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DAIRY, FOOD AND ENVIRONMENTAL

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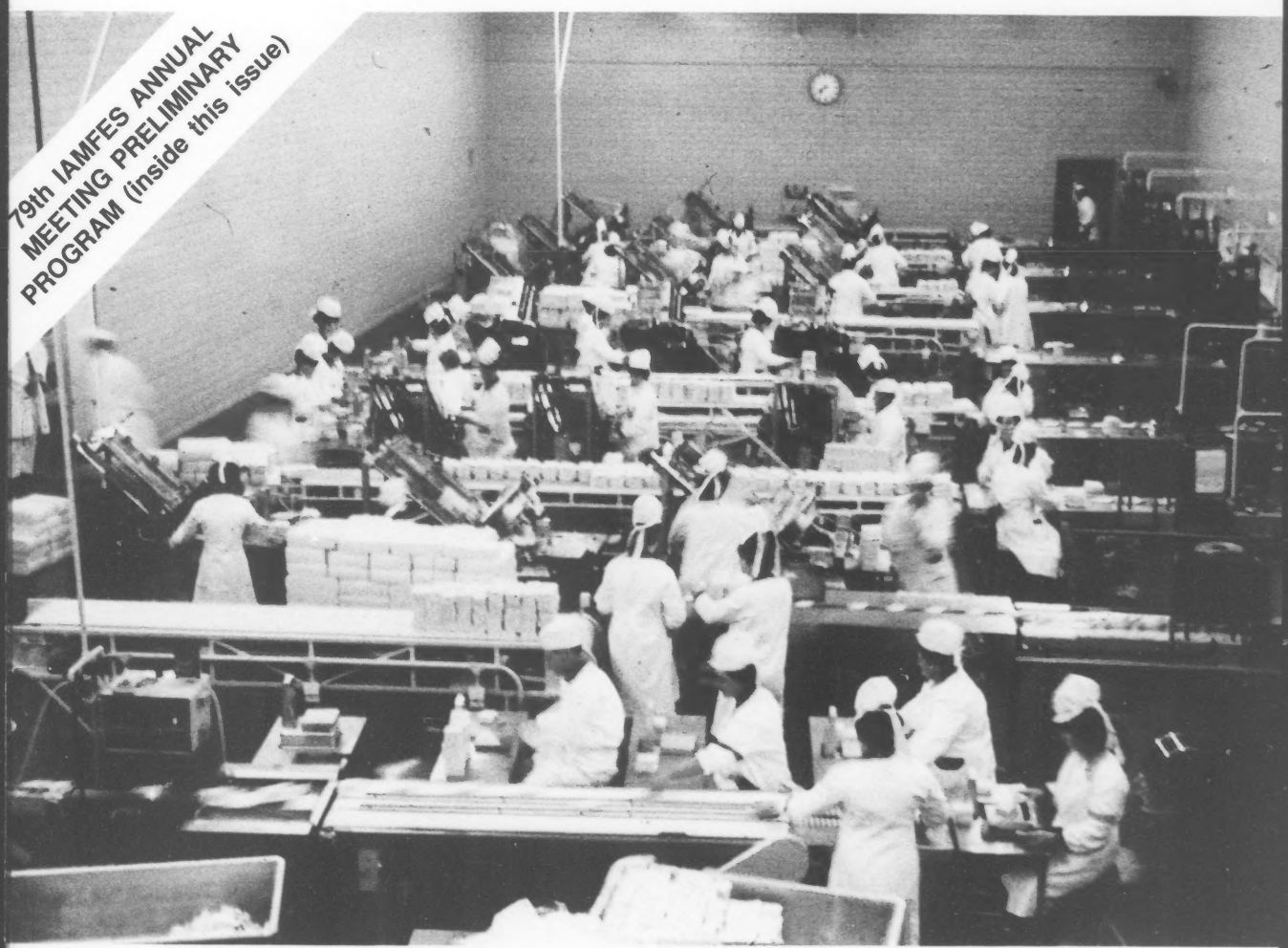
APRIL 1992



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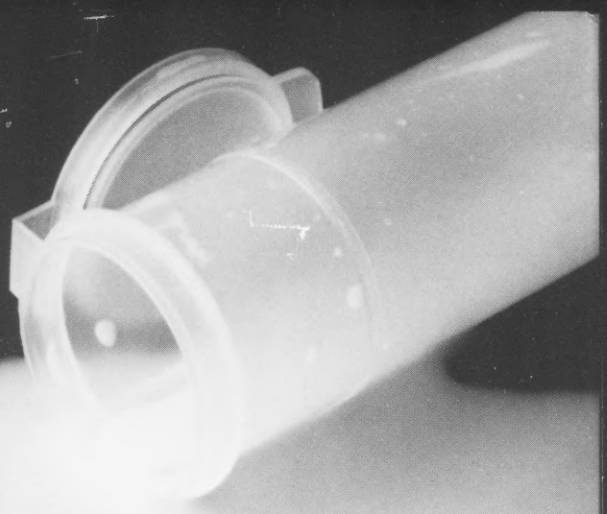

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Dairy, Food and Environmental Sanitation CONTENTS

Articles:

Association News:

ABOUT THE COVER .... *The Processing and Packaging rooms of plant operations are generally the most critical ones in Food Manufacturing. In such operations, many employees are handling exposed cheese products and the product itself is subject and vulnerable to mold bacteria contamination. To build the proper safeguards against product contamination, it is imperative, that management keeps room air exchanges, at all times, free of mold spores. In addition, all plant employees must be acquainted with, and use Good Sanitation and Good Manufacturing Practice techniques to help keep these rooms in a bacteria-free state. Photo courtesy of Lou Bianco, L. J. Bianco & Associates, Inc., 850 Huckleberry Lane, Northbrook, IL 60062.*

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Thoughts From The President . . .

By
Damien A. Gabis
IAMFES President

IAMFES is not exempt from the technological, economic, social, demographic, and governmental changes that affect all other segments of society. In the global food industry, but particularly for us who live in North America, revolutionary changes are taking place. We are importing ever increasing amounts of our foods. We are spending close to 50% of our food dollar eating outside our homes. The number of independently operated food companies continues to shrink. The rate of development and application of new processing and packaging techniques increases. More complex distribution systems continue to evolve. Ever more knowledgeable consumers demand safer and higher quality foods. These modernizations are occurring in the face of decreasing proportions of federal, state, and local government budgets being given to food protection, and funding for academic research in the area of food protection has shrunk.

What will be IAMFES' roles in the future of food protection? Our association faces many present and future challenges, and we will not be prepared to successfully meet them unless we develop and use a strategic visioning and planning process that represents the thinking from a broad spectrum of the association. Preservation of the *status quo* will prevent us from meeting the challenges in our changing professional environment.

To survive and grow IAMFES must consciously plan for its future, and at the recent Executive Board meeting in Toronto, it was decided to proceed with the strategic planning process that I covered in an earlier column; so funds have been set aside in the 1992-93 budget for this purpose. How should we set about developing and implementing a strategic plan to accomplish our goals? The Board believes that the association would benefit most by calling together a long range planning task force from the membership. The association will provide the best possible environment for planning, resources to implement the plan, and a commitment for continuation of the planning process for new challenges, and encouragement for membership buy-in of the plan.

This process must have a beginning, and shortly I will call on members to ask them to participate in charting IAMFES' future by serving on the long range planning task force. I hope that IAMFES members and stakeholders from the following groups and segments of the food industry will agree to participate: Affiliate Council, Past Presidents, sustaining members, 3-A Sanitary Standards Committees, international members outside of North America, dairy foods processing, food processing (including meat, poultry, seafoods) food service, education, regulatory agencies, the environmental area, service laboratories, and Ames office staff. Other groups who should be involved may come to light, and these will be added to the task force. The actual number of people who will be asked to serve has not been determined because it may be possible to have one person representing more than one interest group. However, there will be at least 10 task force members. An organizational meeting is planned to be held at the Annual Meeting in Toronto, but the specific time and room has not been determined at this time.

The Executive Board is in the process of inviting facilitator proposals from several firms with good reputations for expertise in association planning and consulting. Selection of the long range visioning/planning task force facilitator will be made prior to the Annual Meeting. We are looking for a facilitator who will be a resource for us to build consensus through participation in the group process.

The group process to develop a vision and strategic plan will foster a consensus to answer some vital questions:

- Who are we? What is the essence of IAMFES?
- What are the core values of IAMFES?
- What are the strengths and weaknesses of IAMFES?
- How can IAMFES make a difference in the professional lives of the members and in society?

The visioning and planning process will help us define our strengths and potential for growth...and to renew our organization through the energy, enthusiasm and commitment of our members.

On My Mind . . .

By
Steven K. Halstead, CAE
IAMFES
Executive Manager

. . . Toronto Travel Tips

Since the March Executive Board meeting was held in Toronto, I'm thinking about the many small but important things those attending the Annual Meeting will want to consider.

For example:

- Be sure you have with you some form of identification which establishes your citizenship. Those of you from the United States don't need a passport (all other non-Canadians will) but you will need something - a birth certificate or voter registration card. Clearly, a passport will work just fine.
- If you like to "shop til you drop," be prepared to spend a lot of time on the floor. Shopping opportunities are everywhere! Within just a few blocks of the meeting hotel - the Sheraton Centre - is the Hudson's Bay Company; Eaton's; Eaton Centre Mall; and hundreds upon hundreds of shops along the underground passageways that link much of the downtown areas.
- As long as you're spending money, buy some culture. "Aspects of Love" is playing at the Elgin-Wintergarden; "Phantom of the Opera" is at the Pantages; "Les Miz" is at the Royal Alexander plus there are numerous dinner theatres, art galleries, museums, etc. Many of these are just a few blocks from the Sheraton. Easy, safe walking distances.
- Bring your credit cards. I have found that even though they take one percent off the top, I get the best exchange rates by using the credit card. Otherwise, there is no "official" rate and it will vary from shop to shop. Right now there is about a 15% difference between the US and Canadian dollar (i.e., $1 US equals $1.15 Canadian), and it is still going up. That is good news to those of us with US dollars.
- Bring your calculator if you want to know how much you are paying for your goods as all prices are marked in Canadian funds. Right now, you can simply multiply by .85 but that will change according to the prevailing rate in July.
- Be prepared for some different spellings. Centre, flavours, and cheque come to mind quickly. It takes "correct spelling" to a new level of excitement. Also note that QUAY is pronounced "key" - be sure to visit Queen's Quay on the lake shore especially if you like neat, quaint little shops (and lots of them).
- If you plan to drive, be alert to the fact that parking is going to be expensive. Remember, you are in the heart of a major, metropolitan city where every square inch of space commands a high price. Parking at the hotel is very limited and quite pricey - meaning $20 per day. Just across the street is a city parking garage at $12 per day. If you look around you will be able to find some parking not too far away for less than $10 per day. (Remember those prices are in Canadian dollars.)
- Check on your medical insurance plan, just in case. Some plans will not pay out of country expenses or will require you to pay the bill and then reimburse you. Medical insurance by the day is available. Your travel agent should be able to help you with this.
- If you are planning to fly, the lowest fares usually require a Saturday night stayover. You can usually save enough to pay the hotel bill for the extra night as well as the registration fee for one of our outstanding workshops - Frank Bryan's "Implementing a HACCP System" or Rusty Bishop's "Food/Dairy Processing Plant Sanitation."
- If you are flying, the trip from Lester Pearson International to the Sheraton Centre will take about 30-45 minutes depending on traffic. The cheapest way is via Gray Lines buses at $9.75 (CDN) one way or $18.50 (CDN) roundtrip. Cabs are about $35; limos about the same. If you don't have too much luggage, you can double or triple up in a cab and save some money.
- Buses, taxis and limos are located just outside the baggage claim areas. The buses run every half hour at :25 and :55, so if you miss one, you're going to have to wait 30 minutes for the next one.
- For your return trip, get to the airport earlier than you normally do as you are going to have to go through customs and that can take some time. Again, have your proof of citizenship handy as they may well ask you. They might also ask you difficult questions such as where you live, where you were born, who you work for, etc.

These tips are bound to generate more tips which I will share at a later time.

Dairy, Food and Environmental Sanitation, Vol. 12, No. 4, Pages 204-209 (April 1992)

Bacteriocins and Food Applications

Karl F. Eckner, Ph.D.
Silliker Laboratories Group, Inc., 1304 Halsted Street, Chicago Heights, IL., 60411

The following article originally appeared in the September, 1991 issue of SCOPE, a quarterly technical bulletin published by Silliker Laboratories Group, Inc., 1304 Halsted Street, Chicago Heights, IL, 60411

Under the panoply of the term bacteriocin, there are a number of substances produced by bacteria that are inhibitory to other microbes. The potential for use of bacteriocins in the food industry has spurred research in this area. Bacteriocins have been envisioned as an effective means of ensuring food safety by inhibiting foodborne pathogens, by aiding in the preservation of foods, by controlling fermentations, and by preventing or reducing food spoilage while extending the shelf-life and stability of the product with regard to microbial activity. At present, many attempts are being made to incorporate bacteriocins into processes and products. However, only nisin has been granted Generally Recognized As Safe (GRAS) status by the FDA.[11]

Jacob et al.[24] were the first to define the term bacteriocin. Their definition referred to colicin proteins with intraspecies antagonistic effects. As more substances of similar nature have been found, the term has grown broader. Presently, there are a wide variety of bacteriocins, of which nisin is best characterized with regard to the food industry. General criteria for grouping under the term bacteriocin include: 1) a narrow spectrum of activity against other bacterial strains; 2) an essential, biological moiety for activity; 3) bacteriocidal activity; 4) adsorption to specific receptors on cells, 5) the genes for production and immunity to the bacteriocins found on plasmids; and 6) lethal biosynthesis.[56] Unfortunately, there is no widely accepted definition that includes all characteristics nor are all the antagonistic substances noted so far fully characterized to allow classification (e.g., ammonia,[48] fatty acids,[61] organic acids,[59] and hydrogen peroxide [19,33,55,64]). These traits, however, allow bacteriocins to be differentiated from other inhibitory substances produced by microbes.

Various free fatty acids[63] and other organic acids, such as lactic acid,[60] possess antibacterial properties. Some bacteria such as streptococci produce hydrogen peroxide.[19,33,55,64] Ammonia has been noted to be a microbially-produced inhibitor.[48] Finally, antagonistic enzymes such as lysozymes and lysostaphin can act as inhibitory substances in media or foods. Using the general criteria stated above, these compounds fail to meet some of the points listed. The greatest point of overlap in these definitions concerns some of the antibiotics. In fact, some researchers state that nisin and diplococcin, for example, are antibiotics[17,20,56] whereas others call them bacteriocins, inhibitors or anti-bacterial substances.[5,22]

NOMENCLATURE

The nomenclature for bacteriocins is inconsistent.[56] Some bacteriocins have been named based on the bacterial species producing them, and even these names are subject to inconsistencies. Bacteriocins of *Listeria* have been named listeriocins and monocins. Sometimes genus names, either full or truncated, are used as the root term; other times the species names are used. Other bacteriocins have been named in general terms, for example, the generic use of colicins produced by coliforms or lactostrepcins for those produced by lactic streptococci.[26,28] Part of the difficulty is that one bacterial type can produce more than one bacteriocin.[18]

PROTEIN/STRUCTURES

Some bacteriocins appear to be simple proteins.[18] Others such as those isolated from *Staphylococcus*, *Clostridium* and *Lactobacillus* indicate that the bacteriocins contain active protein, lipid, and carbohydrate groups. As the proteins are essential for function, it is speculated that they interact in some manner with the bacteriocin-sensitive bacterial cell, presumably at the cell surface. Some appear to be amphipathic[4] (possessing both hydrophilic and hydrophobic regions) and that the different regions possibly facilitate interactions at the cell surface.

The molecular structure of nisin was determined in 1971 by Gross and Morell.[13] The active nisin molecule possesses 34 amino acid residues, has an amino and carboxyl end groups, and five thioether bonds to form five small ring structures. The molecule has a weight of 3510 Daltons. Dimers and trimers occur with weights of approximately 7,000 and 14,000 Daltons. According to Hurst,[22,23] nisin is usually found as a dimer with a molecular weight of 7,000.

MODE OF ACTION

The different charge on different parts of the protein may cause a localized alteration of the cytoplasmic membrane because such proteins possess a weak, detergent activity. The interaction has been said to occur in two stages.[41] The first stage is the adsorption of the bacteriocin to a cell-surface receptor. No cellular damage results from the attachment and the adsorption is reversible. After a distinct interval, the second stage occurs causing lethal

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alterations in the cell. Data indicates that bacteriocins act as lethal particulates.[32] This is termed "quantal" killing to indicate that one bacteriocin molecule can kill one cell. The mechanism for this effect is unknown. Research has suggested that the adsorption causes an alteration in the cell surface which is transmitted and/or amplified to other sensitive cellular targets. For gram-positive microbes, abnormalities are noted in energy production, macromolecule synthesis, membrane transport, and/or membrane permeability. Changes in these processes can induce other cellular anomalies depending upon the systems initially affected. Trypsin has the ability to inactivate bacteriocins, presumably by enzymatic attack on the essential protein component. However, this only occurs if the bacteriocin is free or shortly after adsorption to the cell surface.

With nisin, the primary target is the phospholipid components[16] in the cytoplasmic membrane.[44,49,50] Nisin causes a rapid, non-specific efflux of amino acids and cations and loss of the membrane potential[27,49] resulting in a situation incompatible with continued cell viability. According to Morris et al.[34], the cytoplasmic membrane disruption is effected by nisin inactivation of sulfhydryl groups. This was recently confirmed by Lui and Hansen.[31] Nisin is reactive to cellular nucleophiles acting as electrophilic Michael acceptors. Nisin is only effective against gram-positive microorganisms.

The bacteriocins also often exist in two or more related but distinct forms. These may be actual variations of structural form, variations based on monomers, or artifacts of preparation treatment.

PRODUCTION

The conditions for production can influence bacteriocin production. Some gram-positive species were found to produce bacteriocins only on solid media. Other studies have indicated that increasing the viscosity of a liquid medium increases bacteriocin production by oral streptococci. Certain components in the media may be necessary for bacteriocin production such as protein supplementation, metal ions like manganese, and sugars. Temperature, growth phase, redox potential, and pH can also significantly affect the production of bacteriocin.[56]

The bacteriocins are either cell-associated or in an extracellular form with the actual production occurring at the cellular level.[21] In the case of nisin, S1 mapping indicates that nisin is produced during all phases of growth.[2]

GENE ENCODING

Generally, the bacteriocins and the resistance genes appear to be encoded on plasmids and the traits are conjugally transmissible. Specifically, the nisin gene has recently been cloned and sequenced by several researchers.[2,7,25] Buchman and Hansen[2] performed a total DNA digest, whereas Kaletta and Entian[25] used plasmid DNA. Both found the same gene. The question remains whether the nisin gene an episome (a plasmid that can exist autonomously or integrate and excise itself from the chromosomal DNA) or is the gene chromosomal or plasmid. It has also been demonstrated that production of synthetic nisin is possible.[4]

The fact that the production and resistance genes are transmissible is both an advantage and a disadvantage. It is easier to construct desired bacterial strains which produce nisin or use the resistance trait as a marker. The stability of the traits and whether the resistance can be passed amongst other microbes present, however, are uncertain.

This is important if the product safety is partially dependent on the production of nisin as a means of controlling spoilage or pathogenic microbes. If the trait is not stable, there will be loss of the bacteriocin protective effect. If the resistance gene can be transferred, then it is possible that the gene enters other organisms and is passed like antibiotic resistance factors to other microbes.

