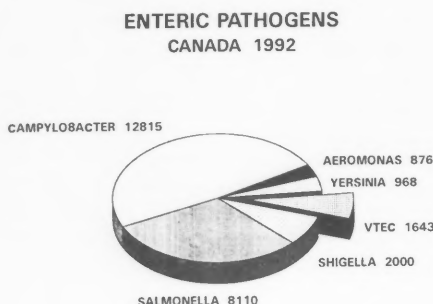


Figure 1. Enteric pathogens, Canada 1992.

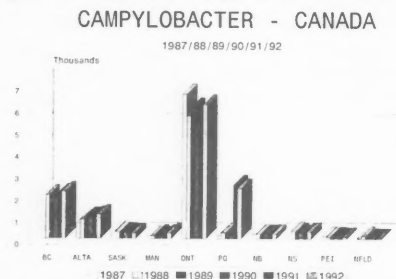


Figure 2. Campylobacter, Canada 1986-92.

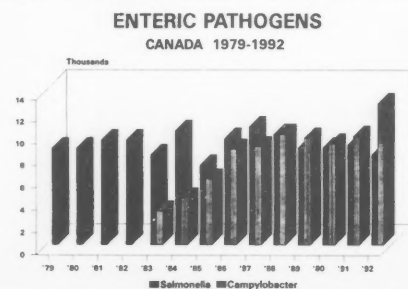


Figure 3. Enteric Pathogens, Canada 1979-92.

The seasonal distribution of *Campylobacters* in Canada follows closely the same pattern seen in temperate countries with other enteric pathogens, such as *Salmonella*, with a peak in late June lasting through August and September. Smaller increases are recorded following holidays, such as Thanksgiving, Christmas, etc. (Fig. 4) probably because of the high consumption of poultry and turkey.

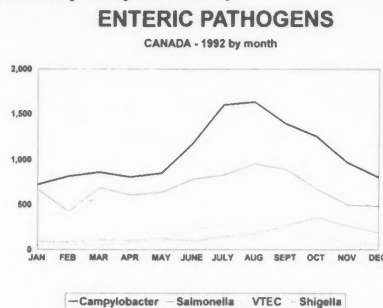


Figure 4. Enteric Pathogens, Canada — 1992 by month.

The dramatic increase in the isolation of *Campylobacters* from human diarrheal disease and the high rate of carriage of these organisms in animals and especially poultry, necessitated the identification and characterization of markers to support epidemiological investigations.

A variety of methodologies have been developed over the years, which includes species identification, serotyping, biotyping and phagotyping and also molecular typing techniques, such as pulse-field gel electrophoresis, random amplified polymorphic DNA, ribotyping and others (Table 2).

TABLE 2. *Campylobacter-differentiation.*

SEROTYPING
BIOTYPING
PHAGOTYPING
PULSE-FIELD GEL ELECTROPHORESIS (PFGE)
RANDOM AMPLIFIED POLYMORPHIC DNA (RAPD)
RIBOTYPING
RESTRICTION ENDONUCLEASE PATTERNS
PLASMID PROFILE ANALYSIS
WHOLE CELL PROTEIN PROFILE

Species identification.

Most laboratories report the isolation of *Campylobacters* and do not make any attempt to identify the species as it is required for other enteric pathogens, such as *Salmonella* or *Escherichia coli*, and report these organisms either as *Campylobacter* spp. or *C. jejuni/coli*. Identification at the species level is probably the first epidemiological marker that can be of some use in the preliminary tracing of an infection. The identification of *C. jejuni* or *C. coli* is relatively simple and easy and should be performed in every laboratory involved in the isolation of *Campylobacters*. The biotyping scheme devised for the differentiation of *C. jejuni*, *C. coli* and *C. lari* (17)

will also allow the identification of these three species (Table 5). Other emerging pathogenic species, such as *C. upsaliensis* should be differentiated from other catalase-negative or weakly positive organisms. Provision of correct identification of organisms is a first step in an epidemiological investigation.

TABLE 3. *Campylobacter serotyping scheme — Lior.*

<i>C. jejuni</i>	- 74 serogroups
	55 - human sources
	11 - non-human
	8 - not stated
<i>C. coli</i>	- 46 serogroups
	24 - human sources
	14 - non-human sources
	8 - not stated
<i>C. lari</i>	- 10 serogroups
	6 - human sources
	4 - non-human

TABLE 4. *Distribution of the 15 most common Campylobacter serogroups by source^a — Lior's Scheme.*

Rank	Serogroup	Human	Non-human Sources					
			Chicken	Turkey	Bovine	Swine	Water	Others
1	4	847	42	1	44	3	9	2 dogs 2 mink, 2 mice 1 milk 1 cat 4 N/S
2	1	411	41	3	24	6	1	1 dog 8 N/S
3	7	352	12	-	67	1	-	8 milk 2 dogs 1 ovine 6 N/S
4	2	346	52	13	18	12	4	2 dogs 2 ovine 1 lemur 1 goose 1 emu 3 N/S
5	36	236	7	-	5	11	-	14 N/S 2 ovine 1 dog
6	8	188	17	16	20	11	-	3 dogs 1 cat 1 N/S
7	11	169	18	-	1	2	-	3 rabbits 1 goat 1 N/S
8	9	166	8	1	7	6	24	2 dogs 1 pigeon 2 ovine 1 N/S
9	5	158	3	-	16	5	-	1 kangaroo 3 N/S 1 feline
10	6	131	12	-	1	5	7	-
11	17	126	2	3	-	2	7	2 dogs 1 cat 1 N/S 1 pigeon 1 monkey

TABLE 4. (Continued).

12	28	89	9	-	-	-	1	-
13	21	77	11	6	-	9	-	-
14	55	70	4	-	1	2	2	2 dogs
15	15	61	-	-	-	-	1	-
Total 15 Serogroups		3427 (74%)	238 (76%)	43 (86%)	204 (88%)	75 (50%)	66 (74%)	
Total all Serogroups	5657	4635	315	50	232	151	89	
Total Human	4635							
Total Non-human	1022							

^a Includes *C. jejuni*, *C. coli*, *C. lari* and *Campylobacter* spp.

TABLE 5. *Biotyping scheme for C. jejuni, C. coli and C. lari.*

BIOTYPE	<i>C. jejuni</i>				<i>C. coli</i>		<i>C. lari</i>	
	I	II	III	IV	I	II	I	II
TEST								
HIPPURATE HYDROLYSIS	+	+	+	+	-	-	-	-
RAPID H ₂ S TEST	-	-	+	+	-	-	+	+
DNA HYDROLYSIS	-	+	-	+	-	+	-	+

Serotyping.

Different approaches have been developed for the serotyping of *Campylobacter*s. A Passive Hemagglutination technique using sheep cells coated with heat-extracted antigens (heat-stable antigens) of *C. jejuni* and *C. coli* and unabsorbed antisera was designed only for the serotyping of these two species and recognizes about 60 serogroups (28).

Lior et al., in 1982 described a simple and rapid serotyping technique using slide agglutination of live bacteria, which has developed into a serotyping scheme based on specific, absorbed antisera raised against heat-labile antigens of three species *C. jejuni*, *C. coli* and *C. lari*.

The reference strains are from many geographical areas on all five continents and the serotyping scheme has been applied in many countries with a high degree of typeability and specificity. At present, the serotyping scheme recognizes 130 serogroups composed of 74 *C. jejuni*, 46 *C. coli* and 10 *C. lari* reference strains (Table 3).

To date, 5,657 isolates from human (4,635 strains) and non-human sources (1,022), originating from many countries around the world, have been serotyped in Canada. The distribution of the 15 most common serogroups by source is listed in Table 4.

Seventy-four percent of the human isolates belonged to the 15 most common serogroups. Serogroup 4 accounted for 18% of the isolates — followed by serogroups 1-9%, serogroup 7-8%, serogroup 2-7% and serogroup 36 for 5%.

Among non-human isolates, serogroup 2 was most common among chicken strains followed by serogroups 4, 1 and 11. Among turkey isolates, serogroup 8 was most common followed by serogroup 2. Most bovine isolates belonged to serogroup 7, 4, 1 and 8 and most water isolates from United Kingdom belonged to serotype 9, 4 and 8.

Serogroups 1, 2, 4, 6, 7, 21, 28, 29, 44, 46, 54, 55, 79, among many others, were common in several countries

including: Central African Republic, Nigeria, India, China, Thailand, Japan, Kuwait, Canada, Mexico, Chile, Austria, France, Belgium, United Kingdom, Romania, Germany, Sweden and others.

Among *C. jejuni*, serogroups 4, 1, 7, 2, 36, 17, 6, 5 and 9 were most commonly encountered. Among *C. coli*, serogroups 8, 21, 44, 45, 20 and 55, among *C. lari* serogroups 35, 31 and 56 were common.

Arcobacter butzleri, formerly known as *Campylobacter butzleri*, represents another important group of emerging pathogens isolated from humans, animals and the environment (47). We have been developing a serotyping scheme for these organisms and at this time the scheme recognizes 65 serogroups.

Biotyping.

Serotyping can and will provide extremely useful markers and the only limitation is, when strains belong to "common" serogroups. In these cases additional typing is required and this can be easily accomplished by identifying different biochemical attributes of the species. As *Campylobacter* are quite inert biochemically, some characteristics, such as production of unusual enzymes can be used for the differentiation of isolates. Skirrow and Benjamin in 1980 proposed the differentiation of *Campylobacter* based on hippurates hydrolysis, production of H₂S on FBP medium and resistance to Nalidixic acid. By this scheme, *C. jejuni* was divided into two biogroups, but *C. coli*; and *C. lari* were not subtyped.

Lior in 1984 proposed a biotyping scheme, which was an extension of the scheme of Skirrow and Benjamin, and which was based on hippurate hydrolysis, production of H₂S in FBP medium and DNA hydrolysis in an improved medium (18). This scheme allows, not only the identification of the three species, but also differentiates *C. jejuni* into four biogroups, *C. coli* into two and *C. lari* into two biogroups (Table 5).

Over 3,650 strains of *C. jejuni*, 938 isolates of *C. coli* and 36 *C. lari* isolated from human and nonhuman sources, were biotyped by this scheme (Table 6).

Of 3,162 *C. jejuni* isolates from human sources, 53% belonged to biotype I, 38% to biotype II, 6% to biotype III and 3% to biotype IV. Among 490 isolates of *C. jejuni* from non-human sources, a similar distribution is seen, 52% were biotype I, 40% biotype II and 5% and 3% biotypes III and IV, respectively. Among *C. coli* of human origin, 69% were biotype I and 31% biotype II and a similar distribution was observed among *C. coli* isolated from nonhuman sources. Of 36 isolates of *C. lari*, 17 belonged to biotype I.

Another biotyping scheme has been developed for the newly reported species, *A. butzleri*, (formerly *C. butzleri*). The biotyping scheme can differentiate 16 biotypes among these isolates.

The value of epidemiological markers provided by serotyping has been greatly enhanced by combining the serotyping scheme and the biotyping scheme and the results obtained have shown an increased discriminatory ability, especially of common serogroups, which could be further subdivided into biotypes.

Phagotyping.

Khakhria and Lior in 1992 extended the phagotyping scheme for *C. jejuni* and *C. coli* of Grajewski et al. 1985 by the addition of new phages and proposed an improved typing scheme designed to provide additional markers for epidemiological purposes. For many years, phagotyping schemes have been of great value and assistance in many epidemiological investigations involving important enteric pathogens, such as *Salmonella typhi*, *S. typhimurium*, *S. enteritidis* and other salmonellae, or *E. coli* O157:H7, for which there are no other markers which could assist in the differentiation and tracing of strains.

The phagotyping scheme recognizes at present 50 phagotypes and has been applied to isolates from human and non-human sources isolated from 17 countries (Table 7). Twenty-four different phagotypes have been identified among Canadian isolates, 17 types among isolates from Portugal, 14 types in the United Kingdom. The predominant

TABLE 6. Distribution of biotypes of *C. jejuni*, *C. coli* and *C. lari*.

Biotype	Lior's Scheme							
	<i>C. jejuni</i>				<i>C. coli</i>		<i>C. lari</i>	
	n = 3652 (79%)				n = 938 (20%)		n = 36 (1%)	
	I	II	III	IV	I	II	I	II
Source								
Human	1686 (53%)	1188 (38%)	193 (6%)	95 (3%)	443 (69%)	198 (31%)	17	5
Non-human	254 (52%)	198 (40%)	22 (5%)	16 (3%)	210 (71%)	87 (29%)	11	3
Total	1940 (53%)	1386 (38%)	215 (6%)	111 (3%)	653 (70%)	285 (30%)	28	8

type 11 was encountered in 12 countries. Phage type 3 was common among *C. jejuni* isolates from human sources, followed by types 27, 23, 19 and 10 (Table 8). Among bovine strains phage types 11 and 23 were most common, and among poultry strains, types 36 and 18 (Table 9).

Excellent results have been obtained when the three typing schemes, serotyping, biotyping and phage typing, have been combined, (20,21,27) supporting the complimentary use of phage typing in conjunction with other typing scheme for the epidemiological analysis of *Campylobacter* infections.

TABLE 7. Frequency of phage types of *C. jejuni* and *C. coli* strains isolated from human and non-human sources.

Phage Type	No. <i>C. jejuni</i> isolates		No. <i>C. coli</i> isolates		Total No. Isolates
	H.	N.H.	H.	N.H.	
1	1	-	-	-	1
2	2	-	-	-	2
3	45	11	2	-	58
4	-	1	-	-	1
5	34	8	1	-	43
6	1	-	-	-	1
7	2	1	-	-	3
8	1	-	-	-	1
9	10	6	-	-	16
10	36	-	3	-	39
11	119	18	4	5	146
12	5	-	-	-	5
13	5	-	1	-	6
14	3	-	-	-	3
15	8	-	-	-	8
16	3	-	-	-	3
17	9	-	-	-	9
18	24	14	-	-	38
19	42	1	-	-	43
20	27	2	-	-	29
21	13	1	1	-	15
22	1	-	-	-	1
23	42	14	-	-	56
24	3	-	-	-	3
25	28	-	-	-	28
26	14	3	3	2	20
27	47	2	-	9	58
28	14	3	-	-	17
29	3	-	-	-	3
30	-	2	-	-	2

TABLE 8. Rank frequency of phage types of *C. jejuni* and *C. coli* strains isolated from human and non-human sources.

Rank	Phage Type	No. <i>C. jejuni</i> isolates		No. <i>C. coli</i> isolates		Total No. Isolates
		H.	N.H.	H.	N.H.	
1	11	119	18	4	5	146
2	3	45	11	2	-	58
3	27	47	2	-	9	58
4	23	42	14	-	-	56
5	44	17	1	27	8	53
6	5	34	8	1	-	43
7	29	42	1	-	-	43
8	10	36	-	3	-	39
9	18	24	14	-	-	38
10	20	27	2	-	-	29
(Others - 40 different types)	175	38	15	6	-	234
Atypical	16	4	2	-	-	22
Untypable	150	28	13	4	-	195
Total		774	141	67	32	1014

Whole cell protein profiles.

Total protein profile analysis by polyacrylamide gel electrophoresis (PAGE) has been used frequently and found useful in identifying and distinguishing *Campylobacter* spp. including *C. jejuni* and *C. coli*, and has been used for the differentiation of strains and for resolving taxonomic problems at the species and subspecies level (46). Owen et al. 1990 have identified by this technique *C. upsaliensis* isolates. The method is fast, reliable and amenable to numerical analysis and is particularly useful for studying bacteria, which are difficult to identify by traditional methods. Fraser et al. 1992, using linear gradient PAGE, found 17 different profiles among 27 *C. coli* serogroup 20 strains investigated. They reported that linear gradient PAGE and RFLP demonstrated the greatest degree of discrimination among these strains.

Plasmid profile analysis.

Plasmid analysis of many strains depends in a great measure, on the presence of plasmid DNA in the isolates. Plasmids have been observed in about 30 to 50% of *C. jejuni* and *C. coli* isolates, but the instability of the plasmids may diminish their potential value in epidemiological investigations (43). Fraser et al. in 1992 have investigated a number of strains of *C. coli* Lior serogroup 20 and found that 24 of the 27 strains carried one or more plasmids, suggesting a high degree of genetic exchange in the strains of this serogroup.

Restriction fragment length polymorphism.

The restriction endonuclease analysis has been applied for the differentiation of the strains by Owen et al. 1990, and this method was successful in three outbreaks investigated. Fraser et al. 1992 has investigated a number of *C. coli* strains of serogroup 20 (Lior) and have reported that the restriction endonuclease analysis demonstrated the greatest degree of discrimination among the strains. The enzyme *Hha* I (*Cfo* 1) yielded the greatest differences between the strains, each strain showing a distinct banding pattern. *Hha* I produced 16 different profiles among the 27 *C. coli* strains. Some strains, which displayed identical plasmid profile, had different restriction profiles. Chromosomal restriction endonuclease digests, in many instances, will generate large number of banding patterns that may be difficult to interpret.

Ribotyping.

The discrimination of strains by ribotyping has the advantage that most patterns may have three to six restriction fragments, which make the interpretation much simpler than the numerous bands observed by RFLP. Patton et al. 1991 and Wachsmuth et al. 1991 have reported on the application of ribotyping to the study of outbreaks involving *Campylobacter*s and have observed using *Pst* I digests, the greatest discrimination among strains belonging to a serotype.

TABLE 9. *Campylobacter phage types associated with non-human sources.*

Source	No. of Isolates	<i>C. jejuni</i> Phage Type (numbers)	No. of Isolates	<i>C. jejuni</i> Phage Type (numbers)
Bovine	62	3(9); 4(1); 5(8); 9(3); 11(14); 19(1); 23(14); 32(1); 49(2); UT(9)	3	11(1); UT(2)
Poultry	60	7(1); 9(3); 11(4); 18(14); 20(2); 26(1); 27(2); 30(2); 36(18); 44(1); AT(2); UT910)	17	11(1); 27(9); 31(1); 44(5); UT(1)
Porcine	0		8	11(3); 26(1); 31(3); UT(1)
Others	19	3(2) ^a ; 21(11) ^b ; AT(2) ^c ; 40(2) ^d ; UT(9) ^e ; 28(3) ^f	4	26(1) ^d ; 44(3) ^a
Total	141		32	

^a Unspecified sources

^b Avian

^c Water, 7; Avian, 1; Monkey, 1

^d Pet (Cats and Dogs)

TABLE 10. *Distribution of C. saliensis serogroups by source. Lior's Scheme*

Serogroup	Human	Canine	Feline	Others	N/S	TOTAL
1	40	26	2	-	1	69
2	71	-	-	-	15	86
3	18	26	-	-	1	45
4	12	-	-	1 (pet)	1	14
5	28	7	1	-	-	36
6	8	2	1	-	-	11
7	-	-	-	-	1	1
TOTALS	177	61	4	1	19	262

MAY, '93

Multilocus enzyme electrophoresis.

Multilocus enzyme electrophoresis (MEE) is based on the electrophoretic migration distance of enzymes present in bacteria. Enzyme mobility differences relate directly to allelic variation in the structural gene locus for each enzyme (33). In a recent study, Aeschbacher and Piffaretti 1989 reported the finding of 50 MEE electrophoretic types (ETs) among 104 *C. jejuni* isolates and 14 ETs among 21 *C. coli* strains. Multilocus enzyme electrophoresis was also one of the most sensitive of ten techniques for the differentiation of epidemic associated strains (27).

Fraser et al. 1992 have investigated *C. coli* strains by multilocus enzyme electrophoresis using 25 enzymes. Ten enzymes showed easily distinguishable bands and of these, only malate dehydrogenase appeared monomorphic, that is the migration pattern for this enzyme was uniform for all strains and isocitrate dehydrogenase was the most polymorphic. The 27 strains investigated were assigned to 9 different ETs and 17 of the strains belonged to ET 1. Multilocus enzyme electrophoresis is, however, highly complex and relatively time consuming.

Pulse-field gel electrophoresis.

The development of pulse-field gel electrophoresis (PFGE) allows the analysis of smaller number of large-molecular-weight chromosomal DNA fragments generated by appropriate digestion by restriction enzymes (31). Yan et al. in 1991 reported the investigation of *C. jejuni* and *C. coli* strains digested with *Sma* I enzyme and found that PFGE analysis can be an alternative method useful in epidemiological investigations for differentiating *C. jejuni* from *C. coli*. Salama et al. in 1992 studied strains of *Campylobacter fetus* by PFGE, after digestion with enzymes *Sma* I and *Sal* I, and were able to differentiate *C. fetus* spp. *fetus* from *C. fetus* spp. *venerealis* by their different genomic sizes (1.1 Mb versus 1.3 Mb). In another study Salama et al. 1992 investigated strains of *Campylobacter hyointestinalis* isolated from five members of the same family digested with *Sal* I enzyme and found that only three of the strains had the same genome pattern.

Random amplified polymorphic DNA.

Mazurier et al. 1992 have described protocol for the differentiation of *Campylobacter* by randomly amplified

polymorphic DNA (RAPD) fingerprinting by PCR using three different 10-mer primers. Nine distinct RAPD profiles were obtained with one of the primers and 10 other profiles with another primer. Distinct RAPD profiles were identified among strains belonging to the same serotype.

Giesendorf et al. 1993 have reported the development of species-specific DNA probes by PCR fingerprinting of *C. jejuni*, *C. coli* and *C. lari*. These authors have used RAPD fragments combined with DNA probing in Southern blots.

We are presently investigating the differentiation of various *Campylobacter* spp. based on PCR amplification with arbitrary primers. Twenty 10-mer primers were investigated, and with one of the primers selected we obtained excellent differentiation of non-outbreak isolates and also a very detailed differentiation of non-related strains belonging to the same serotypes.

An excellent correlation has been observed with strains isolated from several outbreaks. Epidemiologically and serologically-linked strains were grouped with ease by RAPD. This technique has been greatly simplified and present protocols use DNA template from heated-whole cells instead of the time consuming extraction of DNA.

Campylobacter upsaliensis.

Campylobacter upsaliensis first isolated from dogs, has been in recent years increasingly isolated from human cases of enteritis (8).

Campylobacter upsaliensis lacks any specific biochemical characteristic and in order to provide markers, we have developed a serotyping scheme which at present recognizes seven serogroups.

To date, we investigated 262 isolates from human cases of enteritis (177 strains), 61 isolates from dogs, 4 from cats and 19 from unspecified sources.

Serogroup 2 was most common among human isolates and serogroup 1 was common among human and canine isolates (Table 10).

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Campylobacter: A European Perspective

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"Microbial Concerns of the International Community Symposium" sponsored by the International Life Sciences Institute

Internationally, *Campylobacter* has assumed an importance of considerable magnitude with respect to its potential as an agent of foodborne illness. Wherever figures for foodborne illness are collated, often *Campylobacter* is shown to be responsible for more cases of gastroenteritis than *Salmonella*.

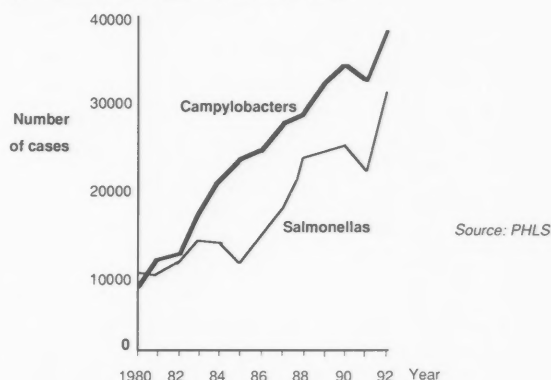
Concern in the United Kingdom over a variety of food microbiology safety issues led to the formation of the Committee on Microbiological Safety of Food ("Richmond Committee"). Two comprehensive reports were produced in 1990 and 1991, which made a number of recommendations including some associated with *Campylobacter* and its significance in the food chain. With the termination of the Richmond Committee, United Kingdom Ministers established a new committee structure to continue the work on the microbiological safety of food. The Advisory Committee on the Microbiological Safety of Food (ACMSF) was established with the following terms of reference: "To assess the risk to humans of microorganisms, which are used or occur in or on food and to advise Ministers on the exercise of power in the Food Safety Act 1990, relating to the microbiological safety of food." In October 1993, this Committee published its *Interim Report on Campylobacter* containing a number of conclusions and recommendations. The ACMSF works are parallel with the Steering Group on the Microbiological Safety of Food.

Within Europe, the United Kingdom undoubtedly has the most sophisticated and comprehensive system for surveillance of foodborne illness and epidemiological investigation. However, across Europe much progress is being made on the collation of food poisoning information with the aid of the WHO Surveillance Program for the Control of Foodborne Infections and Intoxications in Europe. This program is managed by the FAO/WHO Collaborating Centre for Research and Training in Food Hygiene and Zoonoses in Berlin. The Centre's first report was published in 1981 and the most recent report (fifth), covering the period 1985-89, was published in 1992.

In this report, 31 countries participated in reporting foodborne illness, and, of these, 18 presented some information in relation to *Campylobacter*. Not surprisingly, both the

quality and quantity of the information was extremely variable. Twelve countries reported information on outbreaks and in all cases, apart from England, Wales and Scotland, the number of outbreaks attributed to *Campylobacter* was less than 10.

In Fig. 1, the number of laboratory reports of gastrointestinal infections in England and Wales for the years 1980-92 are presented. The laboratory diagnosed cases of *Campylobacteriosis* which have risen from 12,168 in 1981, to 34,552 in 1990. Reports in 1991 returned to the 1989 levels but in 1992 rose again, in line with the earlier trend, to 38,552. Since 1981, *Campylobacter* has been more prevalent than *Salmonella* in England and Wales and it is the most commonly isolated pathogen from cases of acute infectious diarrhea. A similar picture has occurred in Scotland (Table 1) where the cases have risen from 1,273 in 1980 to 3,080 in 1989. Since 1985, *Campylobacter* has been more prevalent than *Salmonella* in Scotland.



Source: PHLS

Figure 1. Laboratory reports of gastrointestinal infections in England and Wales, 1980-92.

In Northern Ireland there has been a steady increase in reported isolates since 1981. However, the annual total of 419 in 1992 is a rate of incidence of 26.4 per 100,000 of the population, about 30% that of the rest of the United Kingdom. This is illustrated in Fig. 2.

Figure 2. Laboratory isolates of *Campylobacter* in England and Wales, Scotland and Northern Ireland, 1981-92.

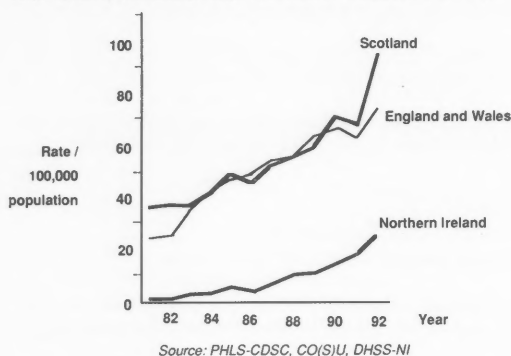
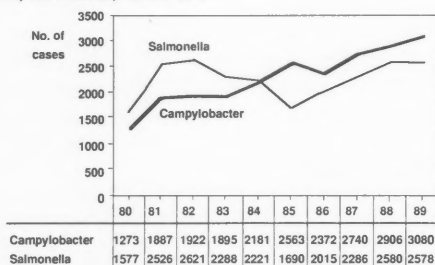


TABLE 1. Gastrointestinal infections in the United Kingdom, Scotland, 1980-89.



The WHO Report contains figures for Denmark for the years 1984-89, and these are presented in Fig. 3. During this time there has been a steady increase in laboratory confirmed cases of *Salmonella*, whereas *Campylobacter* cases have essentially remained static. *Yersinia* cases are shown as a comparison. *Campylobacter* figures for Norway during 1980-89 (Fig. 4) are shown in comparison to *Salmonella*, where there has essentially been a slow and steady rise in the number of cases. Data for the German Democratic Republic for the period 1985-89, presents comparative information for the number of cases (in thousands) of *Salmonella*, *Campylobacter* and *Yersinia*. Whereas, the underlying trend for *Salmonella* is one of increase, the number of cases of *Campylobacter* have remained steady for the years 1987-89; the cases of *Yersinia* have declined (Fig. 5). The only other country reporting detailed information on *Campylobacter* to the WHO is Finland (Table 2) where laboratory confirmed cases of *Salmonella*, *Shigella* and *Campylobacter* are compared.

Figure 3. Laboratory confirmed cases of *Campylobacter*, *Salmonella* and *Yersinia* in Denmark, 1984-89.

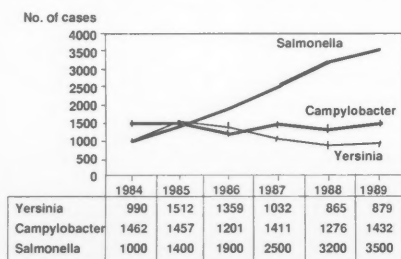


Figure 4. Cases of *Salmonella* and *Campylobacter* infection in Norway, 1980-89.

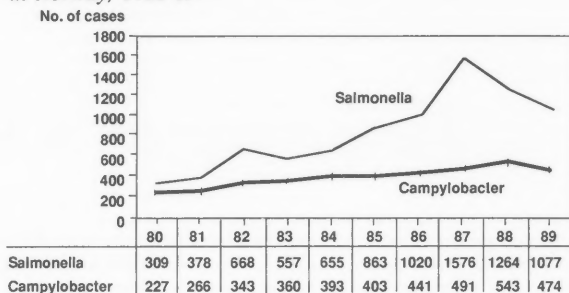


Figure 5. Reported cases of *Salmonella*, *Campylobacter* and *Yersinia* infection in German Democratic Republic, 1985-89.

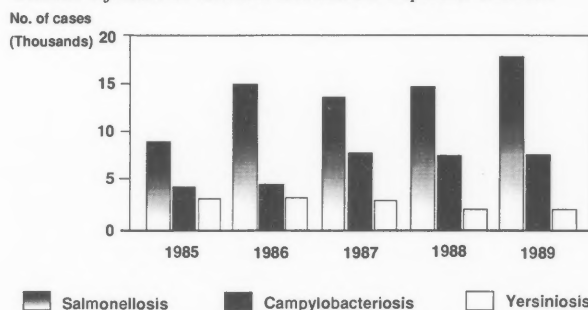


TABLE 2. Number of laboratory confirmed single cases and incidence rate of some gastrointestinal diseases in Finland, 1985-89.

Agent	1985	1986	1987	1988	1989
<i>Salmonella</i> spp.					
Number of cases	4380	5329	5171	7507	6536
Incidence rate	89.3	108.7	105.5	153.2	133.0
<i>Shigella</i>					
Number of cases	163	145	176	207	241
Incidence rate	3.3	3.0	3.6	4.2	4.9
<i>Campylobacter jejuni/coli</i>					
Number of cases	804	848	1203	1452	1627
Incidence rate	16.4	17.3	24.6	29.6	33.2

In conclusion, it is now evident that there is widespread recognition across Europe of *Campylobacter* as a serious and important cause of gastrointestinal disease and of its association with foodborne illness. It is likely that the next report from WHO will continue to endorse this view and produce more information in relation to the epidemiological investigation of outbreaks of food poisoning.

Within the European Community, the most extensive investigations of *Campylobacter* and its association with foodborne illness have been in the United Kingdom and an excellent account of this subject is contained in the United Kingdom's Advisory Committee on the Microbiological Safety of Food "Interim Report on *Campylobacter*." In this report the Public Health Laboratory Service's Communicable Disease Surveillance Centre has made available information on the number of outbreaks reported in England and Wales during the period 1988-92 (Table 3).

TABLE 3. *Campylobacter* infection: Outbreaks reported to CDSC* in England and Wales, 1988-92.

Outbreaks	1988	1989	1990	1991	1992+
Total	15	370	328	399	466
General	10	9	11	8	10
Family	5	361	317	391	436

+ Provisional figures.

• An improved data handling and storage system was introduced in 1989.

* Source: Public Health Laboratory Service, Communicable Disease Surveillance Centre.

It can be seen that thereby reference to Fig. 1, the vast majority of cases of *Campylobacter* infection are sporadic and outbreaks are rarely identified. On average there have only been around ten general outbreaks each year. It is of interest to note that the improved data handling and storage system introduced in 1989 resulted in a marked increase in the number of reported household outbreaks. In the CDR Review of November 6, 1992, the sources of outbreaks of *Campylobacter* in England and Wales for the years 1984-91 were reported and this information is given in Table 4. Milk, particularly unpasteurized (raw) milk, is the source most commonly reported as a food vehicle in outbreaks. Raw milk is still sold in England and Wales which remains a preventable source of *Campylobacter* infection. In Scotland, the sale of raw milk was banned in 1983. Milk is still delivered to houses in the United Kingdom each day ('doorstep' delivery), and cases of illness have been linked to the consumption of milk from containers where the foil bottle tops had been pecked by birds, particularly jackdaws and magpies. Poultry is the second most common food source associated with infection. Between 30% and 100% of retail broilers have been shown to be contaminated with *Campylobacter*. Outbreaks due to water have been associated with drinking untreated water or result from the contamination of supplies of potable water by birds, sewage or untreated water.

TABLE 4. Reported sources of outbreaks of *Campylobacter* in England and Wales.

Years	Total reported/identified	Number where a source was suspected	Sources			
			Milk	Poultry	Water	Other*
1984-88	228	85	38 (6) ^b	29	6(3) ^b	12
1989-91 ^c	1069	20	7	8 (1) ^b	1	4
Total	1297	105	45 (6)	37 (1)	7 (3)	16

^a Includes red meats, shellfish and pizzas.

^b Indicates outbreaks where the organism was isolated from the suspect source.

^c Provisional data.

Source: Communicable Disease Report, 'CDR Review' No. 12, November 6, 1992.