BACTERIOCIN-PRODUCING STRAINS

Many species of bacteria produce bacteriocins or bacteriocin-like substances. Certain bacilli produce subtilin or megacin. Several different bacteriocins have been found in the genera *Lactobacillus*, *Listeria*, *Micrococcus*, *Staphylococcus*, *Streptococcus*,and *Pediococcus*. These are of greatest interest to the food industry and are being actively pursued for food applications. *Clostridium*, *Corynebacterium*, *Mycobacterium*, *Sarcina*, the enteric bacteria, and *Streptomyces* also have been noted to produce bacteriocins. Of all the bacteriocins, nisin is probably the best known and most applicable for use in the food industry.

FOOD SAFETY, PRESERVATION, AND SPOILAGE

Meats

The uses of bacteriocins in meats can be divided up into several sub-categories. Fresh meats are commonly found to have lactic acid bacteria as part of their natural microflora. The idea of inoculating fresh meat with bacteriocin-producing strains of lactic acid bacteria has the potential to prevent or deter spoilage, and prevent growth and/or kill pathogenic psychrotrophs like *Listeria monocytogenes*.

Nielsen et al.[35] have demonstrated that it is possible to reduce the number of *Listeria monocytogenes* bacteria attached to fresh meat by 0.5 to 2.2 log cycles with a bacteriocin produced by *Pediococcus acidilactici*. These researchers found that the efficacy depended on concentration of the bacteriocin and contaminant microflora population levels. It is envisioned that application of bacteriocins coupled with conventional preservation technologies and good manufacturing practices could contribute to safer fresh meat.

Mettwurst is a German sausage prepared from chopped, cured raw pork packed into sausage casings and subjected to a very short ripening period. Thus, the sausage does not undergo drying and/or acidification. As *L. monocytogenes* often can be isolated from meat and meat products, the use of bacteriocin-producing lactic acid bacteria for fresh raw pork-containing sausages to inhibit *L. monocytogenes* has been investigated.[51] It was found that a bacteriocin-producing strains of *Lactobacillus sake* had a bacteriostatic effect on *L. monocytogenes* and concluded that such a bacteriocin-producing strain could be used as a prophylactic measure.

There is potential for use of bacteriocin-producing starter cultures or adjunct cultures in dry and semi-dry, fermented sausages where pediococci, lactobacilli, and other lactic acid bacteria are used as starter cultures. These starter cultures beneficially alter the characteristic organoleptic qualities of the sausages by improving color, aroma, texture, and shelf-life. The main deficiency of the use of bacteriocins in the meat industry is the narrow range of effectiveness, since most bacteriocins are only effective against similar strains of bacteria and, in addition, are restricted to gram-positive species. In general, this means that there is no protection against gram-negative bacteria. Consequently, there are large numbers of gram-negative spoilage and pathogenic bacteria which would not be affected.

Furthermore, unlike other foods, especially fluids like milk or soups, the solid meat substrate would severely restrict the diffusion of the bacteriocins through the product. This could limit the effectiveness of whatever bacteriocin level is produced as it would be available and active only in localized areas within the sausage matrix.

Lastly, there is the possibility that proteases produced by the starter cultures or native meat proteases may inactivate the essential protein, which bestows the anti-microbial nature unto the bacteriocin. In addition to proteases, other sausage components could bind or alter the bacteriocin rendering it ineffective.[51] As a consequence, only a fraction of the bacteriocin produced by the starter or adjunct culture may be available to work against undesired microbes. Thus, the claim about the value of protective cultures, may be very limited in scope.

The use of nisin as a means to reduce nitrite, a precursor of the known carcinogen nitrosamine, but effective *C. botulinum* inhibitor in heat-treated meat slurries simulating canned ham processing has been investigated.[45] It was found that there was a synergistic effect to nisin-nitrite combinations. A combination of 75 ppm nisin together with 40 ppm nitrite was far superior in preventing *C. botulinum* spore outgrowth than was 150 ppm nitrite without any nisin.

Use of nisin has been suggested as an additive in canned meats as a means for reducing thermal processing time. The nisin would contribute an additional inhibitory factor for remaining spores to overcome in addition to the nitrites, salt, and other components in the product.

Fish

A similar suggested application has been made for canned fish because the spoilage is mainly due to thermophilic clostridia and facultative anaerobes.[14] Potentially, nisin could reduce spoilage and fish-related bacterial defects and the same claim was made about reducing processing times.

The alteration of gas ratios in modified atmosphere packaging (MAP) or elimination of gases, vacuum packaging (VP), can extend shelf-life of the fish by suppressing the natural spoilage microflora. MAP in combination with nisin has been shown to be an effective preservation system by Taylor.[59] Nisin, together with carbon dioxide packaging atmosphere, has been shown to extend safe shelf-life of cod, hot-smoked mackerel, and herring significantly at 10°C. Sensory shelf-life was shorter than the safe shelf-life. The investigators defined shelf-life as time to organoleptic rejection and "safe" shelf-life as time to toxin detection. At abuse temperatures of 26°C, nisin extended the safe shelf-lifes by one-half to one and a half days, although it was possible for toxin to develop prior to organoleptic rejection. This last case is the most critical as the nisin/CO_2 gaseous environment could be creating a micro-environment favorable for *C. botulinum*

Addition of nisin to caviar at levels of 0.1, 0.3, and 0.5% in the brine has been investigated. Variable results for the production of caviar were obtained. The early research using a 0.5% level and 120 minutes of pasteurization was determined to be most effective in extending the shelf-life of caviar.[61] In later research, [62] it was noted that addition of preservatives to caviar before heat-treatment was not necessary. These contradictory results were interpreted to be a function of the roe quality. However, it must be noted that the first experiments used an English source of nisin and the second a Russian source. This difference in materials may also have contributed to the contradictory results.

Dairy products

Use of bacteriocins has been suggested as a way to prevent spoilage in cheese ripening due to the outgrowth of spores of *Clostridium tyrobutyricum*, which may be present in the raw milk from the silage and survive pasteurization. The bacterium produces gas causing late swelling during the ripening of Emmenthaler cheese. Nisin was first tested as a preservative in Emmenthaler cheese to prevent *Clostridium butyricum* "blowing".[17] In this study and subsequent studies on cheese, it was found that spoilage by such microbes could be controlled with the use of nisin.

Other uses in dairy products such as cottage cheese dressings or dairy-based salad dressings to control psychrotrophic and lactic acid-producing spoilage microbes can be envisioned.

The use of nisin in processed cheese spreads has been a focus of research. The stability of the cheeses depends on the interrelationship of cheese variety, moisture, salt, pH, and sodium phosphate and sodium citrate levels.[57,58] Most importantly, from the standpoint of *C. botulinum* growth, salt and sodium phosphate levels must be increased if pH and moisture levels are increased. The presence of nisin would allow an extra margin of safety and/or enhanced options in formulating cheese spreads. Somers and Taylor[54] found that nisin addition increased processed cheese formulation flexibility with regard to reducing sodium levels and/or increasing moisture levels. Levels of 500 to 10,000 IU/g cheese delayed or prevented proliferation and toxinogenisis by *C. botulinum* type A and B. Levels of 250 to 500 IU/g cheese controlled non-botulinal spoilage of pasteurized, processed cheese spreads. At the present, both moisture and sodium formulation alterations are useful as marketing claims of lower sodium content or lower calorie content of a product. Use in cheese sauces which have higher moisture content could also be possible.

Recently, Roberts and Zottola[46,47] investigated using genetic engineering to manipulate starter cultures to produce sufficient acid and nisin, yet not be inhibited by the nisin. This aspect of "natural incorporation" of the bacteriocin into

cheddar cheese was combined with the production of pasteurized processed cheese and contamination with *Clostridium sporogenes* PA3679 spores. The levels of nisin produced by the genetically altered starter bacteria were approximately 750 units/gram and were sufficient to prevent spoilage of the processed, high-moisture cheese spread at both room and abuse temperatures. Thus, a cheese manufacturer with a bacteriocin present naturally can circumvent the nisin regulations and enjoy its benefits.

Cereals

Little research has been conducted on the use of bacteriocins in cereal or cereal related products. Delves-Broughton discussed the use of bacteriocins in cereal puddings.[5] Another possible use could be foreseen in pasta. Pasta dough is susceptible to contamination and growth of *S. aureus*. Bacteriocins, with their activity against gram-positive microbes, may be able to inhibit growth of this pathogen in the dough.

Fruits and Vegetables

Many canned vegetable and fruit products have been investigated for potential use of nisin. The products range from potatoes, to peas, mushrooms, soups, canned tomatos, tomato juice,[3] cream-style corn and chow mein.[65] Use of nisin may allow reduced thermal processing of canned fruit, thereby preserving color, taste, texture and nutritional value.

Nisin at levels of 100 to 200 IU/g product can prevent germination and growth of *C. botulinum* spores.[6,53] This ability, together with the heat stability of nisin, has allowed for reductions in heat treatments in certain thermally processed foods such as mushrooms.[15]

Beverages

Use of nisin in beer has been investigated. Nisin would be used as an additive rather than enter the product through fermentation.[36,37,38,39,40] Yeast is not affected by the bacteriocin because nisin is only effective against gram-positive bacteria. This is important as beer contamination and defects are induced by *Lactobacillus* and *Pediococcus*, both gram-positive bacteria. In addition to its anti-bacterial effect on the contaminants, its use may allow reduction of the pasteurization times for beer where the benefit is a greater retention of flavor and less energy expenditure.

A similar use in wine[42,43] has been suggested. However, bacteriocins may inhibit the malo-lactic acid fermentation. The malo-lactic fermentation is considered secondary fermentation which mellows high-acid wines.[29] The presence of autolyzed yeasts stimulates growth of an added *Lactobacillus* inoculum. The lactobacilli decarboxylate the malic acid, thus transforming it into lactic acid. Thus application would likely be limited to only certain wines which do not undergo the malo-lactic acid fermentation.

SHELF-STABLE VS REFRIGERATED PRODUCTS

The use of protective cultures in "new generation" products such as sous-vide and some dinners, pasta, salads, pasta sauces which are minimally processed to retain flavor, color, texture, freshness, and nutrients has been suggested. These products require a long refrigerated shelf-life with minimal processing to remain "fresh". The use of *Lactobacillus* cultures as a protective inoculum against product temperature abuse has been investigated. The main protective effect against pathogen growth would be acid production. However, cultures could be chosen which produce bacteriocins to add another microbial "hurdle" for undesirable gram-positive microbes to overcome. There would not be any effect on the gram-negative microbes, and these would still be of great concern and consequence if there were product temperature abuse.

FUTURE USES, POTENTIAL

A plethora of information has been generated by genetic engineering studies. It is possible now to transfer desired bacteriocin genes via a "foodgrade" vector into other microbes, often those used in food fermentations in the dairy, and meat application areas. Applications could be designed for fruit and vegetable fermentations. The stumbling point appears to be translating the progress made in the genetic engineering field to applications.

Nisin, the only presently GRAS-approved bacteriocin, will likely find increasing use in traditional and new products. Although it possesses a limited antimicrobial scope and is only effective on low levels of sensitive bacterial species, there are added benefits to its incorporation into products. Thermal processing may be reduced, which reduces energy cost and improves organoleptic characteristics and nutritional content of the products. There is an added level of microbiological safety from both spoilage and pathogenic microbes, while avoiding the potential misuse of bacteriocins to conceal inferior ingredients, products, or manufacturing practices. The fact that nisin is not effective against high levels of contamination would be a consumer advantage since poor quality cannot be concealed.

On the negative side, there are still many difficulties to overcome. Many applications may not be suitable for use of bacteriocins, either because of chemical or enzymatic activity, processing treatments, or physical characteristics like high viscosity or particulates. These are apart from the limitations of bacteriocins related to narrow antibacterial specificity and activity ranges. When protective cultures are relied upon to produce the bacteriocins instead of direct addition, there is an even greater uncertainty introduced because of growth conditions, microenvironment, and the metabolic state of the organism.

Presuming bacteriocins are effective in inhibiting certain spoilage and pathogenic microbes, concern exists about its impact on product stability in relation to pathogens and spoilage microbes under this altered microenvironment. In the environment, whether macroscopic or microscopic, there is always competition for resources. If the incorporation of bacteriocins eliminates some of the intrinsic microflora or alters their behavioral response, there is an "ecological vacuum" which may be exploited by other competing microbes. The shift in microflora could result in suppression or alteration of typical spoilage characteristics, thereby increasing additional risks to the consumer from temperature abuse of refrigerated and sous-vide products.

Additional risks which have not been fully evaluated involve bacterial resistance to bacteriocins. It is well-documented that bacteria can develop resistance to various antibiotics via plasmid transfer. It is not known whether similar resistance characteristics would be selected for with increasing use of bacteriocins, however, the development can be easily envisioned. Use of bacteriocins has potential to allow production of safer, more stable and perhaps more nutritious foods. However, the limitations and risks, discussed above, must be recognized, and each application thoroughly investigated.

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Chilled Food Handling and Merchandising: A Code of Recommended Practices Endorsed by Many Bodies

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Introduction

Purpose and Scope

Chilled foods, especially prepared and ready-to-eat potentially hazardous products, are often produced or assembled in establishments under the minimum of supervision and by people who have had little training in food hygiene. This code aims to set out the *minimum precautions* necessary to ensure that a wholesome, hygienic, safe product is supplied to the consumer.

Training for all persons handling chilled products should include at least familiarity with the contents of this code.

The code is not concerned with products which have no need of chilling for distribution or display.

The code in no way detracts from the need to be aware of and obey the relevant regulations governing food premises and the hygienic production and distribution of food, whether these are federal or local.

Currently, federal codes and many state/local regulations ban vacuum, modified atmosphere and controlled atmosphere packaging in retail food stores. This includes the preparation of sous vide products, i.e., those prepared by placing raw or partially cooked ingredients in an impermeable container, evacuating the air or otherwise reducing the oxygen, hermetically sealing the container, cooking at a low (no more than pasteurizing) temperature and then holding it under refrigeration. Such products are usually reheated for consumption.

For purposes of this code, chilled foods are defined as those potentially hazardous food products with a water activity (A_w) of 0.93 or above; possessing a pH of 4.6 or higher, which are uncured and which require holding between 29 and 38 degrees Fahrenheit (-1 and 4 degrees Celsius).

Objectives of Chilling

Food products are chilled both to retard deterioration and to prevent the growth of pathogenic microorganisms.

I. Food for Chilling

1. Chilling only retards quality loss; it does not preserve indefinitely. Only sound and wholesome foods should be selected for chilling at an optimum level of freshness.
2. Chilling should only be performed in equipment (blast chiller, chill room with rapidly moving air, or an immersion chiller) designed specifically for the purpose. When fully loaded with product to be chilled, the apparatus should be capable of reducing the center of the product, after equilibration, of all the contained product to 50 degrees Fahrenheit, 10 degrees Celsius within two hours. The product should remain in the chilling equipment until it reaches 38 degrees Fahrenheit, 4 degrees Celsius.

II. Chill Storage

1. Each chill room or cabinet should be so designed as to allow for free air circulation when fully loaded. It should never be overloaded. It should be equipped with sufficient refrigeration capacity to maintain the coolest temperature required by any product which may be stored, but not cold enough to freeze any product. This refrigeration capacity should be adequate to maintain the product temperature at 38 degrees Fahrenheit (4 degrees Celsius) during reasonably anticipated conditions of high ambient temperatures and peak loading of the

equipment including a reasonable number of expected door openings.

2. Each chill storage area should be equipped with an accurate recording thermometer (plus or minus 1 degree Fahrenheit, 0.5 degrees Celsius) and other temperature sensing devices installed so as to reflect correctly the warmest air temperature. Care should be taken in siting such thermometer. In the absence of adequate forced air circulation considerable variations in air temperatures can be found — high up, close to doors, near fans, etc. The thermometer shall be checked/recalibrated weekly. Each day on which the storage area is opened, temperatures of each area should be recorded. A file of such temperatures should be maintained for at least one year. Alarms should be installed to be activated by malfunctioning of refrigeration equipment or high temperatures. Back up power supply to allow for power outages is recommended.

III. Handling Practices

1. Product temperatures should be checked with a digital probe thermometer on receipt and recorded. The person in charge of the chill storage equipment should ensure that no chilled food is accepted for storage at a temperature warmer than 38 degrees Fahrenheit, 4 degrees Celsius, or colder temperature if required by the supplier/buyer.
2. All chilled product placed in storage should be properly labeled, have its identity, code/date mark and handling instructions clearly legible.
3. Chilled food should never be left at ambient conditions, exposed to humid air, direct sunlight or any possible source of contamination.
4. Space between cases and walls or floors should be adequate to allow free air circulation at all times.
5. A cool dock, maintained at 38 degrees Fahrenheit, 4 degrees Celsius, shall be provided for all staged product unless product is loaded into a pre-cooled trailer within ten minutes.
6. It is important that the mechanical refrigeration unit should be turned off whenever the doors are open to prevent warm, humid air being drawn into the vehicle. The unit should be turned on and the doors closed whenever loading or unloading is not being carried out.
7. The thermostat on the refrigeration unit should be set so as to maintain air temperatures at the coolest end of the desired temperature range during high summer ambients and towards the warmer end of this range during freezing ambients but never warmer than 38 degrees Fahrenheit, 4 degrees Celsius.

IV. Display for Sale on Retail Premises

1. Chilled foods should only be displayed for sale from chill cabinets or display cases capable of holding product temperatures cooler than 45 degrees Fahrenheit, 8 degrees Celsius, but not colder than 29 degrees Fahrenheit, -1 degrees Celsius. Only adequately chilled products should be loaded into chill cabinets or display cases
2. Each display case should be equipped with a dial type thermometer (accurate to plus or minus 1 degrees Fahrenheit, 0.5 degree Celsius) which should be located to measure the warmest air, this is generally the air returning to the evaporator.
3. Display cases should be positioned away from direct sunlight, drafts, heaters, etc.
4. Each display case should have clearly marked load lines limiting the area outside of which product should not be placed.
5. Display cases should be provided with a sufficient number of grids, dividers and separators to ensure adequate air circulation and be kept clear of debris, signs or tags which could restrict or deflect the flow of refrigerated air.
6. Display cases should be defrosted as required and disinfected periodically, including condensation trays and drains.

V. Retailer Handling Practices

1. Chilled foods should be maintained at all times in chill storage; any significant deviation above the recommended holding temperature for a particular product should render the food unfit for sale. Such food should be asided and advice sought as to its disposal. (See appendix 2 for recommended methods of taking product temperature.)
2. Sanitation and personal hygiene, as detailed in "Summary of the Basic Rules of Hygiene for Food Handlers" should always be followed.
3. Rotate inventory on a "first in, first out" basis.
4. Withdraw stock which is past its shelf-life ("sell-by" date and/or manufacturer's recommended instructions) for disposal.