Pearson et al. (1993) published interesting work on the colonization of broiler chickens by waterborne *Campylobacter jejuni*. The report investigated a farm which was the only supplier of a local slaughterhouse associated with *Campylobacter* outbreak in 1984, caused by serotype Lior 1 Penner 4. This serotype persisted on the farm for 18

months, and its prevalence in the human population served by the farm was also high until it disappeared from the farm in 1986. A variety of sources and routes of transmission of *C. jejuni* to the broilers were investigated. The predominant source of *C. jejuni* on the farm was shown to be the water supply. An intervention program based on water chlorination, cleaning and disinfection of the drinking and shed system and withdrawal of furazolidone from feed reduced the proportion of birds colonized with *Campylobacter* from 81% to 7%. Two months after the end of the intervention program, colonization of the birds returned to 84%.

The United Kingdom's Advisory Committee on the Microbiological Safety for Food (ACMSF) Report on *Campylobacter* is, without doubt, the most comprehensive and definitive appraisal of *Campylobacter* published in Europe and in many ways ranks in status alongside the Recommendations by the National Advisory Committee (United States) on Microbiological Criteria for Foods Report on *Campylobacter jejuni/coli* published in June 1993. In Table 5, the contents of each Chapter in the ACMSF report are summarized, along with the number of conclusions and recommendations made in each chapter.

TABLE 5. Summary of chapter contents in the United Kingdom's Advisory Committee on the Microbiological Safety of Food Report on *Campylobacter*.

CHAPTER 1: INTRODUCTION

Introduction
General background to *Campylobacter*
The ACMSF's approach to its work

CHAPTER 2: THE INFECTIVE AGENTS

Introduction
Growth and survival
Isolation and identification of *Campylobacter* species associated with human enteritis
Use of subtyping schemes
Conclusions (3)*
Recommendations (2)*

CHAPTER 3: DISEASE DESCRIPTION AND IMMUNE RESPONSE IN HUMANS

Introduction
Infectious dose and clinical effects
Disease causing mechanisms
Aspects of the immune response to *Campylobacter*
Conclusions (4)
Recommendations (1)

CHAPTER 4: EPIDEMIOLOGICAL SURVEILLANCE IN HUMANS

Introduction
Surveillance
Trends in data
Descriptive epidemiology of *Campylobacter* infections
Conclusions (3)
Recommendations (1)

CHAPTER 5: SOURCES AND TRANSMISSION OF INFECTION

Introduction
Sources and routes of transmission of infection
Poultry
Milk
Water
Red Meat
Other means of transmission
National Case Control Study
Conclusion (3)
Recommendations (1)

CHAPTER 6: CAMPYLOBACTER IN ANIMALS

Introduction

Poultry
Poultry processing
Other agricultural livestock
Red meat slaughterhouses
Pet animals
Conclusions (5)
Recommendations (1)

CHAPTER 7: CAMPYLOBACTER INFECTIONS IN HUMANS: POSSIBILITIES FOR PREVENTION

Introduction

Growth and survival characteristics of *Campylobacter* in food

- Storage temperature
- Heating
- Salt (sodium chloride)
- Water activity (A_w)
- Acidity/alkalinity (pH)
- Atmosphere
- Other factors

Hazard Analysis and Critical Control Point (HACCP) Analysis

- Purchase
- Storage
- Cooking
- Cooling
- Prevention of cross-contamination
- The need for food hygiene training and education
- Committee's further action
- Conclusions (12)
- Recommendations (12)

CHAPTER 8: SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

GLOSSARY

APPENDIX 1: THE GENUS *CAMPYLOBACTER*

- Genus definition
- Species of importance in human disease
- Isolation

APPENDIX 2: SUB-SPECIES TYPING OF *C. JEJUNI/COLI*

Biotyping

Bacteriophage typing

Serotyping

Genotyping methods

- Chromosomal DNA fingerprinting
- Ribotyping
- Pulsed field gel electrophoresis (PFGE)
- Multi-locus enzyme electrophoresis (MEE)
- Use of polymerase chain reaction (PCR) in sub-species typing

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APPENDIX 3: PATHOGENICITY DETERMINANTS

Motility and mucus colonization

Adherence and invasion

Toxins

APPENDIX 4: HOST ANTIBODY RESPONSE TO *C. JEJUNI/COLI* INFECTION

In summary, the Interim Report contained a total of 30 conclusions and 18 recommendations. The recommendations include emphasis on the following:

- (i) Establishment of a central United Kingdom *Campylobacter* Reference Laboratory.

- (ii) Studies of isolation, identification and sub-typing methods, with attention being given to viable, non-culturable forms of *Campylobacter*.
- (iii) Strains of *C. jejuni/coli* causing illness and other species capable of causing disease.
- (iv) Extension of epidemiological and population studies to better understand magnitude of *Campylobacteriosis*.
- (v) Improved protective packaging.
- (vi) Studies on why some *Campylobacter* under various conditions of salt, temperature and pH and extension of use to include different atmosphere and preservatives.
- (vii) More use of MAFF Micromodel (United Kingdom Predictive Microbiology Database) for information on survival of *Campylobacter* under various conditions of salt, temperature and pH and extension of use to include different atmospheres and preservatives.
- (viii) Adoption of HACCP-based systems for control of microbiological hazards and better controlled use of refrigeration and heating equipment.
- (ix) Consumer guidance information and training of personnel involved in all aspects of the food chain.

The ACMSF have declared their intent to produce a further report on *Campylobacter* when the results of surveillance and research work recommended in the current report are available.

It is evident that there is much information that is not known about *Campylobacter* and there is a need to research many questions in relation to its significance and role in foodborne illness. Both in the United States and the United Kingdom, the National Advisory Committees have essentially identified the same complex range of issues which need to be addressed. It is particularly important that during this period of extensive research and information gathering, a clear guide is given to the food industry by government enforcement agencies as to the approach it should take concerning the presence of *Campylobacter* in raw foods and manufactured products that are minimally processed or contain raw ingredients.

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4. World Health Organization Surveillance Programme for Control of Foodborne Infections and Intoxications in Europe. Fifth Report. 1985-89. Institute of Veterinary Medicine - Robert Von Ostertag - Institute (FAO/WHO Collaborating Centre for Research and Training in Food Hygiene and Zoonoses), Berlin.
5. Communicable Disease Report CDR Review. Pearson, A. D. and T. D. Healing. 1992. The surveillance and control of

Continued on page 330

Foodborne Illness (Part 8) *Escherichia coli*

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Escherichia coli is considered a prominent member of the normal facultative flora of the intestine and plays an important role in maintaining its physiology; it is generally found in feces. Most *E. coli* isolated from the environment are not pathogenic. But, there are at least four main categories of *E. coli* which cause distinct syndromes of diarrhea; the categories are based on the following:

- Distinct virulence properties;
- Distinct O:H serotypes;
- Different interactions with intestinal mucosa (lining);
- Distinct clinical syndromes;
- Differences in epidemiology.

The four sub-groups of diarrheal *E. coli*, all implicated in food outbreaks, are:

1. Enterotoxigenic *E. coli* (ETEC) — a major cause of travelers' diarrhea and infant diarrhea in developing countries. These strains produce either a heat-stable toxin (cannot be destroyed by cooking) or a heat-labile toxin (can be destroyed by cooking) or both. Illness is similar to cholera, but much milder.
2. Enteroinvasive *E. coli* (EIEC) — a cause of diarrhea. Illness similar to shigellosis.
3. Enteropathogenic *E. coli* (EPEC) — an important cause of infant diarrhea.
4. Enterohemorrhagic *E. coli* (EHEC) — a cause of hemorrhagic colitis and hemolytic uremic syndrome. At least three "verotoxins," cytotoxic to tissue culture cells, have been identified within this group; they are very specific to the colon. *Escherichia coli* O157:H7 is the principal serotype of this group and was first identified as causing a clinical illness in 1982.

Escherichia coli is a gram-negative, facultative, non-spore-forming bacillus occurring in the environment as well

as in the intestines of animals and humans. The species are classified by serotyping, using antibodies, especially against the "O" and "H" antigens of various strains. The temperature growth range for the various serotypes can be from 36.5°F (2.5°C) to 114°F (45°C); the organism can survive both refrigeration and freezer temperatures. The pH growth range is 4.4 to 9.0 and the minimum water activity (a_w) is 0.95. The incubation period can range from 10 to 72 h, depending on the agent's sub-group.

Escherichia coli O157:H7 is currently the serotype of most concern regarding foodborne illness and is the most virulent of any serotype in the four sub-groups. In a January 1993 outbreak the agent caused about 500 cases and several children's deaths from undercooked fast food hamburgers in the Pacific Northwest. Compared to other serotypes it is heartier, is harder to detect and can be deadly. It can cause bloody diarrhea, severe abdominal pain and cramps called hemorrhagic colitis. This organism can also cause hemolytic uremic syndrome (HUS), a leading cause of acute kidney failure in children; this complication could require dialysis and lead to blindness, stroke, seizures or death. Another severe feature of this agent is thrombotic thrombocytopenic purpura (TTP), which occurs infrequently; it is similar to HUS but involves brain damage and has a high death rate. But some people may exhibit only a few symptoms, such as mild diarrhea. Those of particularly high risk for severe illness as a result of the bacteria include children under five years old, the elderly and immunocompromised persons.

Infection from *E. coli* O157:H7 is generally associated with cattle (especially young animals) and their products, especially undercooked ground beef, but apple cider (outbreak in Massachusetts) and water have caused outbreaks. Person-to-person spread can occur by the fecal-oral route. The organism has been found infrequently in retail meats, about 3% of samples examined; pork, poultry and lamb products have been found contaminated with the agent. The organism and HUS seem to have become endemic in parts of the Northwest; incidences in other geographical regions of the United States suggest that the problem is not unique to the Northwest.

CONTROL MEASURES

- Since the principal reservoir of *E. coli* O157:H7 is the intestinal tract of meat animals, raw foods of animal origin may be contaminated via feces during slaughter. The use of good manufacturing practices in meat processing (at the wholesale level) and proper heat processing of foods (at the wholesale, retail, foodservice levels) before consumption is important.
- Present regulations generally state that potentially hazardous food be heated to 145°F (63°C) or above for 15 s, with poultry and pork heated to a higher temperature. Ground beef, with bacteria mixed throughout the product during grinding, has been determined by the Food and Drug Administration to require a higher temperature to properly cook a hamburger patty. To control *E. coli* O157:H7 follow these time-temperature recommendations:

Temperature

140°F (60.0°C)
145°F (62.2°C)
150°F (62.6°C)
155°F (68.3°C)

Time

8 min., 20 s
2 min., 7 s
32 s
8 s

It has been recommended that the cooking on a grill be continued until no sign of pink meat or juice be observed.

- For ETEC, EIEC and EPEC, human carriers are presumed to be the principal reservoir. Foodservice workers need training to follow proper food protection and sanitation practices, including good personal hygiene, with proper handwashing being emphasized, and the control of time-temperature abuse. Careful (and constant) supervision is needed in monitoring sanitary handling techniques.

Continued from page 328

Campylobacter infection. Vol. II. Review No. 12.

6. Pearson, A. D., M. Greenwood, T. D. Healing, D. Rollins, M. Shahamat, J. Donaldson and R. R. Colwell. 1993. Colonization of broiler chickens by waterborne *Campylobacter*

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7. Recommendations by the National Advisory Committee on Microbiological Criteria for Foods. 1994. *Campylobacter jejuni/coli*. J. Food Prot. (In press).

Federal Register

Department of Health and Human Services

Food and Drug Administration

21 CFR Part 101

[Docket No. 94N-0191]

Food Labeling: Application of Nutrition Labeling, Nutrient Content Claims and Juice Labeling Requirements to Food Products; Certification.

Agency: Food and Drug Administration, HHS.

Action: Final rule; notice of legislation and of address for submission of certifications.

Summary: The Food and Drug Administration (FDA) is announcing the address to which a person should submit certifications made pursuant to Pub. L. 103-261. The public law extends the time period for compliance with certain provisions of the Federal Food, Drug and Cosmetic Act (the act) but makes the extension contingent upon the submission of a certification to FDA. This notice is published in response to the passage of Pub. L. 103-261.

Dates: Certifications must be received before June 15, 1994.

Addresses: Certifications should be sent to the Office of Food Labeling (HFS-150), Food and Drug Administration, 200 C St. S.W., Washington, D.C. 20204.

For Further Information, Contact: Gerad L. McCowin, Center for Food Safety and Applied Nutrition (HFS-151), Food and Drug Administration, 200 C St. S.W., Washington, D.C. 20204, (202) 205-4561.

Supplementary Information: President Clinton has signed into law Pub. L. 103-261. This law extends the time period for food products to comply with section 403(q) and 403(r)(2) of the act (21 U.S.C. 343[q] and 343[r][2]), and with the provision of section 403(i) of the act (21 U.S.C. 343[i]) that was added by section 7(2) of the Nutrition Labeling and Education Act (NLEA) (21 U.S.C. 343), until after August 8, 1994. This delay is contingent, however, on the person who introduces the product or delivers it for introduction into interstate commerce submitting before June 15, 1994, a certification to the Secretary of Health and Human Services that such person will comply with Pub. L. 103-261 and with section 403(q) and 403(r)(2) of the act, and the provision of section 403(i) of the act referenced above, after August 8, 1994.

All such certification should be submitted to: Office of Food Labeling (HFS-150), Food and Drug Administration,

200 C St. S.W., Washington, D.C. 20204.

The words "NLEA certification" should be placed on the bottom left-hand corner of the envelope containing the certification.

All labels and labeling applied to food after August 8, 1994, must comply with section 403(q) and 403(r)(2) and with the provision of section 403(i) of the act referenced above, as well as the regulations implementing these sections of the act (58 FR 44033, August 18, 1993; 58 FR 49190, September 22, 1993; and 59 FR 15049, March 31, 1994).

For a complete listing, please contact the IAMFES office at (800)369-6337 or (515)276-3344.

103D Congress
2D Session

S.2087

AN ACT

To extend the time period for compliance with the Nutrition Labeling and Education Act of 1990 for certain food products packaged prior to August 8, 1994.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that before August 8, 1994, sections 403(q) and 403(r)(2) of the Federal Food, Drug and Cosmetic Act and the provision of section 403(i) of such Act added by section 7(2) of the Nutrition Labeling and Education Act of 1990, shall not apply with respect to a food product, which is contained in a package for which the label was printed before May 8, 1994 (or before August 8, 1994), in the case of a juice or milk food product if the person responsible for the labeling of such food product exercised due diligence in obtaining before such date labels which are in compliance with such sections 403(q) and 403(r)(2) and such provision of section 403(i), if, before June 15, 1994, the person who introduces or delivers for introduction such food product into interstate commerce submits to the Secretary of Health and Human Services a certification that such person will comply with this section and will comply with such sections 403(q) and 403(r)(2) and such provision of section 403(i) after August 8, 1994.

Passed the Senate May 17 (legislative day, May 16), 1994.

Editor's Note: *The above information was provided by the Department of Health and Human Services, Food and Drug Administration, Rockville, MD.*

HAZCON-Based Total Quality Management

Retail Food Operation Food Hazard Control Checklist

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The following is the eighth installment of the Retail Food Operation Food Hazard Control Checklist mentioned in the October 1993 column. This checklist will be continued over the next several months to cover its entirety.

RETAIL FOOD OPERATION FOOD HAZARD CONTROL CHECKLIST [40°F - 150°F (4.4°C - 65.6°C)]¹

FOOD SAFETY CONTROL REQUIREMENTS	PERFORMANCE EVALUATION	NEEDED TO ASSURE SAFETY
<p>Carry-out and banquet food (Haz)</p> <ul style="list-style-type: none"> The freshest possible food with the lowest bacterial counts is provided for carry-out service. Customers are told to keep hot food >150°F, or keep cold food <40°F, or to consume it within 2-1/2 h. All catered food is maintained at temperatures >150°F or <40°F until it is served. 		
<p style="text-align: center;"><u>Storing Prepared Food</u></p> <p>Food cooling time (Haz)</p> <ul style="list-style-type: none"> Food is cooled to 40°F in less than 4 h, according to current FDA standards. This is done by: <ul style="list-style-type: none"> Panning the food <2 in. deep, covering and putting it in the blast chiller at an airflow rate of >1,000 ft. per min. Agitation in an ice bath, potable ice water, liquid or solid CO₂ or liquid nitrogen. However, if food is cooled from 130°F to 40°F in less than 11 h, it will be safe. Refrigeration unit(s) are not overcrowded or improperly loaded so as to obstruct or disrupt the cooling circulation patterns. 		
<p>Storage to prevent cross-contamination (Reg)</p> <ul style="list-style-type: none"> Raw food is stored underneath prepared food; in separate racks and storage areas within a refrigerator or freezer, or in separate refrigerators. 		
<p>Storage time (Reg)</p> <ul style="list-style-type: none"> All leftover refrigerated food that has been on display is used in <3 days. 		
<p>Storage containers (Haz)</p> <ul style="list-style-type: none"> Single use items such as plastic bread bags, seamed metal cans, ketchup bottles, crimped aluminum pie tins and glass jars are not being re-used after original contents have been removed. Food (particularly high acid food) is never stored, prepared and cooked or processed in containers or pipes that contain toxic materials such as galvanized metal, chipped enamelware, lead and lead glazes or copper or copper tubing. 		
<p>Leftovers</p> <ul style="list-style-type: none"> Leftovers are minimized. A tabulation of number of customers served or items sold is used to forecast amount of food to prepare. Progressive food preparation is used whenever possible. Leftover food is cooled to 40°F in less than 11 h (4 h regulatory) from the time it is allowed to go below 130°F, or it is discarded and a record of its disposal is recorded on the waste sheet. Leftover food that is not heated to 165°F is not mixed in with fresh food. 		

Abbreviations: (Haz) = Hazard; (Reg) = Regulatory; (Qual) = Quality; (OSHA) = Occupational Safety and Health Agency

¹Temperatures, unless otherwise stated, are food temperatures. They are measured both 1/16-in. below the surface as well as at the center of food in order to determine the degree of control and stability of hot and cold systems.

FOOD SAFETY CONTROL REQUIREMENTS	PERFORMANCE EVALUATION	NEEDED TO ASSURE SAFETY
<ul style="list-style-type: none"> • When precooked foods (except beef) are reheated, the food is reheated to reach a center temperature of 165°F in 2 h or less to meet quality standards, and within 6 h for safety. <ul style="list-style-type: none"> - This temperature is maintained for at least 1 s to reduce the number of vegetative pathogenic microorganisms, which may have multiplied during the cooling, handling and reheating cycles, to a safe number. - When large amounts of food are reheated, the food is cut or spread out so that the maximum center-to-surface distance is <1 in, This procedure also enables a more uniform transfer of heat. • Unwrapped and potentially hazardous food is discarded after it has been served once. <ul style="list-style-type: none"> - Unwrapped rolls and unpackaged butter and cream are not being reserved. - In hospital foodservice, all food returned on trays or on tables is discarded. • Non-hazardous food that is still packaged and in sound condition may be reserved. 		
<p>Work station cleanliness (Reg)</p> <ul style="list-style-type: none"> • Work stations are clean and orderly and free from debris and spilled food. <ul style="list-style-type: none"> - Crumbs are not swept on the floor; they are swept onto a plate or tray. - Work stations are kept clean with detergent- and water-soaked towels as necessary and are wiped down with a sanitizing solution after each meal. 		
<p>Frequency of surface sanitizing (Reg)</p> <ul style="list-style-type: none"> • Soiled eating areas are cleared promptly and cleaned with a detergent solution. • Tables and counter surfaces are sanitized every 4 h or at the end of the meal to prevent bacterial build-up and to maintain professional food process standards. • Tables in the dining room are washed and sanitized with a milk detergent solution and polished with a dry cloth. 		
<p>Serving utensils and cutting boards (Reg)</p> <ul style="list-style-type: none"> • Serving utensils and serving systems are kept hot (150°F) or cold (40°F); kept dry and clean; or are stored in a dipper well with cold-flowing water. • Cutting boards and utensils used for serving hot, cooked food are cleaned and sanitized at least every 2 h. 		
<p>Beverage dispensing equipment (Haz)</p> <ul style="list-style-type: none"> • All beverage dispensing equipment is cleaned regularly according to the manufacturer's instructions. • The dispensing unit is taken apart once a week, cleaned and sanitized to prevent bacterial build-up. 		
<p>Milk product dispensers (Reg)</p> <ul style="list-style-type: none"> • Milk and milk product dispensers, such as soft-serve machines are cleaned and sanitized before they are used each day (particular attention is given to gaskets and O-rings). 		
<p>Dispensing tableware and flatware (Reg)</p> <ul style="list-style-type: none"> • Tableware and flatware (both multiple use and single service) are dispensed in a sanitary manner so that surfaces which come into contact with food or the mouth are protected from contamination. • Handles of flatware are presented to the user. • Sanitary straw dispensers are used for dispensing straws or wrapped straws must be used. • Sanitary, disposable cup dispensers are used for customer service. 		
<p>Self-service food, dishes and utensils (Reg)</p> <ul style="list-style-type: none"> • Customers are not allowed to re-use single-services or multi-use plates, bowls, tableware, etc., when obtaining additional food from the salad bar or buffet. <ul style="list-style-type: none"> - Customers are given a clean dish and their dirty plate or dish is then taken to the dishwashing area. - A sign is posted at the buffet or service line which gives customers appropriate instructions. • Food in the self-service display units is arranged so that customers do not have to reach over the food. • Properly designed, constructed and installed protective shields or other approved devices are provided to protect food from consumer contamination. 		

Official Notice -- Amendments to the IAMFES Constitution and By-Laws

Editor's Note: *In order to amend the IAMFES Constitution, the proposed amendment must be submitted to the Executive Manager at least 60 days prior to the meeting at which they are to be considered. The Executive Manager must notify the membership that the proposed amendment(s) will be discussed at least 30 days prior to that meeting (this may be accomplished by publication in Dairy, Food and Environmental Sanitation).*

If a majority of those present at the meeting are in agreement with the proposal, the proposal shall then be submitted to the entire membership for a written vote.

The procedure for amending the IAMFES By-Laws is exactly the same except that the proposal does not have to be put to a written vote by the entire membership.

The following amendments to the Constitution and By-Laws have been submitted by the Affiliate Council. They will be considered at the Business Session to be held at the Hyatt Regency Hotel in San Antonio, TX, beginning at 3:30 p.m. CDT on Tuesday, August 2, 1994.

PROPOSED CHANGES FOR 1994

CONSTITUTION

Article IV.

Section 4. An Affiliate Council shall be created, which shall consist of a duly authorized representative for each Affiliate Association, and the Immediate Past President of IAMFES.

- A. Each Affiliate Association shall have one vote.
- B. The Affiliate Council parliamentary procedure shall be governed by Operational Guidelines, adopted by majority vote of Affiliate Representative representing all of the member affiliates and approved by the IAMFES Executive Board. A copy of the current Affiliate Council Operational Guidelines shall be filed with the IAMFES Executive Manager.**
- C. The Affiliate Council shall, elect its Chairperson and other officer(s) as set forth in the Affiliate Council Operational Guidelines, shall keep a record of its proceedings and authorized representatives, and shall submit its recommendations to the Executive Board.
- D. The Chairperson of the Affiliate Council shall represent the Affiliate Associations as a voting member of the IAMFES Executive Board.**
- E. It shall be the function of the Affiliate Council:**
 - 1) To be an advisory body to the Executive Board;**
 - 2) To represent the interest of the Affiliate Associations to the Executive Board and IAMFES members; and**
 - 3) To serve as the means for the interchange of ideas and recommendations on programs, activities, awards and procedures among and between the Affiliate Association and the Executive Board.**

Delete sub-section 4.C of Article IV and the word Secretary in sub-section 4.B of Article IV of the present Constitution. Make additions as shown above in **BOLD UNDERLINE**. Reletter section 4 as shown above.



BY-LAWS

Delete Article V and renumber the remaining Articles. The Affiliate Council will have their own Operational Guidelines. Therefore, the By-Laws do not have to address the Affiliate Council.

DETAILS ON THE CONSTITUTIONAL CHANGES

New sub-section B formalizes the way the Affiliate Council has been working and establishes a means for changing the Operational Guidelines.

Sub-Section B of the present Constitution is moved to sub-section C and modified to allow for officers other than the Chairperson and Secretary. The Council has been working with a different organization during the last couple of years. This change formalizes their organization changes and allows them to change again in the future if the situation requires it.

Sub-Section C of the present Constitution stating the duties of the Council is deleted and replaced with a new sub-section E. The new sub-section E states the reason for an Affiliate Council and is a summary of the duties of the Affiliate Council from the By-Laws Article V., Section 1. The new sub-section D is moved from the By-Laws Article V., sub-sub-section 2.A.2. The By-Laws dealing with the Affiliate Council will be deleted since the Council will be governed by their Operational Guidelines.

Hall Named 3-A Symbol Council Administrator

Joe W. Hall, Jr., Columbia, SC, has been named as the new Administrative Officer of the 3-A Sanitary Standards Symbol Administrative Council. Hall, who recently worked for the South Carolina Department of Health and Environmental Control, has been an active participant in 3-A Sanitary Standards programs for many years. He succeeds the late Walter F. Laun, who served as Council Administrative Officer from 1990-93.

In conjunction with naming Hall as its Administrative Officer, the 3-A Symbol Council announces the relocation of its office from Cedar Rapids, IA, to Columbia, SC.

Effective June 20, the new 3-A Symbol Council address will be:

3-A Sanitary Standards Symbol Administrative Council
3020 Bluff Road
Columbia, SC 29209-3502
Telephone: (803) 783-9258
Facsimile: (803) 783-9265

Ralph M. Shearer, Founder of Southern Belle Dairy, Dies

Ralph M. Shearer, 76, the patriarch and founder of Southern Belle Dairy Co., Inc., died Thursday, May 5, after a brief illness. Mr. Shearer, a dairyman since the 1930s, also founded Cumberland Dairies in Monticello, KY.

From a humble production beginning of 150 gallons per day, Mr. Shearer guided Southern Belle to become one of Kentucky's largest independent dairy companies.

Shearer's sons have continued to expand operations at the Southern Belle plant, which currently employs 250 people and serves more than 4,000 customers in six states. Martin Shearer assumed the presidency in 1985 and Max Shearer is chairman of the board.

Thanks to Mr. Shearer's innovative management, Southern Belle was one of the first dairies in Kentucky to use refrigerated milk storage tanks, vacuum processing and paper and plastic containers. Southern Belle Dairy today produces dozens of brand-name products and processes more the 90,000 gallons of dairy products per day.

Mr. Shearer was an active civic leader, serving as regional vice president of the Kentucky Chamber of Commerce from 1973 to 1976. He was a trustee for the Somerset Municipal Hospital Commission from 1963 to 1978 and also served as chair of the Commission from 1974 to 1978. In recent years, Mr. Shearer was an advocate and pioneer of home health care services. He was also a member of the Somerset Kiwanis Club for 21 years.

Survivors include Mildred Pogue Shearer, Mr. Shearer's wife of 58 years; two sons, Max Shearer and Martin Shearer; a daughter, Gaynelle Baker; a brother, Dr. Frank M. Shearer;

a sister, Leva Schaf; seven grandchildren and four great-grandchildren.

Mr. Shearer was buried Sunday, May 8, in Somerset, his home since 1951.

Fases Symposium Explores Genetic Role in Heart Disease Risk

The important relationship between diet and health has been widely acknowledged as instrumental in preventing disease and maintaining good health. But how influential are genetic factors in determining a person's risk for certain diseases and therefore, the effectiveness of preventative measures?

A symposium sponsored by the National Dairy Council (NDC) and the National Dairy Promotion and Research Board (NDB), was presented at the Annual Federation of American Societies for Experimental Biology (FASEB) conference in April to explore these issues. "Genetic Influences of Lipoprotein Response to Dietary Fat and Cholesterol," was chaired by Ronald Krauss, M.D., head of the Department of Molecular Medicine at Lawrence Berkeley Laboratory, Berkeley, CA.

Genetics determine dietary efforts.

Dr. Krauss recently authored a study examining the effectiveness of a reduced-fat diet on a person's risk of coronary artery disease. The study, published in the January, 1994 issue of *The FASEB Journal*, showed that the magnitude of the benefits accrued from a reduced fat diet depend on an individual's specific genetic profile.

Scientists advise individual approach.

More than 150 scientists and other medical and health professionals attended the FASEB symposium to hear a five-member scientific panel present its findings. Participants included:

- Lawrence Rudel, Ph.D., Bowman Gray School of Medicine, Winston-Salem, NC, who spoke about "Hypo- and hyper-responsiveness to dietary fat and cholesterol in animal models."
- Beverly Paigan, Ph.D., The Jackson Laboratory, Bar Harbor, ME, presented "Genetic analysis of dietary fat responsiveness in inbred mouse strains."
- Margo Denke, M.D., University of Texas South-west Medical Center, discussed "Dietary responsiveness in genetic disorders of lipid metabolism."
- Barbara Howard, Medlantic Research Institute, Washington, DC, explored "Effects of gender, race and other factors on response to variation in fat intake."
- Dr. Krauss, who discussed "Low density lipoprotein subclasses and dietary response in humans."

New IAMFES Members

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Dave Conner
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Arcadia

District of Columbia

Reginald W. Bennett
Food and Drug Administration
Washington

Georgia

Thomas E. Brown
Savannah Cocoa, Inc.
Savannah

Illinois

Mike Novy
M & M Mars
Burr Ridge

Dave Tieman
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Burr Ridge

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Ocean Spray Cranberries, Inc.
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Becky A. Michaels
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City of Henderson
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Peter W. Bodnaruk
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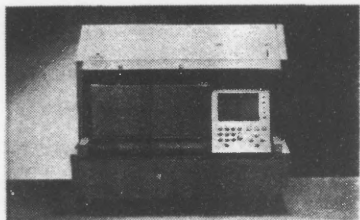
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bioMérieux Vitek's VIDAS® *Salmonella* (SLM) Assay allows food processors to detect *Salmonellae* in foods and environmental samples much faster than standard cultural methods. This qualitative enzyme-linked fluorescent immunoassay is performed in the company's fully automated VIDAS or mini VIDAS instruments.

A patented solid phase receptacle and special reagent test strip contain all pre-dispensed reagents required for on-line processing within the VIDAS. Following a standard enrichment protocol, results are available in approximately 45 min.

VIDAS SLM detects both motile and non-motile *Salmonellae*.

bioMérieux Vitek, Inc. - St. Louis, MO

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Free Hand Sanitation Video From World Dryer

World Dryer Corporation, the leading manufacturer of warm air hand dryers for over 40 years, is currently offering a video that highlights the company's new Wash Station. Designed to improve hand sanitation practices in foodservice, food processing and healthcare facilities, the Wash Station's completely automatic features lead employees through proper handwashing techniques to ensure safety.

The informative video provides a step-by-step guide to the touchless wash system. In less than 4 minutes, the color video illustrates proper handwashing procedures for fighting hand-to-food contamination and other sanitation problems. The unique "logic system" of the Wash Station features sensors that provide a complete soap and water wash, activating water only after soap has been applied - eliminating a "water only" wash.

World Dryer's video also explains product features which make the Wash Station so easy to use. Highlighted are: lighted low soap indicator, on-off switch for cleaning the fixture without triggering the sensors, and a water over-ride. The compact Wash Station can be installed using existing water and electrical lines.

World Dryer Corp. - Berkeley, IL

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Unipath Announces New AnaeroGen™ Anaerobic Atmosphere Generation System

Unipath Limited is pleased to announce a new Anaerobic Atmosphere Generation System, the first product in the new Oxoid brand Atmosphere Generation System.

The unique Oxoid AnaeroGen System employs new technology that replaces oxygen with carbon dioxide in a sealed jar more easily, quickly, and safely than with any other system. With no water, hydrogen, or catalyst to add, the AnaeroGen sachet absorbs oxygen (to a final atmosphere of less than 1% oxygen) from a 3.5 L jar in 30 to 40 min. No hydrogen is generated, heat does not exceed 65°F, and no hazardous pressure build-up occurs.

The fast action of the AnaeroGen System aids presumptive identification by improving colony growth during the first 24-48 h, especially with fastidious and obligate anaerobes.

The Oxoid AnaeroGen System includes everything needed for the transport, culture, selective isolation and susceptibility testing of anaerobic organisms: Oxoid AnaeroGen sachets in 2.5 L or 3.5 L format; 3.5 L anaerobic jar; wide range of special, high quality Oxoid dehydrated and prepared culture media and selective supplements.

Unipath provides the industrial food industry with a complete line of dehydrated culture media, an innovative range of selective culture media, and a wide range of diagnostic kits for the identification of organisms and/or their toxins.

UNIPATH - Ogdensburg, NY

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Klenzade Retains Mona Meyer McGrath & Gavin

Klenzade, a division of St. Paul-based Ecolab, Inc., has selected Mona Meyer McGrath & Gavin to provide marketing communications and trade media relations services.

Klenzade is the market leader in developing and marketing sanitation products, systems and services for the on-farm dairy, dairy processing and food and beverage processing industries. Ecolab, Inc. is a billion dollar, world-wide Fortune 500 corporation and the market leader in global institutional sanitation products and services.

Mona Meyer McGrath & Gavin, headquartered in Minneapolis, employs more than 90 people and is the largest public relations firm in the North Central United States. The firm is part of the London-based Shandwick, which has more than 70 principal offices throughout the world.

Klenzade, Division of Ecolab -
St. Paul, MN

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APV Fluid Handling Expands to Include APV Rosista Valves

Effective February 1, 1994, APV Fluid Handling, Lake Mills, WI, assumed the responsibilities for the sales, application, manufacture and service of all APV Rosista Single Seat, Double Seat and Butterfly Valves as well as related fluid handling components formerly supplied by APV Rockford.

This move consolidates all APV North American Fluid Handling capabilities at one location for more efficient operation and improved customer service. APV fluid handling equipment is sold and serviced by a network of local authorized distributors and regional APV sales offices supported by a team of product managers, application engineers and design engineers. Users of all APV valves may now order new or replacement parts direct by calling the Lake Mills factory at 1-800-358-4100.

In addition to valves, APV Fluid Handling provides the processing industries with a complete line of Rotary and Centrifugal Pumps, Powder Mixers and Special Pumping Assemblies.