DON'T

- allow raw meat, fish, poultry or unwashed fruit or vegetables to touch cooked and/or ready-to-eat foods
- use the same equipment, tables and cutting boards for cooked and/or ready-to-eat foods that you use for raw products
- use any equipment, utensils, tables and cutting boards without thoroughly cleaning and sanitizing them
- handle foods which are not totally enclosed in packaging if you have an infected cut or abrasion even if it is covered with a waterproof dressing
- blow into bags, or touch your mouth or nose when handling food
- smoke in any food handling areas

Summary of Guidelines for Pre-Distribution Storage

DO

- chill products properly before transferring them to the chilled store
- make sure that the holding area is operating at the correct air temperature for the products being stored
- clean coils and foils in holding and display units periodically and dry before food is placed in the units
- check the temperatures of the store and products frequently
- stack the products so that cold air can circulate freely
- keep the store clean and tidy
- make sure that stock is properly rotated
- remove products from stock in adequate time before their marked dates have passed
- defrost the refrigeration plant as necessary

DON'T

- expect the chilled holding store to cool warm products
- allow chilled store doors to remain open for long periods
- keep unwrapped raw vegetables, poultry, fish or meat together in the same store, or in the same store as other chilled foods

Summary of Guidelines for the Retailer

Storage

DO

- check the container thermometer on arrival
- in case of doubt check that the product temperatures are not outside the recommended range
- transfer the chilled products without delay into the chilled store or directly into display cabinets
- ensure that chilled storage capacity is adequate for trading requirements
- store cooked and/or ready-to-eat products separately from raw products
- clean coils and foils in holding or display units periodically and dry before placing food in the units
- ensure that chilled store doors close properly
- defrost refrigeration plant as necessary

DON'T

- accept chilled foods if the temperature is outside the recommended range
- accept more chilled foods than can be stored either in the chilled store or in display cabinets within the load limit line
- store cooked or ready-to-eat products in the same cabinet or counter as raw products even if these are packaged

Stock Rotation in Storage and Display

DO

- rotate stock on the "first in, first out" principle
- ensure that date marks are clearly legible on outer containers and every pack and are not obscured

DON'T

- overstock

Summary of Guidelines for the Caterer

DO

- chill hot foods as soon as possible unless they are either for immediate consumption or held hot, above 14 degrees Fahrenheit
- ensure that chilled storage capacity is adequate
- defrost refrigeration equipment as necessary, establish a routine cleaning and sanitization schedule, including condensation trays and drains
- store cooked and/or ready-to-eat foods separately from raw foods
- put chilled foods into chilled stores immediately after delivery noting the manufacturer's instructions
- keep pasteurized (but not canned) foods in a chilled store
- check operating temperatures regularly
- use different machinery, equipment, tools, utensils and food contact surfaces after use and as frequently as necessary; sanitize; use disposable wipers

DON'T

- accept chilled foods if the temperature is outside the recommended range
- leave chilled store doors open

Appendix I

Recommended Temperatures for Chilled Foods

Chilling and handling food below 4 degrees Celcius, 38 degrees Fahrenheit, is a temporary safeguard against food poisoning. In order to maintain freshness and extend shelf-life products may be grouped in three general categories.

1. Those which should be handled at temperatures close to freezing, i.e., 32 degree Fahrenheit, 0 degrees Celsius, with a temperature range of -1 to +1 degree Celsius, 30 to 34 degrees Fahrenheit.
2. Those which may be handled at just above freezing, i.e., 0 to +5 degrees Celsius, 32 to 40 degrees Fahrenheit.
3. Those where temperature control is required but not to the same degree as in categories 1 and 2, i.e., a range of 0 to +8 degrees Celsius, 32 to 46 degrees Fahrenheit.

Except where a manufacturer makes a specific storage temperature recommendation, storage within the following ranges of temperature is recommended:

Category 1	Recommended Temperature Range
Fresh Meat Fresh Poultry Fresh offals (e.g., heart, liver, kidney, tripe, sweetbreads) Fresh sausage and sausage meat, ground and minced meat, burgers Ready-to-eat and open-pack cold meats and poultry Fresh and smoked fish and shellfish, (which may be held in ice)	-1 to +1 degree Celsius, 30-34 degrees Fahrenheit

Category 2	Recommended Temperature Range
Pasteurized canned meat Milk, cream, yogurts, soft cheese Desserts Coleslaw, prepared salads, mayonnaise, cut fresh fruit and sliced mushrooms Bakery goods with natural or artificial cream or custard Raw pastry, unbaked dough and pastry products, pizza Products prepared by a formal Cook-Chill catering system should be maintained below 37 degrees Fahrenheit, +3 degrees Celsius	0 to +4 degrees Celsius, 32 to 38 degrees Fahrenheit

Appendix II

Routine Temperature Management

For everyday use a simpler method may be used, remembering that a temperature warmer than the correct one is often recorded unless all precautions are followed carefully.

- Choose a reliable, accurate (+/- degree Fahrenheit, 0.5 degrees Celsius) thermometer with a short response time (time required to reach a steady reading) which must be calibrated frequently
- Calibration can most easily be carried out by immersing in a 70:30 ice:water mixture (32 degrees Fahrenheit, 0 degree Celsius) and also steam from a kettle spout which, at sea level, gives 212 degrees Fahrenheit: 100 degrees Celcius
- Mercury in glass or alcohol in glass thermometers should be avoided, both because of the hazard presented by glass and because such thermometers have a long response time
- Highly satisfactory digital thermometers are available with either flat blade or needle probes. Bimetal dial thermometers, which can be easily calibrated, are also suitable
- Before recording a temperature, pre-cool the probe by inserting it between two packets of chilled food and wait until a steady reading is reached
- To obtain a reading insert the pre-cooled probe in the product or between packets, ensuring that good contact is made with the packages

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Comparison of Test Methods for the Determination of Nitrates in Well Water

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Abstract

Three protocols, varying widely in sensitivity and ease of implementation, were used to analyze several well water samples for nitrate-nitrogen. Data obtained by the different test methods were generally in good agreement.

Introduction

Nitrates (from fertilizers, landfills, animal wastes, septic systems, decomposing vegetation and geologic deposits) may be the most prevalent source of groundwater contamination. Recent work by the Environmental Protection Agency suggested that over half of all community water systems and rural domestic drinking water wells contain at least 0.15 mg/L nitrate-nitrogen. Of these, 2.4% of the rural domestic wells exceeded the 10 mg/L health advisory level for nitrate (1). Although nitrates (> 10 mg/L) have been potentially associated with a number of health problems, only methemoglobinemia ("blue baby" syndrome) is directly linked to consumption of water containing elemental nitrates (2). However, high nitrate levels in groundwater often indicate the presence of additional contaminants such as disease-causing bacteria, heavy metals, pesticides or other organic compounds.

A variety of methods have been used for the analysis of nitrate in water and wastewater. These methods differ in relative sensitivity and susceptibility to various interferences (2). Techniques such as high-performance liquid chromatography offer high sensitivity but require specialized instrumentation. Thus, the analyst must select a method suited to both the type of samples being examined and test facilities available. We have examined twenty-two well water samples, in addition to distilled water spiked with known amounts of nitrate, using ion chromatography, a colorimetric assay and a simple test-strip "kit."

Methods

Groundwater samples were collected in polyethylene bottles, filtered through a 0.45 µm nylon membrane filter and stored at 4° C. (Water was allowed to run for 15 minutes first to flush lines.) Chromotropic acid assays (two replicates per sample) and ion chromatography were performed as described in procedures 418D and 429, respectively, of *Standard Methods for the Examination of Water and Wastewater* (2). An additional chromatographic analysis was performed using high-performance anion-exchange liquid chromatography with ultraviolet (195 nm) detection (3).

"Aquachek" test strips, manufactured by Environmental Test Systems, Inc., Elkhart, IN, were used according to kit directions (4) with independent evaluations of each water sample provided by three individuals. Prior to evaluation for nitrate-nitrogen, all samples were checked for the presence of nitrite, and none was found. The test for nitrate-nitrogen consists of reducing nitrate in the sample to nitrite via addition of an encapsulated reducing agent, followed by a colorimetric reaction on the test strip; intensity of the resultant pink color is proportional to the concentration of nitrate present.

Standards of known nitrate concentration were made by diluting a 100 mg/L stock solution, prepared gravimetrically by dissolving dry KNO_3 in distilled, deionized water.

Results and Discussion

Results for all nitrate standards and well-water samples are shown in Table 1. Data from eight standards, prepared from distilled, deionized water (calculated to contain 0-50 mg/L nitrate-nitrogen) indicate that variation among test results is minimal when no interfering ions are present. As would be expected, more differences among methods were observed for some of the well water samples, compared to spiked "pure" water. Data obtained by the two ion-chromatographic techniques (conductivity vs UV detection) were in close agreement except for samples 29-03 and 8-02. Sample 29-03 also gave disparate results using the test strips. Values obtained by the chromotropic acid assays were close to those obtained by ion chromatography, except for sample 10-02. This sample may have contained excess chloride or other ions (2) which interfered with the chromotropic acid assay, since repeated analysis by this method gave identical results. Nitrate-nitrogen contents reported by three readers using the "Aquachek" test strips were consistent with data obtained using the more time-consuming and expensive standard methods. Nitrate levels, as judged by the three different readers, agreed well except for sample 29-03. The test strips allowed users to correctly identify groundwater samples that contained 5-15 mg/L nitrate-nitrogen. This is important since the Environmental Protection Agency has

Table 1: Nitrate-Nitrogen content (mg/L) of standard solutions and well water samples evaluated by three methods.

Sample	Ion Chromatography Conductivity Detection	Ion Chromatography UV Detection	Chromotropic Acid Assay	"Aquachek" Test Strips* Reader 1	"Aquachek" Test Strips* Reader 2	"Aquachek" Test Strips* Reader 3
Standards:						
0	0	0	0	0	0< X <0.5	0< X <0.5
0.5	0.6	0.4	0.5	0.5	0.5< X <2	0.5
1.0	1.1	1.1	1.0	0.5< X<2	0.5< X <2	0.5< X <2
2.0	2.2	2.3	1.9	0.5< X<2	2	0.5< X <2
5.0	5.5	5.4	5.1	5	5	5
10.0	11.1	10.0	10.5	10	10	10
20.0	21.9	19.9	19.3	20	20	20
50.0	54.3	51.2	50.1	>50	50	50
Well Water:						
No. 1-02	0	0	0	0	0	0
6-02	0	0	0	0	0	0
11-03	0	0	0	0< X <0.5	0	0
2-03	1.4	1.5	1.3	0.5< X <2	0.5< X <2	0.5< X <2
14-02	1.6	1.1	1.4	0.5< X <2	0.5< X <2	0.5< X <2
14-03	1.6	1.8	N.A.	0.5< X <2	0.5< X <2	0.5< X <2
15-03	2.1	2.0	N.A.	0.5< X <2	0.5< X <2	0.5< X <2
28-03	2.3	2.8	1.6	0.5< X <2	2	0.5< X <2
16-03	3.2	3.3	2.6	2	2	0.5< X <2
30-03	7.8	10.9	N.A.	10	10	10
33-03	6.7	11.2	7.1	5< X <10	5	10
6-03	9.9	9.3	9.2	10	10	10
13-03	9.9	12.4	8.4	10	5< X <10	10
29-03	10.5	15.2	N.A.	10	5	20
6-02	10.5	4.1	11.2	5< X <10	10	10
3-02	10.7	6.2	9.5	5< X <10	5	10< X <20
27-03	16.0	19.9	14.2	20	10	20< X <50
31-03	16.4	22.5	16.6	20< X <50	20	20< X <50
3-03	19.7	27.0	16.6	10	10< X <20	20< X <50
32-03	30.4	36.2	26.4	50	20< X <50	50
10-03	31.2	35.6	27.4	50	20< X <50	50
10-02	34.5	N.A.	6.1	20< X <50	50	50

*In the case of a reading which fell between two colors on the test strip evaluation chart, underlining indicates the "closer match".
**N.A. = Not Analyzed.

established 10 mg/L as the maximum permissible level of nitrate for water that is delivered to any user of a public water system (1). All samples of less than approximately 3 mg/L, as determined by the standard methods, were read as ≤ 2 mg/L with the test strips. Samples containing 14-38 mg/L nitrate-nitrogen, as determined by the standard methods, were read as 10-50 mg/L with the test strips.

Conclusions

A comparison of ion chromatography, a colorimetric assay and a test kit for measuring the nitrate content of well water showed that, despite considerable differences among methods, results were generally in good agreement. Inexpensive, easy-to-use test strips offer a definite advantage when analysis facilities and/or time are limited. The best use for such kits, however, is probably as a screening tool. Samples found to contain a concentration of nitrate-nitrogen close to the EPA limit of 10 mg/L should be subjected to analysis by a second method, if possible. Since the chromotropic acid assay is extremely tedious and subject to several interferences, some form of ion chromatography would appear to be the analytical method of choice in these cases.

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High Quality Utilities in the Food and Beverage Industry

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The life blood common to every food and beverage processing facility is its utilities (water, steam and air). High quality fluids (liquids and gases) are required when they are incorporated into finished products or included in the packaging which contacts the product.

The removal of microorganisms and other particulate or suspended materials from utilities can be accomplished using filtration. Food and Beverage processors concerned about consumer safety and product image incorporate various types of filtration to meet safety standards and a consumer accepted product. Filtration for the clarification or microbiological control of water, air and steam is assured by absolute filtration which will not allow any contaminants larger than the rated pore size of the filter to pass through into the effluent (filtrate). Filtration of each utility will be discussed in greater detail.

Water

The utilization of high quality water is required for soft drinks, bottled water, food formulations, beer, and distilled spirits blending to enhance and ensure product quality and image. The production of microbial and particulate free water involves treatments which can include flocculation, filtration through a sand bed, chlorination, activated carbon, deionization, reverse osmosis and sterile filtration. The type and extent of the treatment is dependent on the end use of the water.

The primary steps are concerned with particulate removal and microbiological control. Flocculation followed by sand filtration is an excellent technique for the removal of the majority of the large particulate contaminants found in water supplies. However, many of the fine particles pass through the sand bed along with grains of sand from time to time. Sand filters are depth filters without a fixed structure and any variation in the water flow or pressure can dislodge media and previously trapped contaminants. By installing an absolute rated depth filter after the sand filter, all of the contaminants larger than the rated pore size of the filter will be removed prior to the chlorination and activated carbon treatment. This will improve the chlorination efficiency by virtue of the reduced organic loading, and due to the lower particulate burden extend the life of the activated carbon filter.

Activated carbon removes excess chlorine, trihalomethanes and other by-products associated with chlorine disinfection. However, it also sheds carbon fines and provides sites for microbial growth. Carbon beds are for this reason potential sources of microbial contamination and are difficult to disinfect.

The use of filtration before and after carbon beds will reduce the loading of microorganisms and particles.

Resin beds for deionization of water are also excellent sites for microbial growth and offer the potential to unload or shed resin beads into the treated water. Here again, an absolute rated filter will ensure that particles or microorganisms which are larger than the removal rating of the filter do not pass through into the treated water. As a final treatment the incorporation of a sterilizing PVDF or Nylon 66 0.2 micron filter will remove microorganisms present in the water, provided the system itself has been presterilized. The benefits with sterile filtration are ease of use, no chemical additives and low energy input.

The amount of filtration required by a particular plant is dependent on the raw water supply e.g. well water, river, lake or reservoir. Microbiological contamination of surface water is common and the overall treatment system must be designed to handle it. Common organisms of concern are pathogenic bacteria such as *Coliforms*, *Salmonella*, *Listeria*, *Clostridia* and protozoans such as *Giardia*. Water which is used as an ingredient in a food product may also cause problems when spoilage organisms such as yeasts and molds or bacteria (*Pseudomonas*, *Lactobacillus* or *Streptococcus*) are present.

Microbiological control with chlorine and U.V. treatments as disinfection methods are very common. Chlorine is the most widely accepted treatment but it is not totally effective against all organisms e.g. *Giardia* cysts are resistent. It should be noted that chlorine forms carcinogenic by-products such as trihalomethanes with organic substances in the water. U.V. light relies on transmission through water to kill contaminating microorganisms. Turbidity or U.V. absorbing compounds such as iron or other U.V. absorbing organics will compromise this effect. Neither U.V. nor chlorine treatments remove the killed organisms.

A microbiologically stable product may be produced using a combination of flocculation and filtration steps culminating with an absolute rated filter. The ease of use and benefit of not requiring chemicals to sterilize the water are features geared to the modern concept of less is best. The level of filtration required is dependent on the final use and the pretreatment given to the water. For example, blending

water for distilled spirits is typically from a chlorinated and carbon treated well or city water supply which is visually clarified using a depth filter such as a Pall 5.0 - 10.0 micron Profile II® or Profile II Plus™ filter prior to blending with the high proof spirits. The microbiological quality/safety is assured by the chlorination of the water and only polishing prior to blending is required for visual clarity.

Bioburden reduction of potential spoilage organisms not destroyed by chlorination (e.g. spores) is accomplished by clarification with absolute rated depth style filters from 1.0 - 10.0 microns depending on the microbial load. This water may be used for final product rinsing or container flushing to improve shelf life.

Aseptic processing and packaging relies on the thermal treatment of the product to produce a commercially stable/sterile product. The maintenance of sterile conditions on an aseptic filler during all aspects of the packaging step e.g. lubricating/cooling water for the pistons and filling heads must be sterile. This is accomplished by prefiltering the water through a double layer filter such as a 20.0 micron/2.0 micron glass fiber filter and then sterile filtering through a 0.2 micron Nylon 66 membrane filter. The double layer coarse prefilter will remove all of the heavy fouling contaminants and enhance the life of the sterilizing membrane filter.

Air

Air or gas used for product agitation or transportation, drying of products or working surfaces and incorporation into food (e.g. whipping) must be sanitary. The 3-A Standard for supplying air under pressure in contact with milk, milk products and product contact surfaces is Number 604-03. The standard requires that the efficiency of the filters shall be at least 50% as measured by the DOP test[1]. The standard correlates to Profile II depth filters with a 30.0 micron or tighter pore size. See Table 1.

Filtration of air or gas with a 30.0 micron filter basically produces a visually clarified fluid to the naked eye, but does not assure safe microbiological quality. The need for extended product shelf life has driven the processor to remove or drastically reduce the numbers of potential spoilage organisms through the use of improved processing techniques such as finer filtration. Extension of product shelf life results in less returned product and ability to ship over greater distances.

The USDA, Food Safety and Inspection Service (FSIS) requires that air used during slaughter operations (Federal Register/Vol. 55 No. 140/Friday, July 20, 1990/Rules and Regulations) meets more stringent rulings on air quality. "Air filtration would consist of not less than two stages. An initial stage of filtration would occur at or near the use point and would consist of an aerosol or coalescing filter, capable of filtration to not more than 0.75 micron for the removal of oil and water. A subsequent stage of filtration would occur at or near the point of needle hose attachment to the air line and would be a particulate filter capable of filtration to not more than 0.3 micron. The filters would be maintained by inspecting regularly to assure they are working properly and cleaned or replaced when necessary." The use of a 0.3 micron coalescing filter ensures that the bulk of the water and oil are removed from the air or gas which greatly improves the life of the final filters.

The crux of an aseptic packaging machine is a sterile filling environment. The quality of the final product and hence its shelf life is affected by the level of contamination entrapped in the packaging of the product. Quality is assured when the air or purge gas within the packaging machine is filtered through a 0.2 micron liquid rated (0.01 micron gaseous rated) sterilizing grade hydrophobic PVDF membrane filter which removes all potential airborne spoilage organisms. Sterilizing filters for this purpose are typically made of a hydrophobic material to assure total removal of bacteria even from moist air or gas; common in processing areas due to the presence of steam and water.