APV Fluid Handling - Lake Mills, WI

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Pall Corporation and New Logic International, Inc. Agreement for Membrane Separation System

Pall Corporation and New Logic International, Inc. have entered into an exclusive agreement under which Pall has acquired manufacturing and sales rights under New Logic's Vibratory Shear Enhanced Processing filtration system patents and know how. Pall will market the system under the name Pall-Sep VMF™ filter. Pall has obtained exclusive rights to manufacture and sell the separations system worldwide.

The Pall-Sep VMF filter offers high flux rates, high concentration limits, low power requirements and mechanical simplicity in separations ranging from low molecular weights through 30 microns. These features, offered for the first time in a membrane system, provide a new standard in rapid separation. The Pall-Sep VMF filter can replace many conventional separation processes, such as evaporation, rotary drum vacuum filtration, centrifugal separation and crossflow membrane filtration.

The Pall-Sep VMF filter can be configured with reverse osmosis, ultrafiltration and microfiltration removal rated membranes and is designed to accommodate pilot and industrial scale filtration applications.

Pall Corporation - East Hills, NY

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IAMFES Offers the Northeast Dairy Practices Council (NDPC) "Guidelines for the Dairy Industry"

At the urging of our **Dairy Quality and Safety Professional Development Group**, IAMFES has entered into an agreement with the Northeast Dairy Practices Council (NDPC) to distribute their "Guidelines for the Dairy Industry." NDPC is a non-profit organization of education, industry and regulatory personnel concerned with milk quality and sanitation throughout 15 northeastern/mid-Atlantic states. Interestingly, its membership and subscriber rosters list individuals and organizations throughout the United States, Canada and Japan.

For the past 25 years, NDPC's primary mission has been the development and distribution of educational guidelines directed to proper and improved sanitation practices in the production, processing, and distribution of high quality fluid milk and manufactured dairy products.

The NDPC Guidelines are written by professionals who comprise five permanent Task Forces. Prior to distribution, every Guideline is submitted for approval to the key milk control sanitarian in each of the 15 states which are now active participants in the NDPC process. Should any official have an exception to a section of a proposed guideline, that exception is noted in the final document.

Although the Guidelines are developed east of the Mississippi River, clearly they have a high degree of applicability wherever cows are milked and milk is transported, processed and distributed.

The Guidelines are renowned for their common sense, and useful approach to proper and improved sanitation practices. We think that they will be a valuable addition to your professional reading library.

The entire set consists of 48 guidelines including:

- | | |
|---|---|
| 1 Dairy Cow Free Stall Housing | 32 Fat Test Variations in Raw Milk |
| 2 Effective Installation, Cleaning and Sanitizing of Milking Systems | 33 Brucellosis and Some Other Milkborne Diseases |
| 3 Selected Personnel in Milk Sanitation | 34 Butterfat Determinations of Various Dairy Products |
| 7 Sampling Fluid Milk | 35 Dairy Plant Waste Management |
| 8 NE Ext. Publ., Conferences, Short Courses, Correspondence Courses and Visual Aids in Dairying | 36 Dairy Farm Inspection |
| 9 Fundamentals of Cleaning and Sanitizing Farm Milk Handling Equipment | 37 Planning Dairy Stall Barns |
| 10 Fluid Milk Shelf-Life | 38 Preventing Off-flavors in Milk |
| 11 Sediment Testing and Producing Clean Milk | 39 Grade A Fluid Milk Plant Inspection |
| 13 Environmental Air Control & Quality for Dairy Food Plants | 40 Controlling Fluid Milk Volume and Fat Losses |
| 14 Clean Room Technology | 41 Milkrooms and Bulk Tank Installation |
| 16 Handling Dairy Products From Processing to Consumption | 42 Stray Voltage on Dairy Farms |
| 17 Causes of Added Water in Milk | 43 Farm Tank Calibrating and Checking |
| 18 Abnormal Milk--Fieldman's Approach | 44 Troubleshooting Dairy Barn Ventilation Systems |
| 21 Raw Milk Quality Tests | 45 Gravity Flow Gutters for Manure Removal in Milking Barns |
| 22 Control of Antibacterial Drugs and Growth Inhibitors in Milk and Milk Products | 46 Dairy Odor Control |
| 23 Preventing Rancid Flavors in Milk | 47 Naturally Ventilated Dairy Cattle Housing |
| 24 Troubleshooting High Bacteria Counts of Raw Milk | 48 Cooling Milk on the Farm |
| 25 Cleaning and Sanitizing Bulk Pickup and Transport Tankers | 49 Postmilking Teat Dips |
| 28 Troubleshooting Residual Films on Dairy Farm Milk Handling Equipment | 50 Farm Bulk Milk Collection Procedures |
| 29 Cleaning and Sanitizing in Fluid Milk Processing Plants | 51 Controlling the Accuracy of Electronic Testing Instruments for Milk Components |
| 30 Potable Water on Dairy Farms | 52 Emergency Action Plan for Outbreak of Milkborne Illness in the Northeast |
| 31 Composition and Nutritive Value of Dairy Products | 53 Vitamin Fortification of Fluid Milk Products |
| | 54 Selection and Construction of Herringbone Milking Parlors |
| | 56 Dairy Product Safety (Relating to Pathogenic Bacteria) |
| | 57 Dairy Plant Sanitation |
| | 58 Sizing Dairy Farm Water Heater Systems |
-

If purchased individually, the entire set would cost \$174. We are offering the set, packaged in three loose leaf binders for \$125 plus \$9 shipping and handling (outside the U.S., \$21 for shipping and handling).

Information on how to receive new and updated Guidelines will be included with your order.

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

Please enclose \$125 plus \$9 shipping and handling for each set of Guidelines. Shipments outside the U.S. are \$125 plus \$21 shipping and handling.

Payment in U.S. \$ drawn on a U.S. Bank or by credit card.

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IAMFES

PRELIMINARY PROGRAM

81st Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians, Inc.

In Cooperation with the Texas Association of Milk, Food and Environmental Sanitarians

Hyatt Regency Riverwalk, San Antonio, Texas
July 31 - August 3, 1994

REGISTRATION TIMES

Saturday, July 30 12:00 - 5:00 p.m.
Sunday, July 31 8:30 a.m. - 7:00 p.m.
Monday, August 1 8:00 a.m. - 4:00 p.m.
Tuesday, August 2 8:00 a.m. - 4:00 p.m.
Wednesday, August 3 8:00 a.m. - 12:00 p.m.

EXHIBITOR HOURS

Sunday, July 31 7:45 - 10:00 p.m.
(Following the Opening Session)
Monday, August 1 9:30 a.m. - 3:30 p.m.
Tuesday, August 2 9:30 a.m. - 3:30 p.m.

IAMFES BOARD MEETINGS

Saturday, July 30 8:00 a.m. - 5:00 p.m.
Tuesday, August 2 7:00 a.m. - 8:30 a.m.
Thursday, August 4 7:00 a.m. - 9:00 a.m.

COMMITTEE/PROFESSIONAL DEVELOPMENT GROUP MEETINGS

SUNDAY, JULY 31

7:00 - 10:00 a.m. Affiliate Council
10:00 - 11:00 a.m. Dairy Quality & Safety (Farm Section)
10:00 - 11:00 a.m. Audio Visual Library
10:00 - 11:00 a.m. Baking Industry Sanitary Standards
10:00 - 11:00 a.m. Past Presidents Advisory
10:00 - 12:00 a.m. Poultry Safety and Quality
10:00a.m - 5:00 p.m. Communicable Diseases Affecting Man
11:00 - 12:00 a.m. Dairy Quality and Safety (Plant Section)
11:00 - 12:00 a.m. Foundation Fund
11:00 - 12:00 a.m. Nominating
1:30 - 2:30 p.m. Constitution and By-Laws
1:30 - 2:30 p.m. Sanitary Procedures
1:30 - 3:00 p.m. Meat Quality and Safety
1:30 - 3:00 p.m. Dairy, Food & Environmental Sanitation
1:30 - 3:30 p.m. Seafood Safety and Quality
1:30 - 3:30 p.m. Applied Laboratory Methods
1:30 - 3:30 p.m. Food Service Sanitation
3:00 - 4:00 p.m. Environmental Issues in Food Safety
3:00 - 4:30 p.m. Journal of Food Protection Management
3:00 - 5:00 p.m. Food Safety Network
4:00 - 6:00 p.m. Program Advisory

WEDNESDAY, AUGUST 3

12:00 - 4:00 p.m. Program Advisory (members only)

SUNDAY EVENING, JULY 31

Opening Session

- 7:00 **Welcome to the 81st Annual Meeting** - H. BENGSCHE, President of IAMFES and, R. RICHTER, Chairperson of the Local Arrangements Committee
- 7:15 **Introduction of the Ivan Parkin Lecture** - D. CLINGMAN, President-Elect of IAMFES
- 7:20 **Ivan Parkin Lecture**
- The Ivan Parkin Lecture is sponsored by the IAMFES Foundation Fund and is supported by the Sustaining Members
- 8:00 **Nachos and Margaritas Reception** - Held in the Exhibit Hall. An opportunity to greet old friends, make new ones and view the excellent technical displays.

MONDAY MORNING, AUGUST 1

Quantitative Risk Assessment in Food Microbiology Sponsored by the ILSI North America Technical Committee on Food Microbiology

- 8:30 **Overview - the International Commission on Microbiological Specifications for Foods (ICMSF) Approach** - T. ROBERTS, Institute of Food Research, Reading, U.K.
- 9:00 **Risk Assessment Terms and Definitions** - M. POTTER, Centers for Disease Control and Prevention, Atlanta, GA
- 9:30 **Health Risk Analysis of Food in Canada** - E. TODD and J. Harwig, Health Canada, Ottawa, Ontario, Canada
- 10:20 **Process Reliability and Risk - A Food Industry Perspective** - M. COLE, Unilever Research, Bedford, U.K.
- 10:50 **Assessment of Risks Associated with Foodborne Pathogens - an Overview of a CAST (Council for Agricultural Science and Technology) Report** - P. FOEGEDING, North Carolina State Univ., Raleigh, NC
- 11:20 **Risk Analysis and Its Application in Food Regulation** - T. KINDRED, U.S. Dept. of Agriculture, Washington, DC

Technical Session — Dairy

- 8:30 **Vitamin Fortification of Milk** - R. BYRNE, International Dairy Foods Assn., Washington, DC

- 8:45 **Shelf-life of Commercial Conventionally Packaged Cottage Cheese** - S. MURPHY, R. Ledford, D. Bandler, S. Kozlowski, Cornell University, Ithaca, NY
- 9:00 **Computer Models for Thermal Inactivation of Native Milk Enzymes** - R. McKELLAR, Agriculture & Agri-Food Canada, Ottawa, Ontario, Canada

Technical Session — Risk Assessment

- 9:15 **Application of Sewage Sludge to Food Crops** - H. EMERY, San Antonio Water System Regulatory Programs Dept., San Antonio, TX
- 9:30 **Effect of Hydrostatic Pressure, in Combination with Heat and/or Irradiation, on the Survival of *Clostridium sporogenes* in Chicken** - Y. CRAWFORD and E. Murano, Iowa State University, Ames, IA
- 9:45 **Safety and Food Excellence (S.A.F.E.): A Program for Food Service Workers and Care Givers, who prepare Food for the Chronically Ill** - R. GRAVANI, D. Scott, P. Kendall and D. Schmidt, Cornell University, Ithaca, NY
- 10:20 **Environmental Testing for *Listeria*: the Quantitative Edge** - B. JACKSON, VICAM, Watertown, MA
- 10:35 **The Practical and Educational Role of Environmental Monitoring of Food Premises** - I. LINJACKI, University of Guelph, Guelph, Ontario, Canada
- 10:50 **Food Facility Plan Review** - J. SCHRADE, Food and Drug Administration, Brooklyn, NY
- 11:05 **Regulatory Inspection HACCP vs. Food Operation HACCP Self-Control** - O. SNYDER, Hospitality Institute of Technology, St. Paul, MN
- 11:20 **Growth of *Shigella flexneri* in Foods: Comparison of Observed and Calculated Growth Kinetics Parameters** - L. ZAIKA and O. Scullen, U.S. Department of Agriculture, ARS, Philadelphia, PA

Technical Session — Analytical

- 8:30 **Comparison of Enrichment Protocols for Use with VIDAS to Detect Salmonellae** - J. BAILEY and N. Cox, U. S. Department of Agriculture, ARS, Athens, GA
- 8:45 **Fluorometric Acid Phosphatase Method for Verifying End-Point Temperature in Cooked Poultry** - C. DAVIS, W. Townsend and C. Lyon, U. S. Department of Agriculture, ARS, Athens, GA
- 9:00 **Improved Medium and Method for Growing *E. coli*** - R. FIRSTENBERG-EDEN, S. Allen, M. Averill and N. Sullivan, Difco Laboratories, Inc., Ann Arbor, MI

- 9:15 **Comparison of a Micro Identification System to Conventional Biochemical Procedures for the Identification of *Salmonella*, *Escherichia coli* and other Gram Negative Enterobacteriaceae from Food Origin** - M. KNIGHT, M. Newman and J. Agin, Q Laboratories, Inc., Cincinnati, OH
- 9:30 **A New Rapid Coliform Detection Method. Petrifilm 2000 Coliform Count Plate** - G. KREJCAREK, K. Hesselroth, P. Mach, and Y. Yang, 3-M Company, St. Paul, MN
- 9:45 **A Murine Monoclonal Antibody Specific to D-serogroup *Salmonella*** - A. MASI and J. Zawistowski, University of Manitoba, Winnipeg, Manitoba, Canada
- 10:20 **ATP Luminescence as a Means to Rapidly Detect Microbial and Fecal Contamination on Carcass Tissue** - G. SIRAGUSA and C. Cutter, U. S. Department of Agriculture, ARS, Clay Center, NE
- 10:35 **Rapid Assessment of *Listeria* Control Using Bioluminescence** - A. WALKER, G. Stewart and J. Holah, Campden Food & Drink Research Assn., Chipping Campden, Glos., U.K.
- 10:50 **Effect of Monolaurin on *L. monocytogenes* Scott A at 37 and 8°C** - M. JOHNSON, D. Scott and A. Bhunia, University of Arkansas, Fayetteville, AR
- 11:05 **An isolation method for *Arcobacter butzleri* from Poultry** - A. LAMMERDING, Agriculture and Agri-Food Canada, Guelph, Ontario, Canada
- 11:20 **Improved Enrichment Recovery of *Campylobacter* spp. from Broiler Chicken Carcasses** - N. STERN, U. S. Department of Agriculture, ARS, Athens, GA
- 11:35 **DNA Probe-HGMF Methods to Detect Enterohemorrhagic *E. coli* and *Shigella* in Foods** - E. TODD, R. Szabo, J. Khattri, L. Dube, D. Helmerson, D. Granville, A. Boville, H. Lior and J. MacKenzie, Health Protection Branch, Ottawa, Ontario, Canada
- 9:15 **Growth Inhibition of *Penicillium* species by Lactic Acid Bacteria** - H. GOURAMA, The Pennsylvania State University, Reading, PA
- 9:30 **Mechanism of Inhibition of Aflatoxin Biosynthesis by *Lactobacillus Casei Pseudoplatantum*** - H. GOURAMA and L. Bullerman, The Pennsylvania State University, Reading, PA
- 9:45 **Optimization of Parameters for Production of Nisin and Inhibition of *Lactobacillus plantarum* in a Model Mixed-Culture Fermentation** - L. HARRIS and M. Vieira, University of Guelph, Guelph, Ontario, Canada
- 10:20 **Control of *Salmonella*, *Listeria monocytogenes*, *Campylobacter jejuni*, and Psychrotrophs on Chicken Skin with Lactic Acid and Sodium Benzoate** - C. HWANG and L. Beuchat, University of Georgia, Griffin, GA
- 10:35 **Influence of Sodium Chloride on Thermal Inactivation and Recovery of Non-proteolytic *Clostridium botulinum* Type B Spores** - V. JUNEJA, B. Marmer and B. Eblen, U. S. Department of Agriculture, ARS, Philadelphia, PA
- 10:50 **A Field Study Evaluating the Effectiveness of Different Hand Soaps and Sanitizers** - M. MILLER, L. James-Davis and L. Milanesi, General Mills Restaurants, Inc., Orlando, FL
- 11:05 **Development of Bacteriocin-Based Packaging to Reduce Pathogenic Organisms in Fresh Poultry** - N. NATRAJAN and B. Sheldon, North Carolina State University, Raleigh, NC

MONDAY AFTERNOON, AUGUST 1

Microbiology vs. Epidemiology: Complementary or Incompatible Disciplines Symposium