Fermentation facilities require sterile air for the production of starter cultures or the maintenance of sterile conditions within a storage tank. The optimum practice is to first coarse filter the air with a coarse depth or pleated filter to remove the bulk of the contaminants and then use a 0.2 micron PVDFF membrane to sterile filter. The sterile air can be used to "blanket" stored product by creating a positive pressure within the storage vessel (an inert gas such as nitrogen can be used in place of air when the oxygen in air may cause oxidation problems). The main advantage of blanketing a storage tank is the ease of creating a sterile environment, particularly with very large storage tanks. Large tanks are at risk of collapsing due to the generation of a negative pressure which can be created when pumping out the tank if the vent filter (sterile grade) is a restriction to the air flow and the passage of air into the vessel does not match the removal rate of the liquid. The correct sizing and subsequent maintenance of the filter will prevent this.

Agitation or mixing of products may be accomplished using sterile air or gas by bubbling air into the tank. Whipping of desserts or batters using air or specialized gas mixtures (nitrous oxide, nitrogen, carbon dioxide etc.) is an advantageous method of using the physical chemistry of the food products to produce stable foams by the interaction of gas and product. The gases used for this purpose must not only be free of particles as per the 3-A Standard but also microbiologically safe. The risk of food poisoning from pathogenic organisms such as *Salmonella*, *Clostridia*, *Listeria*, and *Coliforms* by inoculation with contaminated air or gas is eliminated through the use of 0.2 micron PVDF sterilizing filters at the point of use. Similarly, the removal of potential spoilage is assured by sterile filtration.

Air or gas sparging of product for aeration, oxygen stripping or carbonation is maximized through the use of specialized sparging elements such as sintered porous stainless steel media. The pore size of the media is selected for the specific operation to produce a correct sized gas bubble. For example, nitrogen sparging of wine to remove dissolved oxygen is accomplished using a 1.3 micron (gaseous) rated sparger which will produce a mean bubble size of 5 micron.

Prior to sparging, the gas should be sterile filtered through a pre sterilized 0.2 micron filter to prevent microbiological contamination of the wine. The carbonation of beer and soft drinks is carried out in a similar manner except the tanks are kept under pressure and carbon dioxide is substituted for the nitrogen.

TABLE I. Overview of Filtration Applications for Utilities in the Food and Beverage Industry

Filter Placement/ Application	Pall Ultrafine Filter Media	Recommended Micron Rating	Objective	Purpose
WATER				
Water Supply	Profile II	40-70	Sand & Debris Removal	Protect Equipment
After Sand Filter	Profile II or Profile II Plus	10-40	Coarse Clarification	Protect Carbon Bed or Ion Exchange Units
After Carbon Beds or Ion Exchange Units	Profile II or Profile II Plus	5-20	Remove Carbon and Resin Fines	Visual Clarification
Prior to UF System or RO	Profile II or Profile II Plus	5-20 Silica	Remove Colloidal	Protect UF/RO Equipment from Fouling.
Distilled Spirits Blending Water	Profile II or PallCell®	5-10 8 (DC)	Remove Particles	Visual Clarification
Final Product Rinsing Container Flushing	Profile II or Profile II Plus	1-10 some spores and microorganisms	Remove Particulates & Rinse Water for Enhanced Shelf Life	Reduce Bioburden to Enhance Shelf Life.
Aseptic Fillers	Ultipor GF®	1. (U010Z) 2. (U220Z)	Reduce Bioburden Remove Particulates	Prefilter for Sterile Filter
	Ultipor N_{66}®	0.2 (NR)	Remove Microorganisms	Sterile Water
AIR				
General Purpose Air/Gas	Profile HDC® II	30 20	Meet 3A Standards Remove Visable Contaminants	Air or Gas for Non-critical Applications
After Compressor	ZM	3	Remove Oil & Water to 0.3 micron Range	Exceed USDA Air Quality Requirement
Point-of-Use	Emflon® II	0.2	Remove All Micro-organisms Down to 0.01 microns	Sterile Air for Direct Contact With Food. Exceed USDA Air Quality Requirements
Sparging	PSS®	1.3 (PH)	Produce Discrete Bubbles	Good Transfer of Air or Gas
STEAM				
Steam Line Prior to Process Equipment	PSS	2.8 (S-200) 1.3 (PH)	Prevent Scale Build Up. Improve Heat Transfer.	Remove Particulates
Direct Product Injection	PSS	2.8 (S-200) 1.3 (PH)	Meet 3A Culinary Grade Steam Standard	Remove Particulates

The recovery of products especially viscous ones can be enhanced by blowing down the equipment to recover product clinging to the equipment and increase product yield. Milk products such as concentrated milk or whey, ice cream mixes and yogurt are typically recovered or moved by air or gas. The use of gas pressure (rather than pumping) to move finished yogurt produces a firm curd with less wheying off and better texture. However, the use of gas/air in contact with a finished product which has not been sterile filtered may jeopardize product safety and quality. The use of "3-A Standard Air" (visually acceptable) could potentially contaminate finished products; a 0.2 micron sterilizing filter will guarantee that air is not a source of contamination.

The use of pleated polypropylene filter cartridges are recommended for bioburden reduction where aseptic conditions are not essential. Typically, products which will be further processed or are microbiologically stable are suitable candidates for this application e.g. syrup storage tanks, milk silos, catsup and tomato pastes, flavorings and make up water.

Steam

Steam is used for thermal processing either through direct or indirect use as an easy to control heating medium. When the steam is added directly to the product, it must conform to 3-A Standard Number 609-00 (3-A accepted practices for a method of producing steam of culinary quality). The steam must not contain any particles 5.0 microns or larger and has to be prepared from water meeting the standards of the Safe Drinking Water Act. The genera-

tion of steam is usually in carbon steel boilers which are highly susceptable to rusting. The continual operation of the boiler will promote the growth of a fine impervious film of rust which acts as a protective barrier against further corrosion. However, intermittent use will allow a continual supply of fresh air containing oxygen into the boiler and promote the oxidation of iron to iron oxides or rust. This continual generation of rust will lead to flaking (as the film grows in thickness) and contamination of the steam.

Essentially all steam is contaminated either from the fine protective layer or from the larger particles associated with intermittent boiler use. Whenever steam is used to sterilize equipment or filters the particles of rust from the boiler and transfer lines will foul the equipment surfaces. Similarly, the rust particles can also block steam valves, filling orifices, filter pores and stain the surfaces of process equipment. The deposition of rust on the equipment will affect the heat transfer characteristics of heat exchangers and potentially generate crevice corrosion in stainless steel. The net result is an overall loss in the efficiency of processing equipment and the added cost of extra cleaning and passivating to restore the stainless steel to its former condition. The removal of the contaminants with a porous 316 stainless steel filter will alleviate these problems. The selection of a filter with an absolute pore rating of 2.8 micron (gaseous service) or tighter will serve this purpose.

An uninterrupted supply of culinary steam is ensured by installing porous stainless steel filters in parallel to allow the cleaning of one set while the other is in use. Once a filtration system is up and running a pattern of fouling can be established and planned maintenance is usually implemented. This allows uninterrupted consistent production of high quality culinary steam.

The direct injection of non-culinary grade steam into food products will add unwanted contaminants and deliteriously effect the quality and image of the product. Again, a 316 stainless steel filter such as a sintered porous stainless steel element with 2.8 micron removal rating will reliably and consistently remove particulate contaminants from the steam. The 316 stainless steel which resists corrosion can be cleaned for reuse, when the level of trapped contaminant interferes with the operation of the filter.

An absolute rated filter rather than a nominal rated filter ensures that all particles larger than the rated pore size are removed and not just a weighted percentage as defined by a nominal filter. The integrally bonded structure and fixed pore size of absolute filters will ensure continually consistent operation.

Typical installations presently fitted with non absolute rated filters experience media and contaminant migration due to fluctuations in the demand for steam which releases previously trapped particles into the steam. The trend in all food processing operations is for finer filtration and better removal efficiencies of all the contaminants. Legislation requiring the use of a 1.0 micron absolute rated filter or tighter appears to be on the near horizon as both manufacturers and consumers alike push for better products.

Table II gives an overview of filters and suggested media for the various applications in the food and beverage industry.

Table II. Gas Filtration Characteristics of Profile II Elements

Grade Suffix	Clean Flow Rates (1) CFM of Air/PSI/10" Module		DOP (0.3 UM)(2) Efficiency %
	RF Style	AB Style	
005	4.0	6.0	>99.9999
007	4.4	6.5	>99.9999
010	4.9	7.0	>99.9999
020	5.3	8.0	>99.9999
030	7.6	9.3	>99.9999
050	13.0	13.0	>99.9999
070	20	20	>99.9999
100	32.3	32	99.2
120	40	40	96.5
150	49	49	88.0
200	93	93	84.8
400	240	240	48.3
700	560	560	34
900	840	840	25

(1) For longer modules, increase the flow rates listed in proportion. The flow rates listed do not take into account pressure losses due to flow in the internal diameter of the element, which becomes significant above 40 to 60 cfm.

(2) Air flow rate used for these data was 20 cfm/10" module, except grade 700, which was run at 4 cfm.

[1]*Dioctylphthalate fog method (DOP). For a description of this test see: Military Standard No. 282 (MIL-STD-282, 28 May, 1956) - Method 102.9.1; Naval Supply Depot, 5801 Tabor Avenue, Philadelphia, PA 19120.*

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The Yogurt Story - Past, Present and Future Part IX

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(Part VIII of The Yogurt Story - Past, Present and Future appeared in the December, 1991, issue of Dairy, Food and Environmental Sanitation, pages 729-733)

Yogurt and Health

Consumers today are paying close attention to reports on relationship between dietary intake and health. Yogurt has been promoted as a healthful food for more than 80 - odd years, ever since Metchnikoff's treatise on the "Prolongation of Life" (2). Over the past few years, studies have been conducted around the globe to understand the general "health-promoting" attributes of yogurt. Some of these have been *in vitro* microbiological experiments and others *in vivo* observations using laboratory animal feeding studies. A few controlled human feeding studies using yogurt have also been published. Although a great deal of literature has accumulated, it is still difficult to draw direct correlating evidence for "health promoting," cancer-preventing or hypocholestremic effects brought about by yogurt consumption. There are definitely some health benefits in consuming yogurt regularly. These probably vary from individual to individual and quite possibly are related to life styles and eating habits. We could, however, list a few attributes of yogurt that have a bearing on general well-being.

Nutritional Benefits of Yogurt

Yogurt is made from milk. The milk may be standardized, skimmed or fortified with extra non-fat milk solids for yogurt manufacture. So, yogurt essentially has all the nutritive components of milk. Milk proteins, namely casein, lactalbumin, lactoglobulin and other minor nitrogenous components are nutritionally high quality proteins. In fact, casein is the standard against which other proteins are compared for nutritional efficiency (P.E.R). From a nutritional angle, consumption of milk or yogurt by vegetarians provides some of the essential amino acids absent or deficient in vegetarian protein sources like pulses, and peas. In many of the underdeveloped countries, where the major caloric and dietary intake consist of grains, tubers, and pulses or beans, and animal proteins in the form of meat or fish are out of the reach of common man or is prohibited by dietary laws, the consumption of milk or yogurt becomes crucial. Vitamin A deficiency is a prime cause of eye disorders in many under-developed countries. Carotene or vitamin A as such is present in cow's as well as water buffalo's milks, and when whole or partially skimmed milk is used for conversion to yogurt, this fermented product is a good source of this vitamin. The same goes for other fat- and water- soluble vitamins in milk. The major advantage of yogurt over fluid milk under conditions prevalent in such countries is the relative stability and safeness of acid containing fermented milks. This especially becomes important in transporting and distributing perishable products in tropical climates where refrigeration is uncommon and proper sanitation is lacking. This view was eloquently stated by Djien (1) thus: "Basically, fermented foods are agricultural products which have been converted by enzymic activities of microorganisms into desirable food products whose properties are considered more attractive than those of the original raw materials. Moreover, if manufacturing procedures are properly followed, the foods are usually safe for consumption. All of these beneficial properties of the final product increase the economic value of the original agricultural commodity. Generally, traditional methods of manufacturing fermented foods are not complicated, and expensive equipment is not required. Therefore, fermentation of indigenous foods is considered an inexpensive and effective means of food production that could be utilized in alleviating world food problems." Yogurt or variations of yogurt are widely consumed with native breads or cooked rice in many of the underdeveloped countries in the Middle East and South Asia. Hence, there are no cultural barriers against daily intake of yogurt.

Another benefit in consuming yogurt is its high content of calcium and phosphorus. The combination of both these minerals in milk and yogurt increases their bioavailability. This makes it important for expectant mothers and children to regularly consume milk or yogurt. Osteoporosis, that afflicts especially older women, could be avoided by the consumption of yogurt.

Other nutritional benefits have been reported in the literature. Sellars has reviewed many of these reports(3). One of the unique nutritional benefits derived through consumption of yogurt and other fermented milks relates to alleviation of problems associated with lactose intolerance. Persons suffering from lactose malabsorption experience extreme discomfort with diarrhea and gas with the consumption of milk. Because of this, such persons are unable to consume milk or milk based foods. Microorganisms used in the manufacture of yogurt liberate the enzyme that breaks down lactose into the milk during yogurt manufacture. Residual levels of this enzyme, *lactase*, is usually present in the finished yogurt. The presence of this free enzyme helps

the breakdown of lactose in the gut. Also, as yogurt starter bacteria lyse in the gut, more of the intracellular *lactase* is liberated. Because of the availability of the lactose-splitting enzyme in yogurt, persons who cannot consume milk will still be able to include yogurt, a representative of the dairy group, in their diet. Yogurt, indeed, would be a suitable dairy product for persons who suffer from slight or moderate lactose malabsorption.

Yogurt and Intestinal Health

The intestinal health of a normal, healthy person is to a large extent governed by the intestinal flora. To maintain normal health, a certain balance of various organisms in the gut is needed. During or after intestinal disturbances or after any illness for which antibiotic therapy is administered, the balance of the gut flora is affected. The normal intestinal flora of a healthy individual contains *Lactobacillus acidophilus* and bacteria belonging to the genus *Bifidobacterium*. When the balance of gut flora is affected, there usually is a decrease in the proportion of these bacteria. The numbers of these bacteria decrease in the feces of individuals suffering intestinal disorders or those who have had antibiotic therapy. The balance can be restored by regular intake of foods containing these bacteria. Yogurt containing these bacteria is a good vehicle to deliver these bacteria to the gut. Yogurt starter bacteria themselves may alter the environment in the gut to favor the desirable ratio of the lactic acid bacteria in the gut. The factors and the microenvironment affecting the balance of gut flora appears to be complex. It is possible that regular consumption of yogurt, a highly acid product, influences the microenvironment favoring the establishment of the desirable lactic acid flora. Several recent reviews discuss the role of yogurt bacteria and associated lactic acid bacteria in the maintenance of intestinal health. For further details the reviews by Sandine (5), Gregor Reid et.al. (4) and several authors in a book published by National Yogurt Association (3) should be consulted.

Other Reported Health Benefits

Several other reports are found in the literature linking yogurt bacteria and other associated lactic acid flora to reduction of serum cholesterol, immunocompetence, and anticarcinogenic effects. More detailed observations backed by clinical evidence gathered by using large number of subjects are necessary to establish these isolated claims. For further details the aforementioned reviews should be consulted.

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Updates . . .

Pre-Meeting Workshops for the 1992 IAMFES Annual Meeting

Hazard Analysis at Critical Control Points (HACCP)

Conducted by **Frank L. Bryan, Ph.D., M.P.H.**

This day and a half workshop will provide step-by-step instructions to develop, implement and refine the HACCP system in the food processing and foodservice sectors.

The procedures and practices to be discussed will include:

- Evaluation of Operations for Hazards and Risks
- Measurement of Time-Temperature Exposures
- Measurement of pH Level of Foods
- Collection of Samples
- Testing of Samples for Pathogens
- Measurement of Water Activity (a_w)
- Analyses of Measurements
- Flow Diagrams of Food Production Processes
- Determination of Critical Control Points
- Establishment of Control Criteria
- Monitoring Data at Critical Control Points
- Verification of HACCP Systems Effectiveness

Workshop Hours will be:
Friday, July 24th - 1:00pm to 5:00pm
Saturday, July 25th - 8:00am to 5:00pm

Costs:	Member		Non-member	
Before 6/1/92	$175(US)	$200(CN)	$200(US)	$230(CN)
After 6/1/92	$200(US)	$230(CN)	$225(US)	$260(CN)

Monitoring/Measuring Environmental Sanitation in Food & Dairy Plants

Conducted by **J. Russell Bishop, Ph.D.**

This one day workshop is designed to provide participants with a working knowledge of proper monitoring of environmental sanitation. The workshop will present the hows and whys, as well as the interpretation and consequences, of proper monitoring.

Issues will be addressed from four perspectives:
Chemical (Sanitation) Industry
Testing Methods Manufacturers
Food Processing Industry
Environmental Services Laboratory

Representatives of these areas will share their experience and expertise with workshop participants.

Specific topic areas to be covered will include:

- Environmental Sanitation
- Monitoring of Quality Assurance Programs
- Various Testing Methods, ie.: Air, Swab, ATP, Petrifilm®
- Acceptable Bacterial Loads
- Sanitation Consequences

Workshop Hours will be:
Saturday, July 25th - 9:00am to 5:00pm

Costs:	Member		Non-member	
Before 6/1/92	$150(US)	$175(CN)	$175(US)	$200(CN)
After 6/1/92	$175(US)	$200(CN)	$200(US)	$230(CN)

For Further Information contact: Mr. Steven K. Halstead, CAE, Executive Manager
International Association of Milk, Food and Environmental Sanitarians
502 E. Lincoln Way Ames, Iowa 50010
(800)369-6337 (U.S.), (800)284-6336 (Canada),FAX (515)232-4736

REGISTRATION FORM

❑ **Hazard Analysis at Critical Control Points (HACCP) Workshop**
Sheraton Centre — Toronto, Ontario — July 24-25, 1992

or

❑ **Monitoring/Measuring Environmental Sanitation in Food & Dairy Plants**
Sheraton Centre — Toronto, Ontario — July 25, 1992

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(*Note: Early Registration Deadline—June 1, 1992)**
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News

Feta Cheese, Salted Whey Can Harbor Listeria

Feta cheese can be consumed 15 days after manufactured if made from pasteurized milk; if made from raw milk, some countries require a 60-day ripening period. The ripening period may not eliminate *Listeria monocytogenes* from the cheese, University of Wisconsin-Madison research has shown.

The results indicated that *L. monocytogenes* is much more tolerant than other pathogens of conditions in Feta cheese and other kinds of white brined cheese. If cheese made from raw or heat-treated milk contains *L. monocytogenes*, ripening at or above 35 F (1.7 C) for 60 days will not ensure a pathogen-free product, according to E. H. Marth, emeritus professor of food science and microbiology.

If present in milk and thus in Feta cheese, Listeria can grow to hazardous levels in the cheese during initial ripening. This emphasizes the importance of using properly pasteurized milk and adequate hygienic practices in cheesemaking, Marth says.

In trials at the College of Agricultural and Life Sciences, researchers made six lots of Feta cheese according to standard procedures, using *Lactobacillus bulgaricus* and *Streptococcus thermophilus* starter cultures. They inoculated vats of pasteurized cow's milk with 5,000 cells of *L. monocytogenes* per milliliter, with Scott A or California strain. This level is probably higher than would be encountered in tanks of commingled milk, but was necessary for these tests, Marth notes.

The cheese was ripened at 72 F (22 C) for one day in 12-percent salt brine, then in 6-percent salt brine at 72 F for four days. The cheese was then stored in the same 6-percent brine at 39 F (4 C). The Feta cheese had an average moisture content of about 55 percent, average fat in dry matter was 44 percent, and average salt content was 2.3 percent.