Technical Session — Antimicrobials

- 8:30 **Decontamination of Beef Carcass Tissue with Bacteriocins Using a Model Carcass Washer** - C. CUTTER and G. Siragusa, U. S. Department of Agriculture, ARS, Clay Center, NE
- 8:45 **Evaluation of Methods to Deliver Bacteriocins during Wiener Manufacturing for Controlling *Listeria monocytogenes*** - A. DEGNAN and J. Luchansky, Food Research Institute, Madison, WI
- 9:00 **Chemical and Microbiological Qualities of Restructured Vacuum-Packaged Lamb Roasts Containing Sodium or Potassium Lactates** - D. FUNG, I. Si-Sheddy and C. Kastner, Kansas State University, Manhattan, KS
- 1:30 **Worldwide Surveillance of Foodborne Disease Based on Epidemiological and Microbiological Findings** - E. TODD, Health Protection Branch, Ottawa, Ontario, Canada
- 2:00 **Microbiology Versus Epidemiology: Who Do You Trust?** - D. SIMPSON, State Epidemiologist, Austin, TX
- 2:30 **Human and Armadillo Leprosy in the Southern United States** - M. HUGH-JONES, Louisiana State University, Baton Rouge, LA
- 3:20 **A Microbiological Paradox: Viable but Non-Culturable Bacteria** - R. COLWELL, Maryland Biotechnology Institute, College Park, MD
- 3:50 **Hazard Analysis: The Link between Epidemiology and Microbiology** - F. BRYAN, Food Safety Consultation and Training, Lithonia, GA

4:20 **Microbiology, Chemistry and Epidemiology: the Setting of Food Safety Policy** - S. MILLER, Health Sciences Center, San Antonio, TX

4:50 **Panel of the Speakers: Questions and Conclusions**

Technical Session — General Food Microbiology

1:30 **Incidence of *Arcobacter* spp. in Ground Pork** - C. COLLINS, I. Wesley and E. Murano, Iowa State University, Ames, IA

1:45 **Commercial Field Trials Demonstrating Salmonellae Reduction in Broilers Using a Mucosal Competitive Exclusion Treatment** - N. COX, J. Bailey and N. Stern, U. S. Department of Agriculture, ARS, Athens, GA

2:00 **The Attachment of Viable and Nonviable *Salmonella typhimurium* to Poultry Skin** - K. KIM, H. Lillard, J. Frank and S. Craven, University of Georgia, Athens, GA

2:15 **Effect of Irradiation of Survival of *Salmonella enteritidis* in Whole Eggs and Liquid Eggs** - L. SERRANO and E. Murano, Iowa State University, Ames, IA

2:30 **Microbiological Evaluation of Reprocessed Broiler Carcasses** - C. POWELL, G. Blank and R. Gallop, University of Manitoba, Winnipeg, Manitoba, Canada

2:45 **Cider Composition versus Heat Resistance of *Escherichia coli* O157:H7** - D. SPLITSTOESSER, J. Churey and M. McLellan, Cornell University, Geneva, NY

3:20 ***Staphylococcus intermedius*: Etiologic Association with Foodborne Intoxication from Butter Blend and Margarine** - R. BENNET, F. Khambaty and D. Shah, Food and Drug Administration, Washington, DC

3:35 **Irradiation Inactivation of *Listeria monocytogenes* and *Staphylococcus aureus* in Ground Beef as Affected by Fat Content and Temperature** - J. MONK, M. Clavero, L. Beuchat, M. Doyle and R. Brackett, University of Georgia, Griffin, GA

3:50 **Trichinosis Outbreak Associated with Smoked Wild Boar Meat, Ontario, Canada** - B. MARSHALL and S. Isaacs, Wellington-Dufferin-Guelph Health Unit, Guelph, Ontario, Canada

4:05 **Enterobacteriaceae from the Chicken Intestine that use Phosphatidylserine for Growth and Inhibit *Salmonella typhimurium*** - S. CRAVEN, U. S. Department of Agriculture, ARS, Athens, GA

4:20 **Characterization of Pyocyanine Produced by *Pseudomonas Aeruginosa*** - N. NABBUT, American University of Beirut Medical Center, Beirut, Lebanon

4:35 **Effects of Ionizing Radiation and Anaerobic Refrigerated Storage on Indigenous Microflora, *Salmonella* and *Clostridium botulinum* types A and B in Mechanically-deboned Chicken** - D. THAYER, G. Boyd and C. Huhtanen, Eastern Regional Research Center, Philadelphia, PA

4:50 **Efficacy of Cultured Whey of Antagonistic Microorganisms to Inhibit Psychrotrophic Pathogens in Refrigerated, Cooked Beef and Poultry** - Y. HAO, R. Brackett and M. Doyle, University of Georgia, Griffin, GA

Stainless Steels for Dairy and Food Equipment Symposium

1:30 **Utilizing Stainless Steels in the Food and Dairy Industries** - P. ELLIOTT, P.E. Corrosion and Materials Consultancy, Inc., Colts Neck, NJ

2:00 **Fabrication and Application of Stainless Steel Equipment for Sanitary Applications** - V. MILLS, Evergreen Packaging Equipment, Cedar Rapids, IA

2:30 **Orbital Welding of Stainless Steel Tubing for Food and Dairy Applications** - B. HENON, ARC Machines, Inc., Pacioma, CA

3:20 **The Effect of Surface Finish on the Behavior of Stainless Steel in Food and Dairy Science** - A. TUTHILL, Tuthill Associates, Inc., Blacksburg, VA

3:50 **Hygiene and Other Health and Safety Aspects of Stainless Steel in Food-Handling and Processing Plants** - J. LILLY, Nickel Development Institute, Toronto, Ontario, Canada

**Meat Quality and Safety:
Effect of Production and Processing
on the Microbial Quality of Meat Symposium
Sponsored by the Ontario Food Protection Assn.**

1:30 **Innovations in Australian Meat Processing Practices and Slaughter Operations: Their Impact on Microbial Status** - B. SHAY, CSIRO Australia, Meat Safety Laboratory, Brisbane, Queensland, Australia

2:00 **Verocytotoxigenic *Escherichia coli*: The Dairy Farm as a Model for Animal - Human Transmission** - R. CLARKE, Agriculture and Agri-Food Canada, Guelph, Ontario, Canada

2:30 **FSIS Nationwide Beef Microbiological Baseline Data Collection Program: Survey of Steers and Heifers** - A.M. McNAMARA, U. S. Department of Agriculture, FSIS, Washington, DC

- 3:20 **Canadian Meat Industry Perspectives on How to Address Foodborne Illness** - G. SUNDEEN, Canadian Meat Council, Islington, Ontario, Canada
- 3:50 **HACCP from Pen to Plate** - R. USBORNE, Caravelle Foods, Mississauga, Canada

Monday Poster Session

- **Summary of Standard Plate Counts of Plant Obtained Chocolate Milk and Drinks After 14 Days at 7.2°C (45°F)** - S. BARNARD and R. Bicher, The Pennsylvania State University, University Park, PA
- **Rapid Colorimetric Method for Estimation of Rancidity in Dairy Products** - T. BAUER and P. Vasavada, University of Wisconsin, River Falls, WI
- **Survival of *Brucella abortus* in the Mexican White Soft Cheese** - M. DÍAZ, Centro De Investigacion En Alimentacion y Desarrolla, Sonora, Mexico
- **S-Value and Epifluorescence Determination of Bacterial Attachment on the Cleaning Brush of an Automatic Milking System*** - C. LIU and D. Westhoff, University of Maryland, College Park, MD
- **Effect of Temperature and Cell Concentration on Radiosensitivity of *Listeria monocytogenes*** - L. ANDREWS, D. Marshall and R. Grodner, Louisiana State University, Baton Rouge, LA
- **Rapid Detection of Enterotoxigenic *Clostridium perfringens* in Beef Using an Alkaline Phosphatase Microcolony Technique** - L. BAEZ and V. Juneja, U. S. Department of Agriculture, ARS, Philadelphia, PA
- **Development of Two Simple Methods for the Recovery of *Salmonella* from Food for Detection by PCR** - W. BARBOUR and H. Zaneosky, DuPont Co., Wilmington, DE
- **Comparative Study for Detection of *Listeria monocytogenes* in Foods by a Colorimetric DNA Method and Conventional Culture Methods** - G. DURBIN, K. Keough and G. Reynolds, GENE-TRAK Systems Corp., Framingham, MA
- **Rapid Assay System for the Detection of Beta-lactam Residues in Milk** - S. FAUST, S. Clark and L. Chaney, IDEXX Laboratories, Westbrook, ME
- **Reduction of Hydroxymethylfurfural of Honey Exposed to Different Sources of Radiation** - J. FARIA, Campinas State University, Campinas, Brazil
- **Estimation of Coliform Counts using the BacT/Alert Microbial Detection System** - S. JEFFREY, K. Read and B. Robison, Organon Teknika Corp., Durham, NC
- **Enrichment Procedures Affecting the Sensitivity of the EHEC-Tek™ ELISA System** - S. JEFFREY, R. Durham, B. Robison, Organon Teknika Corp., Durham, NC
- **Efficacy of the Microcolony Immunoblot Technique to Detect Heat-Injured *Listeria monocytogenes*** - J. PATEL and L. Beuchat, University of Georgia, Griffin, GA
- **Use of the BacT/Alert® Microbial Detection System to Monitor Sterility of Aseptically Processed Pudding** - B. ROBISON, Organon Teknika Corp., Durham, NC
- **The Development of a PCR Based Assay for the Detection of *Salmonella*** - G. TICE, M. Jensen, R. Jackson and J. Noxzek, DuPont Co., Wilmington, DE
- **Identifying and Typing *Listeria* Species with Patterns of Eco R1 Fragments Containing Ribosomal RNA Operon Sequences** - J. WEBSTER, E. Cole, J. Bruce, C. Iem and R. Hubner, DuPont Co., Wilmington, DE
- **A 43 hour Test for Detecting *Listeria* in Foods Using the Unipath *Listeria* Clearview Immunoassay** - R. HOLBROOK, T. Briggs, J. Anderson, J. Blades and P. Sheard, Unilever Research, Bedfordshire, U.K.
- **The Rapid Clearview™ *Listeria* Immunoassay for Detection of *Listeria* Species** - S. PARRY, T. Briggs, J. Blades, M. Gani and J. Piron, Unilever Research, Bedfordshire, U.K.
- **Optimization of Commercial Sterility Testing** - M. ROBART, J. David, S. Alles, T. Weaver, S. Chang and T. VanArman, Gerber Products Co., Fremont, MI
- **Cold Temperature Stress Response of Psychrotrophic *Bacillus cereus*** - E. BERRY and P. Foegeding, North Carolina State University, Raleigh, NC
- **Model for the Non-Thermal Inactivation of *Listeria monocytogenes* in a Reduced Oxygen Environment** - R. BUCHANAN and M. Golden, U. S. Department of Agriculture, ARS, Philadelphia, PA
- **The Synergistic Effect of Sodium Acetate or Sodium Propionate Used in Combination with EDTA and Ascorbic Acid on the Inactivation of *Listeria monocytogenes*** - M. GOLDEN, R. Buchanan and R. Whiting, U. S. Department of Agriculture, ARS, Philadelphia, PA
- ***Aeromonas hydrophila* and Psychrotroph Population of Case- and Pond-Raised Channel Catfish** - Y. HUANG, C. Huang and G. Burtle, University of Georgia, Athens, GA
- **The Use of Response Surface Methodology to Model Non-Linear Survival Curves and to Predict the Effects of Temperature, pH and Sodium Chloride on the Heat Resistance of *Listeria monocytogenes* Scott A** - R. LINTON, W. Carter, C. Gennings and M. Pierson, Virginia Tech University, Blacksburg, VA
- **Validation of Predictive Mathematical Models to Demonstrate Applicability to Foods** - I. WALLS, V. Scott and D. Bernard, National Food Processors Assn., Washington, DC
- **The Economics of Federal HACCP Regulations** - D. ZORN, Food and Drug Administration, Washington, DC
- **An Expert System for HACCP Implementation** - F. BARRON and J. Acton, Clemson University, Clemson, SC
- **Influence of Temperature on Hemorrhagic *Escherichia coli*: Verotoxin Production and Minimum Temperature of Growth** - S. PALUMBO, F. Schultz and A. Williams, U. S. Department of Agriculture, Philadelphia, PA

TUESDAY MORNING, AUGUST 2

**Applications For Predictive
Microbiology Symposium**
*Sponsored by the ILSI North America Technical
Committee on Food Microbiology*

- 8:30 **Overview — Risk Assessment and Predictive Microbiology** - R. BUCHANAN, U. S. Department of Agriculture, Philadelphia, PA
- 9:00 **Modeling Applications** - T. McMEEKIN and T. Ross,, University of Tasmania, Hobart, Tasmania, Australia
- 9:30 **Food Micromodel Update - UK and European Perspectives** - T. ROBERTS, Institute of Food Research, Reading, U.K.
- 10:20 **Model Validation (and Confidence in Models) — an Industry Perspective** - M. COLE, Unilever Research, Bedford, U.K.
- 10:50 **Cold Storage Temperature Fluctuations and Predicting Microbial Growth** - C. GILL, Agrifood and Agriculture Canada, Lacombe, Alberta, Canada
- 11:20 **Predictive Microbiology and HACCP** - P. ELLIOTT, Campbell Soup Company, Camden, NJ

**Reduction of Foodborne Pathogens
on Poultry Symposium**

- 8:30 **Salmonellae Importance and Detection in Poultry Feeds** - A. WALDROUP, University of Arkansas, Fayetteville, AR
- 9:00 **Control of Salmonellae During Poultry Production** - J. BAILEY, U. S. Department of Agriculture, ARS, Athens, GA
- 9:30 **The Application of Process Modifications, Chemical Treatments, and Biopeptides to Inhibit Foodborne Pathogens Associated with Poultry Products** - B. SHELDON, North Carolina State University, Raleigh, NC
- 10:20 **Reduction of Foodborne Pathogens on Poultry by Treatment with Ionizing Radiation** - D. THAYER, U.S. Department of Agriculture, ARS, Philadelphia, PA
- 10:50 **Development of a Comprehensive Total Quality Assurance Program for use in Fully Integrated Poultry Companies** - M. ROBACH, Continental Grain, Duluth, GA
- 11:20 **Foodservice Industry Perspective on Pathogen Reduction in Poultry** - R. HARRINGTON, National Restaurant Assn., Washington, DC

Pesticides in the Food Industry Symposium

- 8:30 **The Impact of Sanitation on Pest Control in the Food Establishments** - R. GRAVANI, Cornell University, Ithaca, NY
- 9:00 **IPM — Trends in Pesticide Use and Indoor Environmental Quality** - A. FRISHMAN, AMF Pest Management Services, Inc., Farmingdale, NY
- 10:20 **Rodent Control for Food Processing** - E. MARSHALL, Lipha Tech, Milwaukee, WI
- 10:50 **Future of Pesticides for Use in Food Handling Establishments** - J. TUCKER, Urban Entomologist, Houston, TX

**Meat Quality and Safety:
Concerns and Solutions throughout
Distribution Systems Symposium**

- 8:30 **Update on Epidemiology of Food Poisoning Outbreaks Caused by Meat Products** - P. SPARLING, Centers for Disease Control and Prevention, Atlanta, GA
- 9:00 **Microbiological Controls for Safety and Quality of Meats During Manufacture** - J. MARSDEN, The American Meat Institute, Washington, DC
- 9:30 **Status of Consumer Education Programs Regarding the Safety of Meat Products** - S. CONLEY, U. S. Department of Agriculture, FSIS, Washington, DC
- 10:20 **The Challenge of HACCP Implementation in Fast Food Operations** - R. HARRINGTON, National Restaurant Assn., Washington, DC
- 10:50 **Safety and Quality of Meat Products at Retail and Deli Operations** - J. FARQUHAR, The Food Marketing Institute, Washington, DC

TUESDAY AFTERNOON, AUGUST 2

**General Session —
The New FDA Model Food Code:
How Will We Implement It?**

- 1:30 **The New FDA Food Code** - J. KVENBERG, Food and Drug Administration, Washington, DC
- 1:45 **The Restaurant Industry Perspective** - R. HARRINGTON, National Restaurant Assn., Washington, DC
- 2:00 **The Food Store Perspective** - J. FARQUHAR, Food Marketing Institute, Washington, DC
- 2:15 **The Vending Machine Industries Perspective** - L. EILS, National Automatic Merchandising Association, Chicago, IL

- 2:30 **The Agricultural Agencies Perspective** - E. HEFFRON, Michigan Department of Agriculture, Lansing, MI
- 2:45 **The Health Agencies Perspective** - D. SOWARDS, Texas Department of Health, Austin, TX

IAMFES Annual Business Meeting

- 3:15 **Welcome and Introduction** - D. CLINGMAN, President-Elect
- 3:30 **Report from the President** - H. BENGSCHE
- 3:45 **Business Meeting** - H. BENGSCHE, Presiding
- Moment of Silence in Remembrance of Departed Association Members
 - Minutes of Previous Business Meeting
 - Report of Executive Manager
 - Affiliate Council Report
 - Journal Management Committee Report
 - Old Business
 - New Business
 - Presentation of Resolutions - M. DOYLE, Past President