Favorable conditions, including high-moisture curd, temperatures of 72 to 82 F (22 to 28 C) during curd drainage and ripening, and an initial pH of 6.65 promoted *L. monocytogenes* growth, especially during the first 24 hours.

The pathogen survived in Feta cheese during storage at 39 F for more than 90 days, even at the low storage pH of 4.3. Strain Scott A tolerated storage conditions better than strain California. After 90 days, strain Scott A populations decreased only half as much as strain California populations.

Survival in Feta brine

L. monocytogenes migrated from the cheese into the 12-percent salt brine after 24 hours of use, Marth found. Experiments involving whey containing 12 percent salt showed that even with favorable temperatures and pH, the pathogen was unable to grow and eventually died off due to the salt concentration.

However, *L. monocytogenes* grew in the 6-percent salt brine during ripening of cheese at 72 F. After initial growth, the pathogen survived in the 6-percent salt brine for more than 90 days during storage at 39 F. In most samples, the brine had a slightly higher population of the pathogen than did the cheese in that brine. Populations of both strains decreased in the brine during storage, with strain California proving less tolerant than strain Scott A of the storage conditions.

Behavior in Salted Whey and Salted Skim Milk

Samples of deproteinated whey and skim milk containing 6 percent or 12 percent salt were inoculated with strain Scott A or California. The 6-percent samples received 1,000 cells per milliliter; the 12-percent samples 5,000 cells/ml. The whey pH averaged about 5.6; the skim milk pH about 6.1.

The samples were inoculated at 72 F to simulate conditions in countries where white brined-type cheeses are stored at room temperature. Both strains grew faster in the 6-percent-salted whey than in the 6-percent-salted skim milk, with generation times of about 3.6 hours versus 4.4 hours. *L. monocytogenes* populations peaked after five days of incubation, and were higher in the whey samples than in the skim milk samples, regardless of strain. Generation times were about 11 times longer at 39 F than at 72 F, Marth found.

Both strains gradually died off in 12-percent salted whey and skim milk incubated at 72 F, but strain Scott A proved more salt-tolerant than strain California. Strain California survived for 80 days in the whey and 105 days in the skim milk; strain Scott A survived for more than 130 days under the same conditions.

L. monocytogenes proved much more salt-tolerant at low temperatures. After 130 days of incubation at 39 F, numbers of both strains declined by less than 60 percent, Marth found.

"Brine, salted whey, or salted milk used for pickling different varieties of white brined cheese have to be prepared under hygienic conditions to prevent contamination with *L. monocytogenes*," Marth concluded. He stressed the need for properly pasteurized whey or milk, along with pickling solutions with a pH of less than 5.0 to prevent the pathogen from growing if it is present.

The pathogen appears in leukocytes (white blood cells) in the milk of *Listeria*-mastitic cows up to three months after clinical symptoms have disappeared. If present in large numbers of leukocytes, some *L. monocytogenes* cells can survive minimum high-temperature short-time pasteurization.

cont. on p. 226

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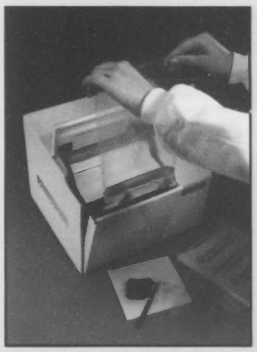

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While listeriosis rarely threatens healthy adults, it can sicken newborn babies, immunocompromised people and pregnant women, and cause stillbirths and miscarriages. As few as 1,000 *L. monocytogenes* cells can sicken susceptible individuals. Infections can produce meningitis, meningioencephalitis and encephalitis, as well as less-serious ailments.

Marth worked on these studies with Demetrious Papageorgiou, now of the Aristotelian University of Thessaloniki in Greece.

For more information contact Elmer Marth at (608)262-3046.

AFFI Submits Frozen Food Industry Position on Food Labeling Regulations

Following months of intensive review, the American Frozen Food Institute (AFI) today submitted its recommendations to the Food and Drug Administration (FDA) and the U. S. Department of Agriculture (USDA) on the agencies' food nutrition labeling proposals.

In the comments, AFFI expressed support of FDA's and USDA's continuing efforts to reform food labeling, but indicated that changes are necessary to make the regulations as beneficial as possible for consumers and most economically feasible for the food industry.

"AFFI believes that the food label should serve as an accurate means for providing nutrition information to assist consumers in selecting foods consistent with individual dietary preferences," state AFFI President Steven C. Anderson in the comments. "I think both the FDA and USDA proposals can accomplish that as long as our recommendations are applied to the final rulemaking."

Highlights of AFFI's comments focused on implied nutrient content claims, use of descriptors, serving sizes and the Nutrition Labeling Verification process (unique to the USDA proposals).

According to AFFI, FDA's proposed definition of an implied nutrient content claim is far broader than that required by the Nutrition Labeling and Education Act (NLEA), and does not offer the food industry enough guidance in determining which statements would be considered implied claims.

Statements concerning an ingredient's character, quality, presence or absence should not be considered an implied claim, said Anderson. "Such representations do not characterize the level of a nutrient and thus fall outside the statutory definition of a nutrient content claim," he added.

Anderson stated that the following items should not be considered implied claims: statements about an ingredient's character, quality, presence or absence; references to the relationship between a food and recognized, authoritative dietary recommendations; and factual statements about nutrient levels.

"If the definition for an implied claim is too restrictive, the dissemination of valuable nutritional information to consumers could be impeded, and could discourage the development of new, healthful products," said Anderson.

AFFI supports FDA's proposal to define "free" for total fat, cholesterol, sodium, sugars and calories as being a "dietarily insignificant source of" or a "trivial source of" the intake of these nutrients. The *de minimus* nutrient threshold levels to appear above the claim are proper because at these levels the specific nutrients are of no public health concern, noted Anderson.

AFFI further believes FDA should revise the definition for "low" sodium for meal-type products by increasing it to 200 milligrams per 100 grams, rather than 140 milligrams per 100 grams as proposed. "The 140 milligram level is overly restrictive and would eliminate such claims for many frozen meal-type products that have been formulated to contain significantly less sodium than other typical frozen food products," said Anderson.

He added that raising the guidelines to 200 milligrams of sodium per 100 grams would strike a reasonable balance and provide manufacturers an incentive to reduce the sodium content of their meal-type products.

AFFI also believes that nutrient density evaluated on a per 100 grams basis for individual foods is overly restrictive and should be deleted from the agency's final regulation. According to Anderson, the applicable serving size based upon amounts customarily consumed provides a sufficient reference point from which to measure nutrient levels.

In regulating relative claims such as "reduced" or "light," AFFI emphasized the importance of ensuring appropriate reference to the food from which the reduction of the nutrient can be measured. "It should be sufficient for a manufacturer to declare the reference food on the principal display panel," said Anderson, "with more detailed numerical information regarding the comparative claim on the nutrition panel."

Relative claims for individual foods should be based on reference to appropriate individual food but not in the overly proscriptive manner proposed by FDA, he continued. The practical consequences of the FDA proposal would be over restriction of the use of relative claims, especially for the term "light," where an industry-wide norm is the only comparison available.

AFFI feels that this result is completely at odds with the NLEA's goal of providing consumers meaningful nutrition information. "FDA should abandon this unduly burdensome and unrealistic feature of its proposal and, in the alternative, require manufacturers to have a reasonable basis for the manner in which they arrive at the reference point for a particular relative claim," Anderson stated.

AFFI also questioned FDA's limitation on a "light" calorie claim based on a food's fat content because consumers may find a benefit from a food formulated to contain fewer calories, regardless of the food's fat content. If the fat criterion is retained, said Anderson,

AFFI suggests that a reduction of fat by 25 percent would be more realistic.

As for FDA's alternative proposal to use the terms "less," "reduced," and "fewer" interchangeably — but accompanied by a statement indicating the percentage by which a nutrient is reduced — AFFI support's this option. AFFI believes, however, that restricting such claims to an absolute difference of an amount exceeding the value of "low" for that nutrient would be overly restrictive and would limit the incentive for manufacturers to develop new, healthier products.

"AFFI proposes that comparative claims not be permitted in those instances where the reference food would meet the "low" definition for the nutrient for which the claim is made," said Anderson. "The comparison proposed by FDA, therefore, is inappropriate."

AFFI supports FDA's alternative proposal that the reference foods for claims using the terms "reduced" and "less" (or "fewer") be an industry-wide norm, a manufacturer's regular product or a valid data base.

Overall, AFFI agrees with the following: FDA'S propose definition of the term "more;" FDA's proposed definition of meal-type products; and measuring the level of a nutrient solely on a per 100 gram basis for meal-type products.

AFFI originally concurred with FDA's judgment that the definition of a "low" calorie meal-type product should be used to designate foods with no more than 105 calories per 100 grams. Following further consideration, however, AFFI suggests that a "low" calorie meal-type product should be used to designate foods with no more than 120 calories per 100 grams.

"This position is based on an analysis of the marketplace wherein the average weight of a 'low' calorie meal-type entree was divided by 300 calories, the accepted industry norm for low calorie meal-type products, and calories per 100 grams were calculated," Anderson noted.

Serving Sizes

AFFI raised several concerns in the area of serving sizes, including the need for FDA to further clarify its guidelines for selecting the appropriate reference amount for a product. As for meal-type products, AFFI proposed that no reference amounts are necessary.

"AFFI finds it puzzling that FDA proposes a product category for 'mixed dishes' which would include products that also would meet the definition of a meal-type product," said Anderson. "AFFI urges FDA to delete the mixed dish category, or to clarify the products which would qualify as meal-type products but would not concurrently be regulated as a mixed dish."

Listing all vegetable products with a value of 85 grams as the reference amount is acceptable to AFFI.

Fat and Cholesterol Claims

In its comments, AFFI proposed that fat content should be stated in 1-gram increments, rather than 0.5-gram increments as proposed. "Rounding to whole numbers is less cumbersome, will not jeopardize accuracy, and will prove more meaningful to consumers," added Anderson.

AFFI supported FDA's proposal to label a food "low fat" if the food contains three grams or less of fat per serving for an individual product. The proposal would permit low fat claims to be made about meal-type products when the product contains three grams or less of total fat per 100 grams of product.

AFFI supports allowing manufacturers to use interchangeable terms regarding fat content, such as "low fat," "low in fat," "contains a small amount of fat," "low source of fat," "little fat," and claims of "low in saturated fat," "low saturated fat," "contains a small amount of saturated fat," "low source of saturated fat," or "a little saturated fat."

FDA's proposal would establish a disclosure level for fat of 11.5 grams per serving and per 100 grams, and would require any cholesterol claim for these foods to be accompanied by a disclosure of the fat content of the food in immediate proximity to the claim. AFFI pointed out that requiring the number of grams to be stated as proposed would have great potential to mislead consumers.

"It unduly would highlight the amount of fat, regardless of whether the actual amount is significant. Moreover, it would create a 'good food/bad food' impression which is at odds with dietary recommendations that stress the importance of having food selections made in the context of a total diet," said Anderson in the comments.

AFFI's comments to USDA on meat and poultry products were similar to those submitted on the FDA proposals. Points of difference, however, concern prior label approval and the deletion of the Nutrition Labeling Verification (NLV) process.

AFFI suggested that USDA continue the current prior label approval system, but streamline procedures to make the process more efficient and less time consuming.

AFFI further recommended that if USDA intends to include a significant change to the system, it should be in the form of a proposed rule, subject to public comment.

As for compliance and analytical methods, AFFI feels the Nutrition Labeling Verification (NLV) requirements currently in place are unnecessary and costly. "FSIS will be unable to review labels in an expeditious fashion if NLV requirements are retained," said Anderson. "Accordingly, the NLV approach should be abandoned, not modified, as suggested by FSIS."

Finally, AFFI suggested that the implementation deadline for companies to comply with all of the proposed regulations (May 1993) be extended to 18 months following publication of the final nutrition labeling regulations.

"It is less than plausible that printers across the country could produce the new labels within a six month timeframe," stated Anderson. "Furthermore, the sheer volume of labels that will require FSIS' prior approval will greatly strain the agency's resources. A realistic

implementation period will ensure that the planned nutrition labeling reform proceeds in an orderly fashion and helps to minimize overall cost."

AFFI is the national nonprofit trade association that has represented the interests of the frozen food industry for 50 years. AFFI's member companies account for more than 90 percent of the total frozen food production in the U.S.

Editor's Note: For a complete copy of AFFI's comments, contact Traci Vasilik, director of communications, at (703) 821-0770.

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HACCP-An Industry Food Safety Self-Control Program - Part IV

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Foodborne and Waterborne Illness

Annual Estimated Cases and Deaths in the United States. Does the United States have a food safety problem? The answer is, "Absolutely, yes!" While we have some of the safest food in the world, our food still makes millions of people ill each year, and causes death in some cases. The table, **Foodborne and Waterborne Illness**, shows the most current estimated numbers of foodborne illness cases and deaths in the U.S. per year.

Since the Centers for Disease Control information is insufficient, this table is a compilation of estimates made by Bennett et al. (1987), Roberts (1990), Roberts and van Ravenswaay (1989), and Todd (1989), plus information from CDC (1989).

Foodborne and Waterborne Illness

Annual Estimated Cases and Deaths in the United States

CAUSE	CASES	DEATHS
BACTERIA		
Bacillus cereus	84,000	0
Streptococcus (grp. A)	500,000	175
Yersinia enterocolitica	20,000	2-3
Staphylococcus aureus	8,900,000	7,120
Salmonella (non-typhi)	3,000,000	2,000
Campylobacter spp	2,100,000	2,100
Shigella spp	300,000	600
Escherichia coli (enteric)	200,000	400
Brucella spp	50,000	0.1
Clostridium perfringens	650,000	6-7
Vibrio cholerae/vulnificus	13,000	1-2
Vibrio (non-cholera)	30,000	300-900
Clostridium botulinum (adults)	100	2-3
Infant botulism	60	?
Salmonella typhi	600	36
Listeria monocytogenes	25,000	1,000
Miscellaneous microorganisms	107,000	11
VIRUSES		
Hepatitis A	48,000	150
Norwalk virus	181,000	0
Other viruses	6,000,000	6
PARASITES		
Trichinella spiralis	100,000	1,000
Giardia lamblia	7,000	0
Toxoplasma gondii	2,300,000	450
Taena spp	1,000	10
Fish parasites	1,000	0
CHEMICALS/TOXINS		
Ciguatera toxin	27,000	2.1
Chemical poisons	96,000	5.4
Plant poisons	7,000	5.9
Scrombroid toxin	31,000	0
Paralytic shellfish poison	260	0.3
HARD FOREIGN OBJECTS	_____?	_____?
TOTAL	Cases 24,779,020	Deaths 15,990

This table belies the government statement that the U.S. has the safest food in the world. **25,000,000 foodborne illness cases and 16,000 deaths a year** is a national disgrace. Our food is actually highly contaminated. However, because food is usually cooked very well, most of us do not get sick. Today, the government and food growers and processors expect the person who does the final food preparation to be the critical controller. This means that the food preparer must either wash off the contaminants from the food, kill the pathogenic microorganisms, or not allow these organisms to multiply. As a long-term goal, the government cannot make the food preparer responsible for controlling unnecessary contaminants which processors and growers allow to contaminate the food.

The table does not report on chemical hazards. Chemical hazards include standard chemical poisons such as cleaning compounds that get into food by mistake, or food additives such as sulfites, monosodium glutamate, and nitrites in food, which are added to food in excess through human error. Actually, compared to microorganisms, chemicals are insignificant hazards. Since chemical control standards are well established, the only problem is educating people to know how to correctly use chemicals.

Also, the government keeps no records of injuries and deaths caused by hard foreign objects. While hard foreign objects normally do not cause death, they are, according to insurance companies, the most expensive foodborne illness hazard in terms of insurance claims paid. When a foodservice customer bites a peppercorn or a stone and breaks a tooth, or chokes on a metal sliver, there is little doubt that the object came from a food item, and often, the foodservice establishment is sued immediately.

New USDA Chemical and Pesticide Data. Animal antibiotic and other **drug residues** are also a potential problem in terms of foodborne illness hazards. In addition to causing human death, these drug residues can cause violent allergic reactions in some people who consume products made from overdosed animals.

Nonetheless, the rules for safe use of drugs are well established, and many farmers have self-regulation programs. Hence, the drug residue problem is reasonably well controlled. In 1990, the USDA sampled 35,561 livestock for drug residues and found contamination in 132 samples. The USDA took 9,132 poultry samples and found residues in 12 animals (Carnevale and Sachs, 1991).

Prioritizing the Microbiological Standards. Control cannot be accomplished all at once. **First attention must be given to the greatest causes of illness: microorganisms.** *Staphylococcus aureus* is the leading cause of foodborne illness and deaths. *Salmonella* (non-typhi) and *Campylobacter* spp. are the second and third leading causes. *Shigella* spp., *E. coli*, *Vibrio* (non-cholera), and *Listeria monocytogenes* must also be included in the priority group. Note that *Clostridium botulinum* probably kills more babies than it does adults. At two or three deaths per year, *Clostridium botulinum* clearly does not deserve as much immediate attention as the previously mentioned microorganisms, which kill thousands of people.

The known **viruses** Hepatitis A and Norwalk cause many foodborne illnesses, but other viruses cause many more illnesses than both Hepatitis A and Norwalk. In the **parasite group**, *Toxoplasma gondii*, which is rarely mentioned, is widely recognized by experts as being a major foodborne illness problem in the U.S. Note that *Trichinella spiralis* is estimated to cause 1,000 deaths annually, and *Toxoplasma gondii*, 450 deaths per year.

National Cost of Foodborne Illness and Death. Using an estimated cost of $3,000 per illness derived from the references, one can see that the 24,779,020 illnesses cost $74,337,060,000 per year. The estimated cost of each foodborne illness death, including insurance and other expenses, averages $42,300. When multiplied by the estimated 15,990 deaths per year, the annual total cost of foodborne illness deaths is $676,377,000. The total cost of foodborne illness and death to the U.S. economy, then, is $75,013,437,000 annually. **These incidents and their costs are all preventable with education.**

Risk Management vs. Zero Defects. While the government speaks of risk and risk management, one foodborne illness can destroy local customers' faith in a foodservice establishment to the point of putting that restaurant out of business. Hence, risk management cannot be an objective of the retail foodservice industry's hazard control programs. **The only goal can be ZERO risk of foodborne illnesses and deaths.**

A Total Approach to Hazard Control

While the threat to which the government refers is normally only microbiological, research data and claims paid by insurance companies indicate that there exists a wider variety of hazards in our food environment. If a food safety program is to be useful, it must encompass all elements of customer liability faced by food suppliers. The following is an inclusive list of hazards. Note, if one wants to enjoy a long illness- and disease-free life, even nutrition becomes a very important element (Cliver, 1990).

Microorganisms and Toxins. Microbiological hazards include **bacteria**, which have two forms: **vegetative cells**, which are controlled by pasteurization; and **spores**, which are controlled only by commercial sterilization, freezing, or acid, not by pasteurization. **Molds**, which cause some allergies, also can produce deadly toxins. **Viruses** are notorious for causing infective types of illness, including foodborne illness. As shown in the previous table, **parasites** are also major causes of foodborne illnesses in the United States.

Toxic Substances. In addition to microorganisms, there are toxic substances. These include:

1. Intentional food additives (GRAS)
2. Chemicals created by the process
3. Agricultural chemicals: pesticides and herbicides
4. Antibiotic and other drug residues in meat, poultry, and dairy products
5. Accidental addition during food handling (e.g., cleaning compounds)
6. Equipment material leaching (e.g., copper from equipment parts)
7. Packaging material leaching
8. Industrial substances: from the environment.

Monosodium glutamate (MSG) is a "**Generally Recognized As Safe**" (GRAS) food additive which has received much notoriety. MSG was declared as GRAS before it was recognized that there are toxic levels, about 0.5 percent (weight/weight), which should not be exceeded. When used correctly, MSG is safe.

Food processing, such as broiling, produces chemicals that are toxic at high levels. **Agricultural chemicals** (i.e., pesticides, and herbicides) even though they are less of a direct threat to consumers than is assumed, they have a great impact on water systems. When it rains, these toxic substances can run off into rivers and lakes, affecting aquatic animal and plant life that comes into contact with the run-off.

Accidental addition of toxic substances during food handling in the foodservice operations could also occur, since foodservice operations use caustic compounds for cleaning. **Equipment material**, such as copper, can leach into food and cause problems. **Package material** may leach as well. **Industrial chemicals** from the environment may also find their way into the food system.

Adverse Food Reactions. Adverse food reactions are only indirectly controlled by the government, yet they are a major cause of customer complaints in the foodservice industry. It has been estimated that 3 to 5 percent of the population is capable of experiencing adverse food reactions. It is known that nuts, milk, gluten, and other normal foods can cause violent reactions and even death to sensitive people who consume them. Adverse food reactions include:

1. Food allergies
2. Food intolerance
3. Food toxins
4. Metabolic food reactions
5. Pharmacological food reactions
6. Food idiosyncrasy
7. Food sensitivity.

Nutrition. Nutrition plays a part in foodborne illness. Food is consumed in order to properly nourish the body. Yet, there are anti-nutritional factors which are controlled only with heat. Conditions of over-nutrition can lead to cancer formation and heart illnesses; under-nutrition is a form of starvation which has reached monumental proportions in the U.S. and several parts of the world.

Hard Foreign Objects. Hard foreign objects are not recognized by the government as hazards in the retail food environment, yet a wide variety of hard foreign objects find their way into food and cause choking or injuries. In this category would be overly large pieces of food (e.g., a bite of hot dog that was too large, and caused the consumer to choke) and twist ties.

Fraud. Fraud is a problem that is particularly prevalent in the food processing industry. Each year, approximately 2,000 product recalls are directed by the USDA because of misbranding of food products. Resultant fines can be $5,000 to $10,000, and prison sentences of up to six months have been leveled by the government on companies and their owners/managers who are found guilty of fraudulent labeling. Unfortunately, there are individuals who seek personal gain through dishonesty. Therefore, regulatory audits are necessary.

What Is a Microbiological Hazard?

Risk Clientele. Chemical and hard foreign object hazards are well understood and directly controllable. However, microbiological hazards require special attention. First, one must consider **at-risk clientele**. Normally healthy people who have a good nutritional status can typically tolerate moderate levels of microorganisms, as will be discussed. On the other hand, there is an at-risk population. These people are **immune-compromised** and cannot tolerate even low levels of microorganisms. The at-risk population includes:

1. Infants
2. Hospital patients
3. People with allergies
4. Pregnant women
5. Frail, elderly people
6. Malnourished individuals
7. People with controlled physical or metabolic disorders (e.g., diabetes or high blood pressure).

The USDA and FDA have stated that people who are at risk must be responsible for choosing food products that will not cause them harm or death. Their physicians will be expected to help them

determine what is and is not safe. People who sell food to at-risk individuals, then, have the responsibility to know what ingredients are contained in products, so that if someone asks whether or not a particular ingredient is present, sales personnel can (and must) provide an accurate answer.

For example, because of low levels of pathogenic microorganisms in raw and rare food, pregnant women should not eat from salad bars, or consume rare or raw food when dining out. They should avoid eating raw food when they do not know if the food was washed/handled correctly. The elderly and those on antibiotics or other medicines should only eat food that is correctly pasteurized.

Microbiological Hazard Criteria. One must understand that our living environment is contaminated and always will be. Animals in the woods, soil, air, water, and people that handle food can introduce **pathogenic** microorganisms into the food. These are threats. **In order for a food to become hazardous**, the following criteria must be met:

1. **Pathogens must be present in the environment**. If a packaging room functions in a pathogen-free environment, there is no problem of cross-contamination, even if the food is cooked and then handled in an open environment prior to final packaging.
2. **Pathogens must find their way to the food or beverage**. It is incorrect to assume that because, for instance, there are pathogens in the kitchen floor drain, these pathogens are automatically a hazard. Until shown that they can get into food, they are only a threat. If there is management control which prevents the pathogens from transferring from the drain to the food, then there is no hazard because the threat is controlled.
3. **Pathogens must be at high enough levels to outgrow in the product to a hazardous level**. For example, many foods are contaminated with low levels of *Clostridium botulinum*, less than 1 per 500 grams of food. However, at low levels, this pathogen is unable to outgrow and cause a problem. Hence, low levels of *Clostridium botulinum* are tolerated in chilled food systems.
4. **If there is no operational control and no presence of hazard control programs**, as is generally the case today throughout the food industry, **food contaminants will not be controlled**. If food processors and foodservice establishments have adequate hazard control programs, hazards can be prevented or controlled, even though the food might be contaminated.
5. **The food cannot be spoiled**. People will normally reject spoiled food.
6. **Contamination must reach a level at which a normally healthy person**, who is not immune-compromised, **will be made ill**. Remember, people who are immune-compromised must be aware of what they can and cannot tolerate, and must be able to protect themselves from consuming food that is hazardous to them.

Government Microbiological Standards. In 1973, the state of Oregon attempted to legislate microbiological standards for hamburger. Hamburger with more than 5 x 106 APC per gram was not to be served. Four years later, these standards were rejected (Wehr, 1978) (Cliver, 1990) because the only result was severe economic hardship on the wholesale and retail industries. The reasons for this rejection were:

1. Sanitation had not been improved
2. Bacterial levels in ground beef had not been reduced
3. The incidence of foodborne illness had not been decreased.

Current Govemment Checklists. Current government checklists contain items that have no relationship to the safety of food produced in a facility. In the retail environment, these items are referred to as "floors, walls, and ceilings" checklist items. Regulatory personnel are trained to look for facility defects (e.g., broken tiles), as well as for insects (e.g., flies, cockroaches) and pests (e.g., rats), and their droppings. Since these items have not been shown to have any relationship to foodborne illness cases in the retail environment, even though they certainly show lack of management concern, they should not be included in any government hazard control list. It misleads the customer to force restaurants to look clean when the government does not require food establishments, before they are given licenses, to have correct knowledge and have hazard self-control programs for eliminating the contamination present on wholesale food or introduced by food handlers anywhere in the "food chain" from growing and production to consumption.

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Correction: *Dairy, Food and Environmental Sanitation*, Vol. 12, No. 2, p. 84, Section: Pasteurized Crab, 30°F should be 38°F. Sorry for any inconvenience or confusion this may have caused.

Sanitary Design

A Mind Set (Part X)

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Equipment

How many times have you heard - or said - "I wish the (censored) engineer that designed this equipment had to be here to clean it?" Food processing equipment has been, and in many cases still is, designed with only functionality in mind. Designed to correctly perform a specific operation at a certain speed and the marriage of the functional concept with the sanitary design concept or design for ease in cleaning, too often ends in divorce.

Good sanitary design of food and beverage manufacture/processing equipment requires that it be accessible or easily taken apart for cleaning and sanitizing. Panels and covers must be easily removed for access. Unnecessary flat surfaces and hidden or interior channels must be kept to an absolute minimum. Exposed threads on construction bolts should not be in the product zone. Drives, motors and bearings should also be out of the product zone. Sealed gear drives, motors or motor reduction units eventually leak oil. Placing them out of the product zone, which is defined as an area twelve inches either side and below the product or product contact surface extending to the top of the enclosure, greatly minimizes potential contamination by leaking oil. At a recent food processing equipment show, a conveyor manufacturer was proudly showing his latest conveying mechanism. Mounted directly above the conveyor was the motor and drive unit without even a drip pan, showing his engineer had not even thought about the possibility of product or product surface contamination by leaking oil. Motor and drive mountings are one of the many things to be spelled out in the specification package when purchasing processing equipment.

Other equipment specification criteria can be included under a simple statement, "This equipment shall be of sanitary design." USDA makes it easy for meat, poultry and egg processors by approving all the food contact equipment used prior to its installation. The equipment is specified in the USDA manual entitled "Accepted Meat and Poultry Equipment." It is listed by manufacturing company. If it is not listed, then it must either be submitted for approval or not used in USDA inspected plants. USDA is not concerned with equipment performance, only that it can be cleaned, sanitized and does not become a source of contamination for the product. FDA on the other hand, does not offer an approval list of procedure. They do demand that the equipment be cleanable and does not contribute to conditions whereby the product "may" be contaminated.

The product contact surfaces must be nontoxic and noncorrosive to the product, and must not have constituents which migrate or are absorbed by the product. In addition, they must be resistant to cleaning and disinfecting agents under normal use conditions. They must be nonabsorbent to moisture so bacteria, molds and yeasts do not get a foothold and contaminate the product.

Toxic metals, such as the heavy metals, are prohibited by regulations. In general, soft metals do not make suitable food contact surfaces. Hard surfaces should be smooth, continuous and free from cracks, crevices and pits. Ideally, materials should be such that the original surface finish is maintained during the working life of the equipment. The material should not deform, and be resistant to denting, chipping, flaking and delamination.

The materials of choice, therefore, are limited (some due to cost) to a few suitable materials for equipment construction.

Product Contact Materials

Stainless steels are extensively used in the construction of liquid handling equipment and systems. Stainless resists corrosion, abrasion and thermal shock, is easily cleanable and can be sanitized. It meets the requirements of noncorrosiveness, nontoxicity and moisture impermeability as well.

Stainless steels are alloys and chromium is the most common component comprising 12% or more of the steel. The high chromium content allows for easier passivation and gives stainless the ability to resist corrosion. Generally the corrosion resistance of stainless steel increases as the chromium content increases. Other components of stainless steel include nickel which effects the structural and mechanical properties, molybdenum which also increases corrosion resistance, nitrogen, copper, titanium, niobium, sulphur and, of course, carbon. All of these elements play an important part in establishing hardness, corrosion resistance and finish on stainless steels.

Types of stainless used in food equipment are designated in the 300 series. This series is referred to in some areas as 18-8 family (18% chromium and 8% nickel). Of the 300 series, the most commonly used is 304 which has a slightly lower carbon content (0.06%). It is used extensively for pipelines, storage tanks and dairy processing equipment.

Type 316 has an increased nickel content (about 10%) with an addition of 2-3% molybdenum. It has enhanced corrosion resistance and is used with highly corrosive products such as fruit juices and drinks. A variation of 316 is 316L which exhibits better resistance to high salt content products.

Finishes

Most regulations call for food contact surfaces to be smooth, free of cracks and crevices and nonporous so particles of "nutritious dirt," or microorganisms do not become trapped and a contamination hazard.

When viewed under magnification, stainless steel is not smooth. Waves and roughness are readily apparent and are caused by the mechanical action needed to produce the surface. The finish desired must be specified for the product contact surface under consideration. There are no real stainless steel surface finish standards for product contact surfaces processing equipment.

The two most widely used surface finishes for stainless steel sheets used by food and beverage industries are 2B and 4. Number 4 is considered the standard sanitary finish for sheets. Its polished surface is obtained by finishing with a 120-150 mesh abrasive, following initial grinding with coarser abrasives. The smoother the finish, the less time and trouble are required to clean the surface.

For tubing, a classification of full finished (No. 1) is used for general sanitary applications where surfaces are readily accessible for cleaning. Full finished sanitary (No. 2) is tubing having both the inside and outside highly polished to a smoother imperfection-free surface.

In food use, 120 and 180 grit finishes are common. One hundred eighty grit is used for more exacting sanitary uses, such as for dairy use.

Welds

When stainless is used for construction of food processing equipment of pipelines, the preferred way of joining the various pieces together is welding. The quality of any weld finish will depend on the process equipment and if the weld area becomes a product contact surface. Welds in product contact surfaces should be ground and polished to a surface finish similar to that of the original material. Welds not in product areas do not have to be ground as smooth. However, there should be no crevices to hold dirt and make cleaning more difficult.

Pipeline welding, done correctly, using inert gas will usually produce a weld which does not require grinding.

Passivation

Stainless steel will corrode. If a passive (nonreactive) oxide film is formed over the metal, then the corrosion of the metal is greatly reduced. The metal can be passivated in pipeline system by circulating a solution of nitric acid before initial use and periodically during the year. Unrestricted use of hyperchlorite or chlorine (over 10 ppm) in final rinse water increases potential corrosion in stainless steel lines and tanks.

Other Materials

Cast iron is often used for frame work in nonproduct contact equipment. It can still be found supporting equipment in process areas, but its use is discouraged in wet areas due to rust and corrosion. If painted, it is often the source of flaking and peeling paint. It is often used in dry areas as a base for processing equipment.

Mild steel is widespread in the food industry, especially as framework, service pipelines and in dry processing areas. It is usually painted and is often the source of flaking and peeling paint. It should never be used in the product zone.

Galvanized iron is often used for catwalks and platforms. It is not recommended for wet product areas but may be successfully used in dry areas. It reacts with acid products and should not be used for product contact.

Titanium is sometimes used as a product contact surface when processing products with high chloride contents at elevated temperatures such as tomato products and margarine heat exchangers. It has a high cost attached to it.

Aluminum is not recommended as it is soft and is quickly corroded by alkali in cleaning compounds or product and acids as well.

Copper and copper alloys are generally unsuitable for product contact surfaces outside the brewing industry. Copper should not be used as a product contact surface with acidic foods and many vegetables.

Glass was widely used at one time in dairy systems but has been replaced by stainless steel because it has the disadvantage of being breakable.

Food quality natural and synthetic rubbers are used in the food industry for seals and gaskets. Selection of the correct grade of the material for the particular use is as important as the regular inspection of rubber components for any deterioration.

Plastics and various polymers are seeing increased use. Care must be taken to be sure they do not impact a flavor or pass any solids to the product.

They must also be able to withstand any elevated temperature of product or CIP solutions. PVC has been shown to support certain strains of psuedomonas organisms despite the circulation of sanitizers. Plastic piping is relatively inexpensive but may have to be replaced more often due to abrasion and alteration of physical properties by temperature changes.

Wood is not a suitable material for any type of product contact surface or construction of food machinery. Its porous nature allows products to penetrate and becomes a substrate for microbial growth. Once impregnated, it is virtually impossible to clean effectively.

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Q: How long can a chicken stand at room temperature?

This may seem like a silly question. But in the world of food safety it's really an important issue. The Educational Foundation of the National Restaurant Association knows how critical time and temperature are to food safety. That's why time and temperature are the focus of our newly revised ***Applied Foodservice Sanitation (AFS)*** course, the core of the SERVSAFE® Serving Safe Food Program.

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SERVSAFE

Food and Environmental Hazards to Health

Human Rabies—Texas, Arkansas, and Georgia, 1991

From August through October 1991, three persons, one each in Texas, Arkansas, and Georgia, died from rabies. Including these three cases, 16 cases of human rabies have been reported to CDC from 1980 through 1991; seven of these are believed to have been acquired in the United States. This report summarizes epidemiologic and clinical information regarding the three recent cases.

Patient 1. During August 7-9, a woman from Starr County, Texas, had increasing nervousness, shortness of breath, and difficulty swallowing. On August 9, she was admitted to a local hospital with a diagnosis of panic disorder. During the first 3 hospital days, her temperature fluctuated from 97 F (36 C) to 106 F (41 C). On August 12, rabies was first considered in the differential diagnosis because of aerophobia, hydrophobia, agitation, and incoherence alternating with periods of coherence; a skin biopsy and saliva, serum, and cerebrospinal fluid (CSF) specimens were obtained from the patient. An ascending paresis developed, and on August 16 she was transferred to another hospital for a computerized axial tomographic scan of the head; only an old infarct in the left cerebellum was found. After the scan, she had a respiratory arrest that progressed to cardiac arrest; she was resuscitated but did not regain consciousness and died on August 20.

The serum and CSF specimens obtained on August 12 were negative for rabies antibody; in addition, the skin biopsy from the nape of the neck, tested at CDC, was negative for rabies by the direct immunofluorescent antibody (DFA) test. However, on August 17, rabies virus was detected in cell culture of the saliva specimen at CDC. Monoclonal antibody typing showed the rabies virus isolate to be identical to the virus strain found in dogs in Mexico and along the border of Mexico and Texas. A second skin biopsy from the nape of the neck, obtained on August 19, was positive by DFA.

The woman had no known exposure to rabies. She was a native of Texas and had resided all her life in Starr County, where rabies is endemic in dogs and coyotes. She occasionally visited relatives in northern Mexico but had last been there more than 1 year before onset of illness. She had a history of a dog bite at 9 years of age but had no other known animal bites.

As a result of possible exposure to this patient, 43 persons received postexposure prophylaxis. At the first hospital, 30 members of the staff who provided care for the patient—before isolation precautions were instituted on August 12—were treated because of concern about possible exposure to saliva. At the second hospital, postexposure treatment was given to seven persons who assisted in the resuscitation that followed the patient's respiratory arrest and who were unaware of the suspected diagnosis. All six members of the patient's household also received rabies prophylaxis.

Patient 2. On August 17, a man from Clark County, Arkansas, had onset of a sore throat and headache. On August 19, he visited his doctor because of difficulty swallowing and sore throat. On examination, his temperature was 99 F (37 C); he appeared agitated and tremulous and had pharyngitis. He was treated parenterally and orally with antibiotics and sent home. That evening, family members found him pacing and spitting frequently; he appeared anxious and fearful, and his facial muscles were twitching. He was taken to the local emergency room and later was transferred to a tertiary-care hospital, where he complained of headache, generalized itching, difficulty swallowing, and a gagging sensation; he was alert and oriented but tremulous, agitated, and photophobic. Differential diagnosis included drug overdose, viral encephalitis, and tetanus; although rabies was considered, he had no history of animal bites. On August 20, he required intubation because of frequent vomiting and obtundation. He developed rhabdomyolysis, and his temperature was intermittently as high as 106 F (41 C). On August 23, he had a cardiac arrest and was resuscitated but thereafter had no sign of brain stem function. He died on August 25.

Postmortem samples of brain tissue were positive for rabies by DFA testing at the Arkansas Department of Health, and monoclonal antibody typing at CDC suggested a rabies variant commonly found in the silver-haired bat (*Lasionycteris noctivagans*).

The man was a native of Arkansas and had never traveled outside the southwestern region of the state. He had lived in a previously abandoned, rural house. A friend reported that one night in early July a bat had landed on the man's mouth; the patient killed and disposed of it. Although the friend had detected no bites or scratches on the man's face, other friends and co-workers whom the patient had told about the incident recalled bites on his thumb or scratches on his chest.

A total of 99 persons identified as having possible exposures to the patient—from 2 weeks before onset of his symptoms through the time of his death—received postexposure prophylaxis. Of these persons, 32 were community contacts, which included one sex partner, eight family members, 14 health-care personnel who had been near the patient's saliva and vomitus, and nine friends and co-workers who had had recent contact with the patient's saliva through shared utensils. The other contacts included a mortician and 66 (44%) of the 150 hospital staff involved in care of this patient and concerned about their contact with his saliva or vomitus.