Tuesday Poster Session

- **Purification and Characterization of a Bacteriocin Produced by *Carnobacterium piscicola* LK5** - L. BAGI and R. Buchanan, U. S. Department of Agriculture, ARS, Philadelphia, PA
- **Biofilm formation by *Escherichia coli* O157:H7 on Stainless Steel Surface: Effect of Chemical Agents** - R. DEWANTI and A. Wong, Food Research Institute, Madison, WI
- **Cooling Rate and Outgrowth of *Clostridium perfringens* Spores in Cooked Ground Beef** - V. JUNEJA, O. Snyder and B. Eblen, U. S. Department of Agriculture, ARS, Philadelphia, PA
- **Isolation and Characterization of Enterocin EL1 A Bacteriocin Produced by a Strain of *Enterococcus faecium*** - W. LYON, E. Murano and D. Olson, Iowa State University, Ames, IA
- **Effect of Temperature, Salt and pH on Growth Inhibition of *Listeria monocytogenes* by Sodium Polyphosphate** - O. SCULLEN and L. Zaika, U. S. Department of Agriculture, ARS, Philadelphia, PA
- **Evaluation of Different Phosphates to Control Microbial Growth in Meat Products** - S. SUMNER, L. Flores, D. Peters and R. Mandigo, University of Nebraska-Lincoln, Lincoln, NE
- **Inhibitory Activity of Caffeic Acid Against *Clostridium botulinum* Spores** - A. WILLIAMS, B. Bowles, and A. Miller, U. S. Department of Agriculture, ARS, Philadelphia, PA
- **Antimicrobial Effect of Sodium Lactate, Trisodium Phosphate, and Sodium Glutamate Monohydrate Pre-Treatments in Combination with Organic Acids on *Escherichia coli* O157:H7** - P. WIXOM and J. Dickson, Iowa State University, Ames, IA
- **Microbiological Shelf-Life Stability of Textured**

Supro™ Granules - V. COLLETT, Ralston Purina Co., St. Louis, MO

- **Shelf-life and Microbial Ecology of Precooked Poultry Stored Under Modified Atmosphere at 4°C** - R. BARAKAT and L. Harris, University of Guelph, Guelph, Ontario, Canada
- **Effect of Water Activity and Humectant Identity on the Growth Kinetics of *Escherichia coli* O157:H7** - R. BUCHANAN and L. Bagi, U. S. Department of Agriculture, ARS, Philadelphia, PA
- **Resistance of Acid Adapted Salmonellae to Organic Acid Rinses on Beef** - J. DICKSON and M. Kunduru, Iowa State University, Ames, IA
- **Survival of *E. coli* O157:H7 in Refrigerated and Frozen Low Fat Ground Beef and Thermal Inactivation by Microwave Energy** - L. FLORES, S. Sumner and L. Bullerman, University of Nebraska, Lincoln, NE
- **The Fate of *Listeria monocytogenes* and *Clostridium botulinum* in Minimally-Processed Packaged Vegetables** - J. FARBER, Y. Cai, C. Addison, B. Blanchfield, S. Wang and K. Dodds
- **Use of Time-Temperature Indicator to Monitor the Shelf-Life of Packaged Fresh Catfish** - L. HE and Y. Huang, University of Georgia, Athens, GA
- **Recovery of *Arcobacter* from Broiler Carcasses** - H. LILLARD and N. Stern, U. S. Department of Agriculture, ARS, Athens, GA
- **Monoclonal Antibody for Rapid Detection of *Clostridium botulinum* Toxin Type B** - R. CRAWFORD, J. Ferreira, S. McCay and H. Hamdy, Food and Drug Administration, Atlanta, GA
- **Susceptibility of *Listeria* sp. to Cell Bound Pediocin AcH in BHI Broth, Turkey Frank Slurries, and on Chicken Breast Meat** - J. FERGUSON, A. Bhunia and M. Johnson, University of Arkansas, Fayetteville, AR
- **The Fate of *Listeria monocytogenes* during the Manufacture of Manchego Cheese with Bacteriocin-producing Lactic Acid Bacteria and Commercial Lactic Starters** - E. GARCÍA, J. Rodríguez, P. Gaya, M. Medina and M. Nunez, Tecnología de Alimentos, Madrid, Spain
- **Microbial Changes of Osmotically Dehydrated Green Beans Coupled with Modified Atmosphere Packaging Stored at 10°C** - W. TAN, D. Grinstead, J. Mount and F. Draughon, University of Tennessee, Knoxville, TN
- **Mold Content of Stored Popcorn** - L. BULLERMAN and S. Katta, University of Nebraska, Lincoln, NE
- **Effect of Dry Milling on *Fusarium* Counts and Fumonisin in Corn** - A. CAGAMPANG and L. Bullerman, University of Nebraska, Lincoln, NE
- **Isolation of the Zearalenone-producing Strains from Agricultural Products in Southern Korea** - D. CHUNG, S. Kim and S. Kim, Gyeongsang National University, Gyeongnam, Korea
- **Inhibition of Phosphate on Mold Growth and Mycotoxin Production (T-2 Toxin, Zearalenone)** - D. CHUNG, I. Kim and S. Chung, Gyeongsang National University, Gyeongnam, Korea
- **Immunolocalization of Aflatoxin B1 in Liver of Chick Embryo Intoxicated with Aflatoxin B1** - Y. KO, S. Shu, J. Che and D. Chung, Hanyang University, Seoul, Korea

- **The Mycoflora and Mycotoxin-Producing Potential of Fungi from Foods in Burundi** - C. MUNIMBAZI and L. Bullerman, University of Nebraska, Lincoln, NE
- **Application of Immunohistochemical Technique to Visualize Zearalenone Formation of *Fusarium greaminearum*** - J. KANG, S. Kang and D. Chung, Jinju Junior College, Gyeongnam, Korea
- **Use of TECRA® Unique™ for the Detection of *Salmonella* in a Range of Food Products within 22 hours** - D. KERR, M. Ash, D. Hughes and C. Fitzgerald, TECRA Diagnostics, Roseville, Australia
- **A Predictive Model with Improved Statistical Analysis of the Interactive Effects of Factors Affecting the Growth of *Staphylococcus aureus* 196E** - J. EIFERT, C. Gennings, W. Carter and C. Hackney, Virginia Tech, Blacksburg, VA
- **Automated Detection of Foodborne Pathogens Using the TECRA® OPUS® System** - M. ASH, D. Chee and U. Gasanov, TECRA Diagnostics, Roseville, Australia
- **Agglutination Behavior of Lactic Starter Cultures - S. IBRAHIM and A. Nabulsi, University of Jordan, Jordan**

WEDNESDAY MORNING, AUGUST 3

A Symposium on Risk Management
Sponsored by the Grocery Manufacturer's of America

RISK ASSESSMENT The Risk Analysis Approach

- 8:30 **Risk Analysis and Management Defined**
- 9:00 **Risk Analysis and Foodborne Illness**
- Issues in the Assessment of Food Safety Risks**
- 9:30 **Infectious Dose and Susceptible Populations**
- 10:20 **The Role of Epidemiology in Estimating Risk and Risk Exposure**
- 10:50 **Acceptable Risk and the Risk/Benefit Equation**
- 11:20 **The "Cost" of Foodborne Disease**

Safety and Quality-Related Research - Dairy Foods and Research Centers Symposium

- 8:30 **Introduction** - J. BISHOP, Wisconsin Center for Dairy Research, Madison, WI
- 8:40 **A Comparison of Thermal Death Kinetics from Continuous Flow and Batch Leading Systems** - P. FOEGEDING, Southeast Dairy Foods Research Center, Raleigh, NC

- 9:25 **Shelf-Life Extension of Modified Atmosphere Packaged Cottage Cheese** - J. HOTCHKISS and J. Chen, Cornell University, Ithaca, NY
- 10:20 **Bacteria of Concern in Extended Shelf-Life Milk** - B. WEIMER, M. Blake, D. McMahon and P. Savello, Western Dairy Foods Research Center, Utah State University, Logan, UT
- 11:05 **Knowing and Controlling Cheese Pathogens** - J. LUCHANSKY, Wisconsin Center For Dairy Research, Madison, WI
- 11:50 **Dairy Product Safety System (HACCP) Designed Specifically for the Industry** - J. BISHOP and R. Byrne, Wisconsin Center for Dairy Research, Madison, WI

Natural Antimicrobials and Inhibitors for Food Applications *Sponsored by the ILSI North American Technical Committee on Food Microbiology*

- 8:30 **Bacteriocins for *Listeria* Control** - P. MURIANA, Purdue University, West Lafayette, IN
- 9:00 **Potential for Use of Bacteriocin-producing Lactic Acid Bacteria in the Preservation of Meats** - L. MCMULLEN and M. Stiles, University of Saskatchewan, Saskatoon, Saskatchewan, Canada
- 9:30 **Efficacy of Naturally Occurring Food Flavors as Inhibitors of Foodborne Pathogens** - B. BOWLES and A. Miller, U. S. Department of Agriculture, Philadelphia, PA
- 10:20 **Regulatory Perspectives on the Use of Bacteriocins in Foods** - F. FIELDS, U.S. Food and Drug Administration, Washington, DC
- 10:50 **USDA's Regulatory Perspective on the Use of Bacteriocins in Foods** - R. POST, U. S. Department of Agriculture, FSIS, Washington, DC
- 11:20 **Industry Perspective on the Use of Natural Antimicrobials and Inhibitors for Food Applications** - G. GOULD, formerly Unilever Research Laboratory, Bedford, U.K.

The Quality and Safety of Aquacultured Fishery Products Symposium

- 8:30 **Introduction of Aquaculture** - R. MARTIN, National Fisheries Institute, Fairfax, VA
- 8:50 **Chemical/Physiological Perspectives** - G. FINNE, Silliker Laboratories of Texas, College Station, TX
- 9:10 **Microbiological Perspective - Fin-Fish** - D. WESTHOFF, University of Maryland, College Park, MD

- 9:30 **Microbiological Perspective - Crustaceans** - R. NICKELSON, Silliker Laboratories, Homewood, IL
- 9:50 **Microbiological Perspective - Molluscan** - G. RODRICK, University of Florida, Gainesville, FL
- 10:30 **Residues in Aquacultured Products** - I. HIGUERA, Consultores En Alimentos, Sonora, Mexico
- 10:50 **Value-Added Aquaculture Products** - Y. HUANG, University of Georgia, Athens, GA
- 11:10 **HACCP in Aquaculture** - E. GARRETT, National Marine Fisheries Service, Pascagula, MS

WEDNESDAY AFTERNOON, AUGUST 3

A Symposium on Risk Management (cont.)
Sponsored by the Grocery Manufacturer's of America

RISK MANAGEMENT Control Practices and Their Impact

- 1:30 **Managing Risks from the Industry Perspective**
- 2:00 **Economic Impact of Control Practices**
- Education and Communication of Risks**
- 2:30 **Education and the Public's Understanding of Risk - the Role of Industry, Government and Academia**

- 3:00 **Communicating Food Safety Risks to the Public**

Current Regulatory Approaches

- 3:50 **Short Presentation and Roundtable**

Dairy Symposium

Topics to be announced

European Food Processing Equipment Hygiene Standards Symposium

- 1:30 **Food Industry Perspective** - M. MOSTERT, Unilever Research Laboratorium, Vlaardingen, The Netherlands
- 2:00 **Equipment Manufacturers Perspective** - P. SKUDDER, APV Baker Ltd., Crawley, U.K.
- 2:30 **CEN and EHEDG Perspective** - D. TIMPERLY, Campden Food and Drink Research Association, Chipping Campden, U.K.
- 3:20 **The Government Perspective** - B. MITCHELL, Ministry of Agriculture, Fisheries & Food, London, U.K.
- 3:50 **Test Methods and Their Development** - J. HOLAH, Campden Food and Drink Research Association, Chipping Campden, U.K.
- 4:20 **The 3-A Viewpoint on European Standards** - T. GILMORE, Dairy and Food Industries Supply Association, Rockville, MD
- 4:50 **The Challenge - Harmonization of Hygienic Design Criteria** - R. MALLER, Thomas J. Lipton Co., Englewood Cliffs, NJ

Current Food Safety and Related Health Issues Symposium

- 1:30 **The Impact of International Free Trade on Food Safety Standards** - K. TING, U. S. Department of Agriculture, Washington, DC
- 2:00 **International Food Safety and Quality Standards** - C. CARNEVALE, Food and Drug Administration, Washington, DC
- 2:30 **Does International Fair Trade Mean Compromised Food Safety Standards? - Impact on Seafood Safety** - C. HACKNEY, Virginia Polytechnic Institute and State University, Blacksburg, VA
- 3:20 **Poultry Safety After NAFTA** - J. MARCY, University of Arkansas, Fayetteville, AR
- 3:50 **Hantavirus Pulmonary Syndrome (HPS) - An Emerging Public Health Threat** - R. GRINNEL, United States Public Health Service, Albuquerque, NM
- 4:20 **Use of Foodborne Disease Data for HACCP Risk Assessment: A New Approach in the State of New York** - J. GUZEWICH, New York State Department of Health, Albany, NY

81st IAMFES Annual Meeting

Spouse/Companion Tours and Special Events

BIENVENIDOS

Sunday, July 31 — 9:00 a.m. - It's up to you

Cost: \$25 (\$30 on-site) Lunch on your own

Welcome to San Antonio . . . one of America's four unique cities . . . where the east meets the west, where the romance and tradition of old Spain meet the sound and energy of a high tech society, where the river dances through the heart of the city and the fiesta never ends. A chartered transit bus will be your magic carpet and Convention Coordinators guide will be your key as you are met at the Hyatt Regency Riverwalk at 9:00 o'clock in the morning for this introductory tour.

First, we'll drive through Hemisfair Plaza to the Institute of Texan Cultures. This "hands-on" museum is for the interpretation and assimilation of Texas history and folk culture and tells about the 26 ethnic groups who were the pioneers of this great state.

We'll drive through the King William Historic District, which was one of San Antonio's early residential neighborhoods. Built at the turn of the century by German "merchant princes," the area has been "re-awakened" and is once again a gracious and friendly old-fashioned neighborhood.

On to the new IMAX Theater, featuring "Alamo - The Price of Freedom," located in Rivercenter Mall. The movie is a stunning experience, shown on a six-story screen with a six-track sound system that lets you "feel" the action. "Alamo - The Price of Freedom" is the most historically accurate depiction of the famous battle in existence. The 45-minute movie "puts you in the middle of the battle of the Alamo."

Walk next door to the "Cradle of Texas Liberty," the Alamo, tucked in among downtown hotels, office buildings and crowded streets. The Alamo's roughly pitted, sandstone facade belies its quiet, churchlike limestone interior where even the most casual visitor experiences an awe while viewing the names of the Alamo heroes inscribed in bronze on the walls.

Continue to San Jose, Queen of the Texas Missions, for a tour of the Indian compound in this extensively restored mission. You will see Indian living quarters, Spanish officer's quarters, the convent, the beautiful church with its elaborately carved entrance, and the famous Rosa's Window.

There will be time for lunch on your own, shopping and browsing in El Mercado where the shops are loaded with curios from the Southwest. Items include: Dresses, shirts, pinatas, dolls, jewelry, straw hats, leather goods, and many other "goodies." Our guide will tell us how to ride the trolley back to the hotel for ten cents. Return to the Hyatt at your leisure.

LBJ RANCH & FREDERICKSBURG

Monday, August 1 — 8:45 a.m. - 4:30 p.m.

Cost: \$25 (\$30 on-site) Lunch on your own

The beautiful Texas Hill Country has never been so well known as when Lyndon B. Johnson was President of the United States. His barbecues under the oak and pecan trees of his ranch were seen by all in those days. So that you can taste a little of "Pedernales country" for yourselves, we have arranged a day in this legendary part of Texas. A chartered motor coach with a Convention Coordinators guide on board will meet you at the Hyatt Regency Riverwalk at 8:45 in the morning for the drive to the LBJ Ranch. There will be a 90 minute educational tour of this National Historic Park including the Junction School, the Johnson birthplace and cemetery, the LBJ ranchlands with its registered Hereford cattle, the Show Barn, and the exterior of the Texas White House where Mrs. Johnson still resides.

On to the historic Fredericksburg for lunch on your own, shopping and browsing on Main Street in this quaint German town, or visiting the Admiral Chester Nimitz Museum of the War of the South Pacific (a Recorded Texas Historic Landmark) with the Japanese Peace Garden.

See the historic "Sunday Houses", where farmers and ranchers stayed on weekends. Return to the hotel at 4:30 in the afternoon.

MIL COLORES

Tuesday, August 2 — 9:00 a.m. - 3:00 p.m.

Cost: \$25 (\$30 on-site) Lunch on your own

Capture the spirit and the many colors of San Antonio as you depart the Hyatt Regency Riverwalk at 9:00 in the morning. We'll follow the Mission Trail, pausing at Mission Concepcion, and San Jose, Queen of the Texas Missions. We'll proceed to historic Fort Sam Houston, established in 1876, and now Headquarters for the Fifth Army. We'll see the enormous parade field, the Quadrangle where Chief Geronimo was once held captive, and General's Row where many famous military personalities have resided.

On to the San Antonio Botanical Center, 38-acres representing, in miniature, the diverse Texas landscape - from the wild flowers of the Texas Hill Country to the formal rose gardens of East Texas. A Biblical Garden, Children's Garden, and a Fragrance Garden are also featured. A highlight of the center is the new underground conservatory, with rare and exotic plants and flowers.

There will be time for lunch on your own and shopping at Los Patios, an oasis on the banks of Salado Creek. Shop in the boutiques located on the park-like grounds, including: The Flower Forest, Marisol Boutique, Tejas Gifts, Tienda, Big Sky Clothing Company, The Gallery, Vega's Jewelry and Lo Singular. Enjoy lunch at the Gazebo, the Hacienda or the Brazier Restaurants.