Patient 3. On October 2, a woman from Walker County, Georgia, (on the Tennessee-Georgia border) developed sore throat, headache, and fever. She was treated at a local emergency room with parenteral antibiotics and discharged. On October 4, she developed additional symptoms including

difficult and painful swallowing, agitation, and a fever of 104 F (40 C). She was admitted to a local hospital; later that day she was transferred to a referral hospital, where rabies and other viral encephalitides were considered in the differential diagnosis. Her condition continued to deteriorate, with progressive obtundation; on October 8, she died of cardiac arrest. Rabies was diagnosed postmortem by demonstration of Negri bodies in brain tissue and confirmed by DFA at the Tennessee State Department of Health Laboratory and at CDC. Monoclonal antibody typing at CDC suggested the involvement of the same rabies variant as that isolated from patient 2.

The patient had moved to Walker Country, Georgia, from Hamilton County, Tennessee, 8 months before her illness. Extensive interviews with the patient's family and friends in Georgia and Tennessee did not reveal any known animal exposure. She had never traveled outside the United States and had not engaged in outdoor activities.

Editorial Note: Although rabies is enzootic among many species of wild animals, human rabies is rarely acquired in the United States. The last reported case in the United States occurred in June 1990 in Texas, in a county adjacent to that in which patient 1 resided. The last reported cases of human rabies in Arkansas and Georgia occurred in 1956 and 1960, respectively.

A definite bite by an animal was not established as a clear exposure for any of the three patients in this report. A bite by a proven or presumed rabid animal was identified in all 15 of the cases reported in the 1960s and in 18 (78%)of the 23 reported in the 1970s, but only four (40%) of the 10 reported in the 1980s. Because many patients with rabies have died or are severely ill at the time rabies is diagnosed, it is sometimes not possible to determine an exposure. In some cases, however, failure to establish a clear exposure may reflect the possibility that exposure occurred many years before onset of symptoms. Patient 1 may have been exposed when she was bitten as a child, but it is more likely she incurred a recent unreported or unrecognized exposure associated with the rabies epizootic ongoing since 1987 among dogs and coyotes in her county of residence. Canine rabies is a long-standing problem along the U.S.-Mexican border, although human rabies of canine origin acquired in the United States has not been documented since 1979.

Bat rabies is endemic in most states, and bats have accounted for five of the seven indigenously acquired human rabies cases reported since 1980. Although patient 2 had close contact with a bat, no bite was identified, and the patient did not seek postexposure treatment. Patient 3 had no known exposure to rabies but was infected with the same strain as patient 2, suggesting possible exposure to a silver-haired bat.

The earliest manifestations of rabies are commonly nonspecific constitutional complaints. The disease then progresses to one of two distinct presentations: the more common furious form (characterized by hydrophobia, aerophobia, or episodic agitation and anxiety) or the less common paralytic form. Rabies should be considered in any patient with a rapidly progressive encephalitis of unknown etiology, particularly in patients who have lived in an area with endemic canine rabies or who have had an exposure or other close contact with a recognized reservoir of the disease. One hallmark of rabies is its rapid progression to death; no survivors have been reported since 1977.

Rabies postexposure prophylaxis is recommended for all persons bitten or scratched by wild or domestic animals that may be carrying the disease. Exposures other than bites or scratches rarely result in infection. However, postexposure treatment is recommended for persons who report having an open wound or mucous membrane contaminated with saliva or other potentially infectious material (e.g., brain tissue) from a rabid animal. Since the size of bites by bats may be small in comparison to those inflicted by terrestrial animals, it may be prudent to consider postexposure treatment for physical contact with bats when a bite or mucous membrane exposure cannot be excluded. Treatment should always be initiated as soon as possible after bites or scratches by known or suspected rabid animals occur.

Postexposure prophylaxis also is recommended for persons who report a possibly infectious exposure (e.g., bite, scratch, or open wound or mucous membrane contaminated with saliva or other infectious material) to a human with rabies. However, exposure to a human with rabies has never been implicated as a means of rabies transmission except following cornea transplantation from donors who died of unsuspected rabies encephalitis. Casual contact with an infected patient (e.g., touching the patient) or contact with noninfectious fluids or tissues (e.g., blood, urine, or feces) does not alone constitute an exposure and is not an indication for prophylaxis.

MMWR 11/8/91

Cholera Associated with Imported Frozen Coconut Milk— Maryland, 1991

During August 1991, three cases of cholera in Maryland were associated with the consumption of frozen coconut milk imported from Asia. Following an investigation, the product was recalled, and no other cases have been reported.

On August 19, a woman residing in Maryland had onset of severe watery diarrhea and vomiting and, on August 22, was hospitalized with dehydration. *Vibrio cholerae* O1, serotype Ogawa, biotype El Tor, and *Plesiomonas shigelloides* were isolated from the stool specimen obtained from the patient; the *V. cholerae* O1 isolate was confirmed at the Maryland State Department of Health and Mental Hygiene (MDHMH) and CDC and was toxigenic.

The patient had neither traveled outside the United States nor eaten raw shellfish during the preceding month. She and five other persons had attended a private party on August 17. Two of the other persons also had onset of an acute diarrheal illness after the party; incubation periods were 6 hours and 14 hours. Vibriocidal antibody titers were elevated, indicating recent infection with *V. cholerae* O1. One asymptomatic person also had an elevated vibriocidal antibody titer. Thus, four persons attending the party had laboratory evidence of recent infection, and three of the four had symptoms of cholera. None of the four reported recent foreign travel or cholera vaccination.

Food served at the party included steamed crabs and a homemade Thai-style rice pudding served with a topping

made from frozen coconut milk. All six persons ate crabs and rice pudding with coconut milk. However, crabs left over from this party were served at a second party held later on August 17 at the same site; the coconut milk topping was not served. One of 20 persons at the second party had onset of mild diarrhea; specimens obtained from this person and 14 others were negative for vibriocidal antibodies when tested 12-26 days after the party.

The Food and Drug Administration's (FDA) Baltimore District Laboratory cultured unopened packages of the same brand of frozen coconut milk (but a different shipment) as that served at the party. Toxigenic *V. cholerae* O1, serotype Ogawa, biotype El Tor, was isolated from one of six bags tested. In addition, *V. cholerae* non-O1, *V. fluvialis*, *V. alginolyticus*, *Aeromonas* species, and group B, E1, and E2 *Salmonella* were isolated from this product, with coliform counts measuring up to 11,000 most probable number per gram.

No secondary cases of cholera were identified among contacts of the affected persons. In addition, surveillance through emergency rooms failed to identify additional cases in the area. The MDHMH placed Moore swabs in four central sewage collection points in the Baltimore metropolitan and Montgomery County areas as a surveillance measure for the presence of *V. cholerae* O1 infection in the general population; swabs collected from September 11 through October 3 did not yield *V. cholerae* O1.

The implicated product in this outbreak was Asian Best brand of frozen coconut milk, produced in Thailand and exported by a Bangkok trading company to a Maryland distributor. Nineteen shipments, totaling 36,160 8-ounce bags, had been imported since January 1,1991. On September 20, the distributor issued a voluntary product recall, and FDA halted all further importation of this product. The Thai Ministry of Public Health reported that the manufacturer of this brand was not licensed by the Thai FDA and shipped the product only to the United States.

Editorial Note: Of the 24 cases of cholera reported in the United States during 1991, 16 were exposed during travel to South America; all 16 patients were infected with *V. cholerae* O1, serotype Inaba, the strain epidemic in Latin America. Three were exposed during travel to Asia; two of the three were infected with serotype Ogawa, the serotype identified in the patient from Maryland.

The source of infection of the coconut milk implicated in the Maryland cholera outbreak remains under investigation. This product, marketed primarily for home use (distribution to restaurants was limited), is usually consumed well-cooked in ethnic curries and desserts. In this outbreak, the heating of the coconut milk was apparently insufficient to kill cholera organisms, and prolonged holding time at room temperature was sufficient to allow the organisms to multiply to infectious levels. The risk for cholera infection to the general public by this product is minimal given its limited distribution and usual preparation procedure. However, this outbreak illustrates the potential for global dissemination of cholera in a frozen food product. Canned coconut milk is safe because heat treatment during the standard canning process is sufficient to kill vibrios.

MMWR 12/13/91

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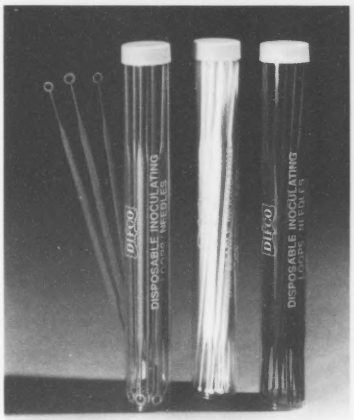
Industry Products



Disposable Inoculating Loops and Needles: New Convenient Packaging

Difco Disposable Loops and Needles are now available in free standing sterile clear plastic tubes. This packaging is designed to be easy to handle, resulting in improved work-flow. The tube is easily accommodated by almost any workstation. Because the package is clear, the color coding that indicates loop size is easily distinguisable; white 1µl, blue 10µl, and black disposable needle. The resealable cap reduces the chance of contamination.

Difco disposable inoculating Loops and Needles are carefully designed to provide the flexibility and control of traditional wire inoculating loops. The use of a special resin allows maximum control and minimum plated media damage.

Disposable Inoculating Loops and Needles in 10-count or 30-count tubes are available in the 1µl size now and will be available in the 10µl size and needle as inventories of the previous zip-lock bag package are depleted. Difco Disposable Inoculating Loops and Needles are available from leading laboratory distributors.

Difco Laboratories - Detroit, MI

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New Video Learning Series on Microbiological Testing

Millipore is pleased to announce the availability of its Video Learning Series on Microbiological Testing. Two videotape series are available: one for beverages, and one for water and wastewater. These kits contain videotapes, study guides and scripts, as well as additional information on Millipore products.

The video learning series has been developed with the assistance of industry experts and the tapes have been pre-viewed by leading corporations in the field. They are ideal for classroom use or for individual learning experiences.

Millipore products are used for analysis, synthesis and purification in life science research, pharmaceutical production, environmental testing, beverage processing, health care and other applications.

Millipore Corporation - Bedford, MA

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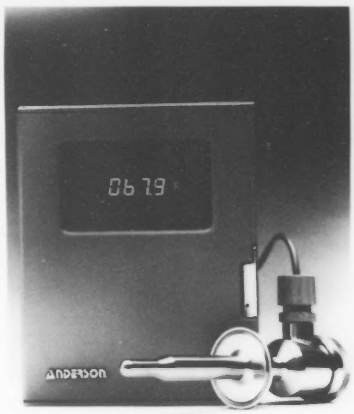

Anderson Paper on Dart Digital Reference Thermometer Presented at ASAE Winter Meeting

At the request of the American Society of Agricultural Engineers, a technical paper was presented by 'Bill Wilson', Marketing Manager of the Anderson Instrument Company.

The paper entitled "Electronic Sensing for Fail-Safe Temperature Reference", was delivered on December 19th at the Society's Winter Meeting in Chicago's Hyatt. The paper, co-authored by Mr. Wilson, Robert Coolman, Manager of Mechanical Technology and John Koegler, Electronic Design Engineer, described the development of Anderson's DART Digital Reference Thermometer.

The DART is unique in that it is the only digital reference thermometer available TODAY that complies with the Pasteurized Milk Ordinance for verification of high-temperature short-time pasteurization temperature.

The Anderson Instrument Company of Fultonville, New York, is a leading manufacturer of indicating, recording and process-control instrumentation used in the production of dairy, food, beverage and pharmaceutical products.

Anderson Instrument Company, Inc. - Fultonville, NY

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The Surge Timekeeper - More than Just Another End-of-Milking Indicator

Babson Bros. Co's. Timekeeper adds a new dimension to milking cows in a stanchion or tie-stall barn. Along with a sight and sound signal that tells the milker when milk flow has stopped, the Timekeeper's built-in timer keeps track of milk flow time and total elapsed time from start to reset.

Prompt removal of the milking unit will avoid the risk of overmilking and applying vacuum to a milked out udder. This minimizes the change of bacteria being forced back into empty teat cisterns; or traumatizing teats that no longer have a milk cushion. It encourages the cow to give her complete cooperation for a faster, cleaner milkout. And it reduces the distraction of having to go back to check milk flow while prepping or post-dipping other cows.

Seeing the actual milking time can be beneficial in several ways. A change in duration can indicate a heat period or a potential health problem. It also discourages the tendency to milk all cows the same length of time. Stage of lactation, age, or inherited factors can all influence milk-flow time. Knowing when a cow is nearly milked out can help determine when to prep the next cow.

Comparing the elapsed time when the milking unit is removed with actual milking time can show how long the cow was overmilked. It could also indicate one operator is trying to use too many units. The total time interval between reset times can be used to show idle time. A good milking routine will reduce unit idle time and improve operator efficiency.

The Surge Timekeeper's unique combination of alarm and time indicator helps focus attention on the milking task; the result is greater consistency, no matter who milks the cows.

Babson Bros. Co - Naperville, IL

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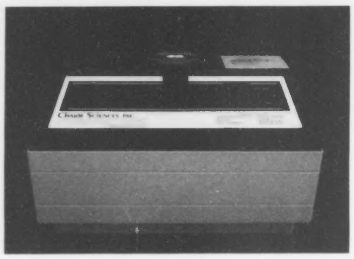

Addition of the Charm ABC Makes the Charm II the Only System That "Does it All"

The addition of the Charm ABC (Active Bacteria Count) to the extensive list of Charm II assays puts the Charm II System in a class by itself — the only *complete* residue detection and keeping quality system available.

The Charm ABC is a multi-purpose assay using a firefly enzyme substrate to measure ATP from the bacteria. Bioluminescence is measured on a Charm II analyzer. *The test requires no additional equipment.*

The Charm ABC has the following applications:

1. Shelf life prediction (18-24 hour incubation followed by a 7-minute assay)
2. Hygiene monitoring assay (2 minutes)
3. Swab microbiological test (7 minutes)
4. Total bacteria count (7 minutes)

With all its features — assays for 8 antibiotic families (in milk and milk products, meat or fish tissue, urine and serum), aflatoxin test (C.A.T.), alkaline phosphatase (CAP Test), supplemental computer software (C2Soft), the Charm Transit Test, and the new charm ABC — The Charm II is the only system that "does it all!"

Charm Sciences, Inc. - Malden, MA

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Introducing New LabWave 9000™: Rapid Moisture and Solids Testing

CEM Corporation, a microwave instrumentation manufacturer, introduces the new LabWave 9000™. The new analyzer combines proven microwave drying methods with state-of-the art technology to provide reliable and precise moisture or solids analysis. A rapid 5 minute test allows processors to make decisions for process adjustments to increase yields, maximize throughput, or improve quality assurance.

The integrated analyzer combines a microwave drying system, internal analytical balance and microprocessor. The menu-driven software permits simply entry and storage of operating parameters for up to 20 programs. Precise microwave power control allows reproducible drying without degradation. Sample drying curves can be plotted to aid in method development.

The LabWave 9000™ is applicable to liquids, solids and slurries covering a full range of moisture levels. Applications include a wide range of food products including meat, vegetables, salad dressings, cheese, ice cream, french fries and butter.

CEM Corporation - Matthews, NC

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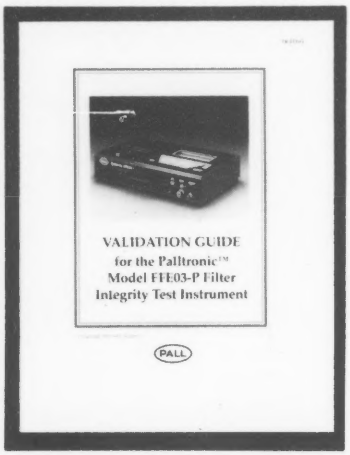

Validation Guide for the Palltronic™ Model FFE03-P Filter Integrity Test Instrument

As the pharmaceutical industry has integrated new technology into their processes, greater reliance has been placed on verification of the integrity of sterilizing-grade filters by automated integrity test instruments. A new validation guide that is the first and only document to establish a standard for validation of this automation process is now available from Pall Ultrafine Filtration Company. This guide contains validation data applicable to the Palltronic™ FFE03-P Integrity Test Instrument. This instrument provides the user with reliable, accurate, and reproducible means of performing integrity tests on sterilizing-grade membrane filters.

The information contained in this guide provides the user with testing protocols, Pressure Decay/Forward Flow formulas and other validation test data and documentation for the test instrument's hardware and software components. This data and information may be used to assist in validating and qualifying the integrity testing instrument and testing processes as performed by the Palltronic Model FFE03-P for use in process applications.

The Validation Guide for the Palltronic Model FFE03-P Filter Integrity Test Instrument is available from Pall Ultrafine Filtration Company, which serves the pharmaceutical, biological, bioprocessing, electronics, food and beverages, and cosmetics industries. The parent company is Pall Corporation.

Pall Ultrafine Filtration Company - East Hills, NY

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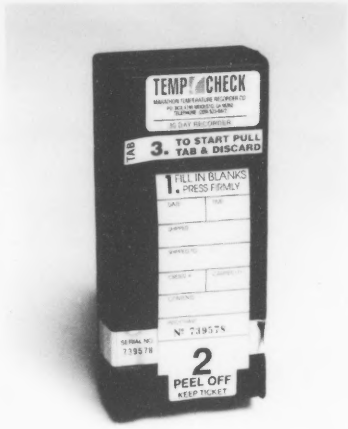

Reliable Cost Effective In-Transit Temperature Recording

Marathon Temperature Recorder Company, Modesto, California, has released their new line of TEMP CHECK single use, low cost, in-transit temperature recorders. Producing a continuous strip chart record of temperature the TEMP CHECK recorder is available in 4, 7, 16, 30 or 60 day models and operates in fresh or frozen conditions.

The TEMP CHECK recorder is easy to use and very reliable. It uses a quartz controlled motor for time keeping and a bimetal coil for temperature sensing. The recorder is fully serialized. Recorder, chart and documentation share the same serial number for positive identification. Each unit is factory sealed using a unique polyester tamper evident seal. (If any attempt is made to remove the seal, the word "VOID" will appear on the seal and case.)

TEMP CHECK recorders are a single use product. There is no burden on your receiver to return an expensive rental instrument to it's manufacturer. MARATHON also provides, at not cost to the user, a post-trip verification service.

Marathon Temperature Recording Company - Modesto, CA

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The Colorimetric GENE-TRAK® Assays Save Time, Eliminate Subjective Analysis, and Increase Confidence in Test Results

GENE-TRAK Systems markets the Colorimetric GENE-TRAK® Assays for the detection of foodborne pathogens. Negative test results using the GENE-TRAK Assays do not require microbiological confirmation. The omission of the confirmation step saves the user time, eliminates the need for subjective analysis, and increases confidence in test results.

On the other hand, microbiological confirmation is required when using conventional detection methods because food samples frequently contain a variety of microorganisms. For example, testing for *Salmonella* using conventional methods frequently requires a microbiological confirmation in which the user would select, isolate, and identify a minimum of three bacterial colonies. Subjectivity comes into play, since many Gram negative bacteria are similar in appearance on microbiological agar plates — Are the colonies *Salmonella*, *Citrobacter*, *Enterobacter*, other organisms, or a combination? Are the final identifications accurate? Which colonies should the user select? Has the user missed any *Salmonella* colonies? The confirmation step introduces the opportunity for error and may decrease confidence in test results.