The McNay Art Museum is a "treasure house of art," religiously dedicated to discriminating taste. Housed in a magnificent Mediterranean mansion built around a lush courtyard and reflecting pool, you'll view works by Van Gogh, Gauguin, Matisse, Picasso, Renoir - to name a few. The McNay is rated one of the best small museums in the country.

We'll pause on Alpine Drive which affords a beautiful view of the city skyline and the Japanese Sunken Garden below. Arrive back at the Hyatt Regency Riverwalk at 3:00 in the afternoon.

SHOPPER'S PARADISE

Wednesday, August 3 — 9:00 a.m. - 4:00 p.m.

Cost: \$20 (\$25 on-site) Lunch on your own

"Shop till you drop!" Today you will see some of the most interesting shops in the area as you depart the Hyatt Regency Riverwalk at 9:00 a.m. in a chartered motorcoach to search for bargains galore! First, we'll journey to San Marcos, Texas, to a new and exciting outlet mall, one of the nation's largest. Clothing, accessories, housewares - in such shops as Adolpho, Perry Ellis, Coach, Mikasa, Eddie Bauer, Etienne Aigner, Nike, Sara Coventry, Fitz & Floyd - and much, much more. On to the Tanger Factory Outlet Center where you'll find items for the entire family. Buy directly from 31 upscale designers and manufacturers outlet stores and save 30 to 70% off retail prices.

Then to the quaint German town of New Braunfels, Texas where "Life is Beautiful." The Langston House, a symmetrical Greek Revival style house, was built in 1854 by Franz Moreau. The log and "fachwerk" construction was common in those days. The house was later occupied by the Gross family, the Frieze Family and then the Langston Family.

We'll continue to the nearby town of Gruene, founded in 1872 by Henry D. Gruene from Germany, who built a home and cotton gin and the town grew. It was known for its dance hall and saloon built in the 1880's which is the oldest dance hall in Texas still in existence. Death came to Henry Gruene in 1920 and this also marked the end of the development of the town. In 1925 the boll weevil and the depression struck and it became a ghost town. The untouched town was purchased in 1974 and businesses were once again established in the old buildings. We'll enjoy stepping back in time as we visit the many shops in town including: Texas Homegrown, The Bush Whacker, Nature's Alliance, The Gruene Antique Company, The Back Porch, Buck Pottery and others. Guests can eat on their own at one of the three restaurants located in Gruene. Arrive back at the Hyatt Regency Hotel at 4:00 o'clock in the afternoon.

Monday Night Social Event

"A LITTLE BIT TEXAN"

August 1 — 6:00 - 10:00 p.m.

Cost: Adults \$35 (\$40 on-site)

Children \$20 (\$25 on-site)

Git your boots, jeans, western shirts and cowboy hats (no six-shooters, please) and head on out for a "little bit of Texas — The Rio Cibolo Ranch."

We'll board our Grey Line buses at 6:00 p.m. and head for the wild, wild east. A short ride later, we'll cross the Rio Cibolo River and pull into the ranch. A Texas style Barbeque dinner - beef brisket and chicken quarters, cole slaw, beans, relish tray, bread and butter and fruit cobbler — will await us.

Work up an appetite by learning or dancing the Texas National past-time — line dancing. A band and dance instructor will be there to show you how its done — the real way. Or there's the Rol-A-Roper, horse shoes, volleyball, basketball, cow-chip toss or wagon rides. Or just chat with your friends under a beautiful Texas sky — (it isn't really any bigger, it just seems like it!)

We'll mosey on back to the Hyatt Regency between 9:30-10:00 p.m.

Traditional IAMFES Gatherings

IVAN PARKIN LECTURESHIP

Sunday, July 31 — 7:00 p.m.

Followed by the Nachos and Margaritas Reception for the Opening of the Education Exhibits.

An opportunity to greet old friends, make new ones and view the excellent technical displays.

IAMFES ANNUAL AWARDS RECEPTION AND BANQUET

Wednesday, August 3

Reception: 6:00 p.m.

Banquet: 7:00 p.m.

Cost: \$30 (\$35 on-site)

Guest Room Commitment
GOOD UNTIL JUNE 29, 1994
Make Your Reservation Now

Please check accommodation requested:

- Single (1 person) Triple (3 persons)
 Double (2 persons) Quad (4 persons)

Bed type:

- King Bed
 2 Queen Beds

Special Requests _____

Please indicate here if you have a disability requiring special accommodations.
All room rates are subject to prevailing taxes.
Reservations must be received by hotel prior to arrival.

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SHARING WITH (Name) _____

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ZIP _____

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ARRIVAL DATE _____ (Check-In Time is after 3 p.m.) DEPARTURE DATE _____ (Check-out Time is 12 p.m.)

SPECIAL REQUESTS _____

After June 29, 1994 reservations will be accepted on a space availability basis only. Reservations will be held until 6:00 p.m. on the date of arrival, unless guaranteed by one night advance deposit, payable by certified check or a Major Credit Card.

CREDIT CARD # _____ CREDIT CARD _____

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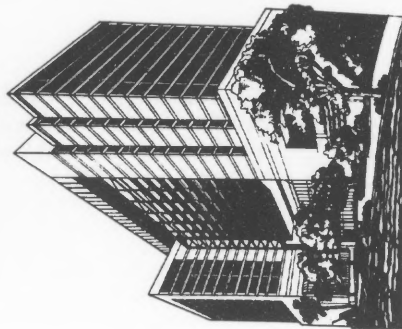
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81st Annual Meeting
July 31-August 3, 1994
Hyatt Regency Riverwalk
San Antonio, Texas



MAIL DIRECTLY TO:

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C/O RESERVATIONS
123 LOSOYA STREET
SAN ANTONIO, TX 78205

81st IAMFES Annual Meeting Registration Form

Hyatt Regency Riverwalk — San Antonio, Texas — July 31 - August 3, 1994
(Use photocopies for extra registrations)

FOR OFFICE USE
Date Rec'd. _____ First Initial _____ Last Name _____
Registration # _____

***Sign up to become a NEW member and take advantage of the member discount.**

First Name (will appear on badge) _____

(please print)

Last Name _____

Title _____

Employer _____

Mailing Address (Please specify: _____)

Home _____ Work _____

City _____

State _____

Zip _____

Fax # _____

Area Code & Telephone _____

Please check where applicable:

- IAMFES Member
- Non-Member
- Local Arrangements
- 30 Yr. Member
- 50 Yr. Member
- Past President
- Executive Board
- Speaker
- Honorary Life Member
- Exhibitor

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Registration

IAMFES Member (Banquet included) _____ Amount _____ Total Amount _____
 Non-Member (Banquet included) _____ \$150 (\$185 on-site)
 IAMFES Student Member _____ \$210 (\$245 on-site)
 IAMFES Member One Day (Circle: Mon/Tues/Wed) _____ \$ 20 (\$ 25 on-site)
 Non-Member One Day (Circle: Mon/Tues/Wed) _____ \$ 80 (\$100 on-site)
 Spouse/Companion (Name): _____ \$105 (\$130 on-site)
 Children (14 & Under), Name: _____ \$ 25 (\$ 25 on-site)
 FREE _____ FREE _____

*New Membership Fees:

Membership (Dairy, Food & Environmental Sanitation) _____ \$ 50
 Membership Plus (Dairy, Food & Env. Sanitation & Journal of Food Protection) _____ \$ 80
 *Student Membership Dairy, Food & Env. San. or Journal of Food Protection _____ \$ 25
 *Student Membership Plus (Dairy, Food & Environmental Sanitation & Journal of Food Protection) _____ \$ 40
 *Full-time student verification required.
 POSTAGE CHARGES: OUTSIDE THE U.S. - SURFACE RATE _____ \$ 22.50 per journal
 AIRMAIL _____ \$ 95.00 per journal

Other Fees: (Per Person)

Nachos and Margaritas Reception (Sun., 7/31) _____ Adult _____ # of tickets _____
 Rio Chobolo Ranch Evening (Mon., 8/1) _____ Child _____
 IAMFES Awards Banquet (Wed., 8/3) _____ \$ 30 (\$ 35 on-site)

Spouse/Companion Events:

Bienvenidos (Sun., 7/31) _____ \$ 25 (\$ 30 on-site)
 LBJ Ranch & Fredericksburg (Mon., 8/1) _____ \$ 25 (\$ 30 on-site)
 Mt. Colores (Tues., 8/2) _____ \$ 25 (\$ 30 on-site)
 Shopper's Paradise (Wed., 8/3) _____ \$ 20 (\$ 25 on-site)

Please indicate here if you have a disability requiring special accommodations.

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Registration Information

Send payment with registration to IAMFES, 6200 Aurora Avenue, Suite 200W, Des Moines, IA 50322. Make checks payable to IAMFES. Pre-registration must be post-marked by July 1, 1994. The pre-registration deadline will be strictly observed. For additional information contact Julie Helm at 1-800-369-6337.

Refund/Cancellation Policy

The IAMFES policy on meeting cancellation/refunds is as follows: "Registration fees, minus a \$25 processing fee, will be refunded for written cancellations post-marked at least two (2) weeks prior to the start of the meeting. No refunds will be made for cancellations made less than two (2) weeks prior to the start of the meeting; however, the registration may be transferred to colleague with written notification to IAMFES."

Exhibitor Information

An exhibition of products and consultant services will be at the Hyatt Regency Riverwalk. For more information on exhibiting at the conference, please contact Scott Wells at 1-800-369-6337.

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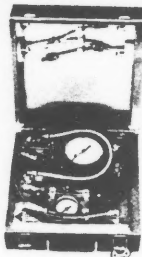
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Coming Events

1994

July

•8-15, Rapid Methods and Automation in Microbiology International Workshop XIV, to be held at Kansas State University, Manhattan, KS. For more information, contact Dr. Daniel Y. C. Fung at (913) 532-5654; FAX (913) 532-5681. A mini-symposium will occur on July 8th and 9th.

•27-August 3, 1994 Dairy Study Tour to Michigan, sponsored by the University of Minnesota, St. Paul, MN. Tour visits dairy farms and scenic sites in Michigan. For more information, contact Gerry Wagner at (612) 625-1978.

•27-28, American Frozen Food Institute (AFFI) Workplace Safety Conference, to be held at the Westin Hotel in Denver, CO. For more information, call Bob Garfield, AFFI's vice president of regulatory and technical affairs, at (703) 821-0770.

•31-August 3, 81st Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians will be held at the Hyatt Regency Hotel, San Antonio, TX. For more information, contact: Julie Heim — Registration; David Tharp — Exhibits; at (800) 369-6337 (U.S. or Canada) or (515) 276-3344.

August

•9-10, Producing Safe Dairy Foods, a two-day course sponsored by the Center for Dairy Research in Madison, WI. For further information, contact the CDS Conference Office at (608) 263-1672.

•9-12, Fermentation Microbiology, a continuing education workshop sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information, contact the ATCC Workshop Manager at (301) 231-5566.

•15-17, Downstream Processing, Recovery and Purification of Proteins, a continuing education workshop sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information, contact the ATCC Workshop Manager at (301) 231-5566.

•16-18, 11th Biennial Cheese Conference, sponsored by the Department of Nutrition and Food Sciences, Western Center for Dairy Protein Research and Technology, Cooperative Extension Service, Utah State University. For more information, contact Gayla Johnson (801) 797-2379.

•20-25, 41st International Congress of Meat Science and Technology, hosted by the American Meat Science Association, to be held in San Antonio, TX. For more information, contact Ken Johnson, ICoMST Secretariat at (312) 467-5520.

•23-24, Microbiological Concerns in Food Plant Sanita-

tion & Hygiene, a two-day interactive lecture course, sponsored by Silliker Laboratories Group, Inc., will be held in Chicago, IL. For further information, contact Silliker Laboratories, Education Services Department at (800) 829-7879.

•25, Dairy and Food Industries Supply Association (DFISA) Seminar, a full-day seminar entitled "Road to Exporting" sponsored by the International Trade Committee of DFISA, will be held at the Hyatt Regency O'Hare in Chicago, IL. For further information, contact Jennifer Brown, Director of Marketing Information, at (301) 984-1444.

September

•8-9, Anaerobic Bacteriology, a continuing education workshop sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information, contact the Workshop Manager at (301) 231-5566.

•14-16, International Dairy Federation Annual Sessions to be held in Adelaide, Australia. **18-22 International Dairy Congress** to be held in Melbourne, Australia. For more information, please contact IDF, 1601 Malvern Road, Glen Iris 3146, Victoria, Australia, Telephone (03) 885-9781; FAX (03) 885-0017.

•14-16, Growth and Preservation of Animal Viruses, a continuing education workshop sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information, contact the ATCC Workshop Manager at (301) 231-5566.

•18-21, 1995 National Educational Conference, sponsored by the Canadian Institute of Public Health Inspectors, "Approaching the 21st Century - Challenges in Health Protection", to be held in Victoria, British Columbia, Canada. For more information, please contact Mr. R. W. Bradbury (604) 478-0523; FAX (604) 478-9363.

•18-23, Second Asian Conference on Food Safety, sponsored by the International Life Sciences Institute, will be held in Bangkok, Thailand. For more information, contact Lili Merritt (202) 659-0074.

•19-21, Indiana Environmental Health Association Fall Annual Educational Conference will be held in Muncie, IN. For additional information, contact Tami Barrett at (317) 633-8400.

•19-23, Second International Activated Carbon Conference hosted by the Professional Analytical and Consulting Services, Inc., will be held at Plaza Hotel in Pittsburgh, PA. For more information, contact Henry Nowicki (412) 457-6576.

•20-22, New York State Association of Milk and Food Sanitarians Annual Conference, Sheraton Inn-Buffalo Airport, Buffalo, NY. For more information, contact Janene Gargiulo (607) 255-2892.

•21-23, Microscopy/Photomicrography, sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information, contact the ATCC Workshop Manager at (301) 231-5566.

•21-24, National Society for Healthcare Foodservice Management (HFM) 1994 National Training Conference will be held at the Breakers in Palm Beach, FL. For more information, contact HFM at (202) 546-7236.

•26-28, Conventional and Molecular Cytogenetic Techniques, a continuing education workshop sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information, contact the ATCC Workshop Manager at (301) 231-5566.

October

•5-7, New York State Registry of Sanitarians 1994 Educational Conference will be held at the Villa Roma Resort Hotel, Callicoon, NY. For more information, please contact Susan Jones (516) 727-8947 or Michele Hecht (516) 349-5816.

•5-8, 1994 International Dairy Show, sponsored by the International Dairy Foods Association, Milk Industry Foundation, National Cheese Institute and International Ice Cream Association, co-sponsored by the American Butter Institute, will be held at the Minneapolis Convention Center, Minneapolis, MN. For more information, contact International Dairy Show Convention Management at (703) 876-0900.

•12-13, Iowa Association of Milk, Food and Environmental Sanitarians Annual Meeting will be held at the Best Western Starlite Village (formerly the Ramada Hotel), Waterloo, IA. For more information, call Dale Cooper at (319) 927-3212.

•12-13, Seafood Quality Evaluation Workshop for Analytical Laboratories and the Seafood Industry, co-sponsored by the University of California Cooperative Extension, Sea Grant Extension Program; U.S. Food and Drug Administration; U.S. Department of Commerce; and National Food Processors Association, will be held at the Doubletree Hotel and Marina in San Pedro, CA. For further information, contact Bob Price (916) 752-2194 or Pamela Tom (916) 752-3837.

•19-20, North Central Cheese Industries Association Annual Conference to be held at the Holiday Inn, Brookings, SD. For further information, contact E. A. Zottola, Executive Secretary, NCCIA, Box 8113, St. Paul, MN 55113.

•21-22, Breakfast Cereal Technology, sponsored by the American Association of Cereal Chemists, will be held in Minneapolis, MN. For more information, please contact Marie McHenry, AACC Short Course Coordinator, 3340 Pilot Knob Road, St. Paul, MN 55121. Phone (612) 454-7250; FAX (612) 454-0766.

•25-26, HACCP for Meat and Poultry Processors, a two-day interactive workshop designed for those responsible for implementing a HACCP plan in a processing plant, will be held in Dallas, TX. Sponsored by Silliker Laboratories Group, Inc., more information is available by calling Silliker's Education Services Dept. at (800) 829-7879.

•25-26, Illinois Environmental Health Association's Annual Education Conference will be held at the Hotel Pere Marquette in Peoria, IL. For more information, contact (708) 682-7979, ext. 7196.

November

•2-3, North Dakota Environmental Health Assn. Annual Educational Conference will be held at the International Inn, Williston, ND. For more information, contact Deb Larson at (701) 221-6147.

•2-7, Fifth Panamerican Dairy Congress, the International Fair of the Dairy Industry and Dairy Cattle Exhibition, co-sponsored by the Panamerican Dairy Federation, FEPALE and the COLANTA Dairy Cooperative, will be held in Medellín, Colombia, South America.

•7-10, Second Saudi Symposium and Exhibition on Food and Nutrition will be held at King Saud University campus in Riyadh, Saudi Arabia. For more information, contact the Food Science Department at (966) 467-8407 or FAX (966) 467-8394.

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112	125	138	151	164	177	190	203	216	229	242	255	268	281	294	307	320	333	346	359
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WHERE

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