The Colorimetric GENE-TRAK Assays are available for the detection of *Salmonella*, *Listeria*, *Staphylococcus aureus*, and *Escherichia coli*, as well as research tests for *Campylobacter* species and *Yersinia enterocolitica*. The Assays are conveniently packaged in 100-test kits and were recently upgraded to improve ease-of-use, including the incorporation of reagent dyes which help to insure proper reagent addition. A new DATA-TRAK Photometer has recently been made available for large volume users. The new photometer enables the user to read samples rapidly and comes equipped with the hardware necessary to connect the unit to a compatible printer so that a hard copy printout can be obtained.

GENE-TRAK Systems - Framingham, MA

Please circle No. 249 on your Reader Service Card

Unipath Co. - Oxoid Division New Product Announcement - MSRV Medium

A new semi-solid medium for the detection of motile *Salmonella* species from food and environmental samples has been introduced by Unipath. Modified Semi-solid Rappaport Vassiliadis (MSRV) medium is based on the formulation by DeSmedt et al[1] which has been shown to detect more salmonella-positive samples than traditional enrichment procedures. The efficiency of the medium is based on the ability of salmonellae to migrate through the selective medium ahead of competing motile organisms, thus producing opaque halos of growth. Further tests can be carried out directly from the migrated culture with the inoculum being taken from the edge of the growth. The Oxoid Salmonella Latex Test is recommended for serological confirmation of Salmonella species.

[1]DeSmedt, JM., Bolderdijk, R., Rappold, H., & Lautenschlaeger, D. (1986) J. Food Prtoect. 49:510-514.

Unipath Co., Oxoid Div. - Ogdensburg, NY

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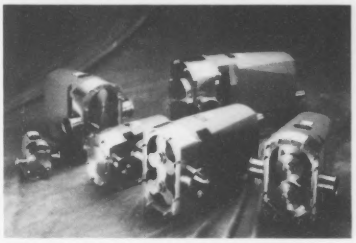

Tri-Clover, Inc. Introduces New T-Series Modular Rotary Lobe Pumps

The new, T-Series of modular, rotary lobe pumps, offering a wide range of applications, is now available from Tri-Clover, Inc. The T-Series, consisting of three basic models, is constructed in a modular fashion — allowing the user to literally "build" a pump that meets their specific application need.

The TSR, TSK and TSC models all offer a variety of seal types, seal face materials, and different sized pump shafts and rotors. In addition, the T-Series features a choice of wide or narrow pump casings. Application options range from the Dairy, Canned Food and General Food Processing to the Biotech and Pharmaceutical industries. The T-Series is able to process a whole host of suspended solids, abrasive slurries and liquid gas mixtures, and easily handles high, medium and low viscosity materials.

All three pumps are CIP compatible, and are constructed of stainless steel for corrosion resistance. T-Series pumps offer less slip and greater flow efficiency due to the casing's reduced clearances. In addition, the lack of rotor-to-rotor contact in the casing provides for durable, low-wearing performance no matter how abrasive the product. And maintenance is worry-free — with easy casing access, and interchangeable rotors, seals, bearings and gears for fast repair, and minimal parts inventories.

The TSR —Built to meet any application

The TSR model pump is available in 12 sizes, accommodating capacities of up to 700 GPM and viscosities up to 1,000,000 CPS. Offering 316 stainless steel shafts for applications up to 145 psi, the TSR model also comes with duplex shafts for applications of up to 290 psi. And, while a 3-lobe rotor is standard, the TSR is available in a 2-lobe option for minimum product degradation.

TSK — The "Ultra-Clean Pump"

Able to completely separate the processed product from contamination sources, the TSK is ideal for biotechnology, food and pharmaceutical applications. Its "ultra-clean" performance is achieved by a unique rotor design that keeps the spline out of the product contact zone, and eliminates the need for cap nuts, and front cover recessses — where product and bacteria often meet. TSK options allow the pumps to reach capacities of 330 GPM, and pressure ranges of up to 220 psi.

The TSC — Three sizes for capacities topping 220 GPM/220 psi

The TSC, available only in a short power frame, comes with externally-mounted, single mechanical seals as standard. Single and double o-rings seals are optional. The TSC also features twin wing stainless steel rotors that prevent product slippage. And, its circumferential piston pumpting action makes it a natural fit for low shear operations.

Headquartered in Kenosha, Wisconsin, Tri-Clover, Inc. is a leading manufacturer of sanitary stainless steel valves, pumps and fittings, as well as flow control, batch/weigh and Clean-in-Place (CIP) systems. Founded in 1919, Tri-Clover, Inc. is now a member of the Alfa-Laval Group, a $1.5 billion multi-national organization headquartered in Sweden that operates more than 160 companies in 130 countries around the world.

Tri-Clover, Inc. - Kenosha, WI

Please circle No. 251 on your Reader Service Card

Problem Solving Specialty Gaskets Described in Chicago Gasket Company New Catalog

New sizes of corrosion and heat resistant specialty gaskets made to current industry standards are described in an up-to-date catalog, providing significant design information to the engineer. Designated as Chicago Gaskets of Teflon, Catalog G-9, the newly revised catalog describes sizes ranging from 1/2" in diameter up to 36" in diameter and which can be obtained as large as 84" in diameter for tanks and reactors.

Details of chemical and physical properties and many industry applications as well as detail drawings are included, along with recommendations for installation and maintenance.

High density, low porosity PTFE and other materials suitable for handling numerous corrosive fluids as well as foods and pharmaceuticals are offered. All of these types of gaskets are available for applications involving flanges of glass, stainless steel and other piping or carrier materials.

Chicago Gasket Company - Chicago, IL

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Federal Register

Department of Health and Human Services

Food and Drug Administration

Advisory Committees; Food Advisory Committee; Establishment

Agency: Food and Drug Administration, HHS.

Action: Final Rule.

Summary: The Food and Drug Administration (FDA) is announcing the establishment by the Commissioner of Food and Drugs of the Food Advisory Committee in the FDA's Center for Food Safety and Applied Nutrition. A notice requesting nominations for membership on this committee will publish at a later date. This document adds to the agency's list of standing advisory committees. The authority citation for 21 CFR part 14 is also being revised to reflect changes made as a result of the transfer and redesignation of certain sections of the Public Health Service Act to the Federal Food, Drug, and Cosmetic Act, by the Safe Medical Devices Act of 1990.

Dates: This rule becomes effective March 6, 1992. Authority for the committee being established will end on December 15, 1993, unless the Commissioner of Food and Drugs formally determines that renewal is in the public interest.

For Further Information Contact: Donna M. Combs, Committee Management Office (HFA-306), Food and Drug Administration, 5600 Fishers Lane, Rockville, MD 20857, (301)443-2765.

Supplementary Information: Under the Federal Advisory Committee Act of October 6, 1972 (Pub. L. 92-463), section 903 of the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 394) as amended by the Food and Drug Revitalization Act (Pub. L. 101-635), and 21 CFR 14.40 (b), FDA is announcing the establishment by the Commissioner of Food and Drugs of the Food Advisory Committee.

The committee shall provide advice primarily to the Director, Center for Food Safety and Applied Nutrition, and as needed, to the Commissioner and other appropriate officials on emerging food safety, food science, and nutrition issues that FDA considers of primary importance in the next decade. The committee shall also provide advice and make recommendations on ways of communicating to the public the potential risks associated with these issues, and recommend approaches that may be considered in addressing the issues.

The Safe Medical Devices Act of 1990, Public Law 101-629, enacted November 28, 1990, amended subpart 3 "Electronic Product Radiation Control" of part F of title III of the Public Health Service Act, and redesignated sections 354 through 360F of that act as sections 530 through 542 of the Federal Food, Drug, and Cosmetic Act, respectively.

Because these are technical amendments to 21 CFR part 14, the Commissioner of Food and Drugs finds under 5 U.S.C. 553(b)(B) and 21 CFR 10.40 (c), (d), and (e), that notice and public procedure are unnecessary and contrary to the public interest. Therefore, the agency is revising the authority citation for 21 CFR part 14 and adding new paragraph (g) to 21 CFR 14.100 as set forth below.

List of Subjects in 21 CFR Part 14

Administrative practice and procedure, Advisory committees, Color additives, Drugs, Radiation protection.

Therefore, under the Federal Food, Drug, and Cosmetic Act and under authority delegated to the Commissioner of Food and Drugs, 21 CFR part 14 is amended as follows:

Part 14-Public Hearing before a Public Advisory Committee

1. The authority citation for 21 CFR part 14 is revised to read as follows:

Authority: Section 201-903 of the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 321-394); 21 U.S.C. 41-50, 141-149, 467f, 679, 821, 1034; secs. 2, 351, 361 of the Public Health Service Act (42 U.S.C. 201, 262, 264); secs. 2-12 of the Fair Packaging and Labeling Act (15 U.S.C. 1451-1461): 5 U.S.C App. 2: 28 U.S.C. 2112.

2. Section 14.100 is amended by adding new paragraph (g) to read as follows:

§14.100 List of standing advisory committees

(g) *Center for Food Safety and Applied Nutrition-Food Advisory Committee*. (1) Date established: December 15, 1991.

(2) Function: The committee provides advice on emerging food safety, food science, and nutrition issues that FDA considers of primary importance in the next decade.

Dated: March 2, 1992.

Michael R. Taylor, Deputy Commissioner for Policy.

Federal Register/Vol. 57, No. 45/Friday, March 6, 1992/Rules and Regulations

Affiliate News

Connecticut Association of Dairy & Food Sanitarians Hold Annual Meeting

The Connecticut Association of Dairy and Food Sanitarians Inc. held their Annual Meeting on Wednesday, January 22, 1992 at the Hawthorne Inn, Berlin, CT. This Associations Affiliation with IAMFES was announced in The *Journal of Milk and Food Technology* in the July-August issue of 1952.

"Field Inspection Automation" was presented by Chris Van Doren. "A Self-Care Action Program Applied to Food Service Establishments" was given by Satyakem Sen, Ph.D. Satyakem is also the delegate to the Affiliate Council for Connecticut.

Kenneth Welch, Entomologist at the CT Ag Experiment Station, gave an informative and sometimes entertaining report on Invaders in Grain and Flour Storage Areas. He also cautioned field inspectors as to the escape artistry of some of these specimens that are sent to his lab for identification.

Daniel Verches told us his views on the Development and Future of Artifical Fats.

Dr. Lester Hankin has retired from the Experiment Station but we trust not from the Connecticut Affiliate. He joined IAMFES in 1955 and has been a valued member and a much published author in The *Journal of Food Protection* and *Dairy, Food and Environmental Sanitation*. Enjoy your retirement, Lester!

Georgia Association of Food and Environmental Sanitarians Meeting

The Georgia Association of Food and Environmental Sanitarians (GAFES) and the Dairy Technology Society of Georgia conducted a joint meeting on February 18, 1992 at the Holiday Inn, Airport North in Atlanta, Georgia. This meeting was held in conjunction with the 6th Annual GAFES Meeting. Over 70 people from academic, government, and industry positions were treated to a diverse program of interest to the general membership of both GAFES and the Dairy Tech Society.

Dr. Ruth Feeley of the Food and Drug Administration in Atlanta presented information on the current status of recently proposed nutritional labeling regulations. Her presentation provided insight into what changes are being proposed and how the process is being conducted.

Charles Murphy from the Georgia Department of Agriculture, Dairy Division in Atlanta discussed the regulatory concerns for the Georgia dairy industry. His presentation covered existing and proposed regulations concerning frozen dairy products.

Upcoming IAMFES Affiliate Meetings

1992

MAY

•**5-6, California Association of Dairy and Milk Sanitarians** will meet in Sacramento, CA. For more information contact John Bruhn at (916)752-2191.

•**11-12, Florida Association of Milk, Food and Environmental Sanitarians Annual Meeting (Taste of the Future — Food Safety)**, will be held at the Marriott, International Drive. For more information contact John Chrisman, General Mills, (407)850-5330 or Jack Dodd, Florida Department of Agriculture, (904)487-1470.

•**11-13, Pennsylvania Association of Dairy Sanitarians and Dairy Laboratory Analysts Conference** will be held at the J. O. Keller Conference Center on the Penn State University Park Campus. For more information call (814)865-8301, or write to the Dairy Sanitarians Conference, The Pennsylvania State University, 306 Ag. Administration Building, University Park, PA 16802.

JUNE

•**2-3, Texas Association of Milk, Food & Environmental Sanitarians Annual Meeting** will be held at the Howard Johnson South Plaza, 3401 South IH-35, Austin, TX. For more information contact Janie Park, P.O. Box 2363, Cedar Park, TX 78613-2363; (512)458-7281.

•**5, Tennessee Association of Milk, Water & Food Protection's Annual Meeting** will be held at the Ramada Airport, Nashville, TN. For more information contact Dennis Lampley, 7346 Sack Lampley Road, Bon Aqua, TN 37025; (615)360-0157.

Dr. Joe Frank of the Department of Food Science and Technology of the University of Georgia reviewed his recent laboratory results concerning the control of *Listeria* in food processing plants. Joe described recently completed survey work involving the distribution of *Listeria* in dairy processing plants and the survival of *Listeria* in biofilms.

Edd Valentine from the Georgia Tech Research Institute in Atlanta spoke on studies involving the management of food processing waste. He presented a brief overview and reviewed his results from a pilot study involving dairy processing waste.

The final presentation was made by Dr. Charlie Huang of the Department of Agricultural and Applied Economics of the University of Georgia. Charlie covered the topic of consumer perceptions of food safety and discussed the findings of recently completed survey work on the subject.

The meeting also provided time for the attendees to interact during the day. A brief business meeting was held. The primary item for discussion at the business meeting was the status of the plans to host the Annual Meeting of IAMFES in Atlanta in August of 1993. Steve Halstead of IAMFES Headquarters described the meeting and what has been done up to this time. The membership was enthusiastic about the plans thus far and is more than ready to organize the local activities that go along with the Annual Meeting.

President's Message
Joseph J. Disch, President, WAMFS

Greetings from your President. At last! We now have a full slate of officers in our Association. Ever since I was elected to my first office as 2nd Vice-President, our Association has not had a full slate of officers. It is a good feeling. I do believe that the group of officers that your President now has to work with is without question "excellent."

That leads me to our newest officer. On behalf of the WAMFS membership, I would like to congratulate Mr. Fritz Buss on his election to the position of 2nd Vice-President. Fritz comes to us from Nelson-Jameson, Inc., Marshfield, WI, where he has been Laboratory Products Manager since 1984. He is a graduate of UW-Madison, with a B.S. from the College of Education and an M.A. from the College of Agriculture and Life Sciences. He played football for the UW from 1965 to 1969 and was drafted by the Philadelphia Eagles in 1970. Fritz is married and has three children. He is a member of the Wisconsin Laboratory Association, IAMFES, WAMFS and the Wisconsin Dairy Technologists Society. I think that Fritz will be a valuable addition to our Executive Board. Fritz will be soliciting exhibitors for the 1992 Joint Education Conference (JEC). If you have any suggestions for exhibitors, please give him a call.

On November 15, 1991, your Executive Board met at the site of our 1992 JEC, which will he held at the Civic Center in Eau Claire on September 23-24, 1992. Most of the meeting dealt with the committees that we now have and the reorganization of those committees. Your Board decided to form three basic committees as follows:

1) Education Committee:

This proposed new committee will replace the Food & Dairy Committees. Dr. P. C. Vasavada has agreed to chair this committee with Jon Dresser, Jim Wickert, and Ken Kirby, as committee members.

2) Nomination Committee:

This three member committee will be responsible for recruiting nominees for WAMFS offices from among our membership. It was decided that the committee should consist of the Past-President and two members-at-large, who will be appointed by the Executive Board.

3) Administrative Committee:

This committee will continue with the duties of auditing the Treasurer's Reports; presenting scholarships and the Sanitarian of the Year award; and assisting with nominations for IAMFES awards. Jon Dresser will chair this committee, with help from Byron Dennison and Gary Swiggum.

The Education Committee is already at work. Jon Dresser has scheduled some farm inspection seminars for Dairy Plant Field Representatives and other interested professionals this coming spring. This would be jointly sponsored by the Food Div., DATCP and WAMFS. Tentative dates are May 5th and May 7th. We will let you know when more information becomes available.

Your Association would like to sponsor more seminars, especially in the food processing area, so if any of you know of up-coming seminars that we can dovetail onto, please let one of the people on the Education Committee or myself know. I believe that we need to get involved in more than just dairy items and we need to get many more of our 337 members involved in our Association. As I said at the beginning of this message, I believe we have an excellent Executive Board, but without you, the membership, we don't have much. Please let's get involved.

To the Members, Officers and Delegates of All Affiliates to IAMFES

Affiliate Council Chairman Dr. Ron Schmidt will soon be appointing a committee to nominate a slate of candidates for the offices of Affiliate Council Chair and Secretary serving from 1992 through 1993. In order to be considered for appointment to this nomination committee, you must be your affiliate's current delegate to the IAMFES Council of Affiliates. If your affiliate has not yet informed the IAMFES office of its 1992 delegate, please call 1-800-369-6337 (US), 1-800-284-6336 (Canada) as soon as your delegate has been selected.

After the nominating committee has selected the nominees for Affiliate Council Chair Person and Secretary, IAMFES will send a ballot to the contact person for your affiliate as well as the known delegate (1991 or 1992). Each affiliate is allowed one vote so you will need to come to an agreement and mail the ballot back to the IAMFES office.

Synopsis of Papers for the 79th Annual Meeting

The following are abstracts of papers to be presented at the 79th Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians, Inc., to be held in Toronto, Ontario, July 26-29, 1992.

A COMPARISON OF ANTILISTERIAL ACTIVITY OF TWO LACTIC STARTER CULTURES IN CHICKEN SUMMER SAUSAGES, A. J. Maurer*, Professor, G. Baccus-Taylor, K. Glass, and J. B. Luchansky, Dept. of Poultry Science, 1675 Observatory Drive, University of Wisconsin, Madison, WI 53706

Chicken summer sausages (100% hand-deboned chicken meat) were manufactured with a bacteriocinogenic (Bac^+) or a bacteriocin-negative (Bac^-) *Pediococcus acidilactici* starter culture and challenged with a five-strain mixture (10^7 CFU/g) of *Listeria monocytogenes* (Lm). Fermentation was conducted at 37°C (85% R.H.) until pH 5.0 was attained (ca. 11 h). Sausages were cooked to an internal chub temperature of 66.6°C for 45 min and cold-showered (5 min). Although sausages were similar in A_w (0.96) and titratable acidity (0.7%), about a 1 $\log_{10}$ reduction of listeriae was observed over the fermentation period in sausages prepared with the Bac^- starter, whereas about a 3 $\log_{10}$ reduction of Lm occurred in sausages fermented with the Bac^+ pediococci. No listeriae were recovered from cooked sausages following storage at 4°C for 6 days. Thus, Bac^+ starter cultures may afford an additional measure of safety in products that are either improperly heated or not cooked.

CONTROL OF *ESCHERICHIA COLI* O157:H7 BY FERMENTATION, Karim Kone*, Graduate Research Assistant, and Daniel Y. C. Fung, Department of Animal Science and Industry, Kansas State University, Manhattan, KS 66506

Escherichia coli O157:H7 has been implicated in outbreaks and sporadic cases of foodborne diseases causing hemorrhagic colitis, a bloody type of diarrhea, followed by hemolytic uremic syndrome (HUS) and renal failure, especially in children. One major vehicle of transmission of this pathogen is fresh ground meat. *E. coli* O157:H7 grows well in the temperature range (from 30 to 44.5 C) often applied when making fermented sausages, which usually do not undergo any further heat treatment prior to consumption. We studied the interaction of ten strains of *E. coli* with two starter cultures in a laboratory medium and in salami to ascertain the control of the pathogen by fermentation. *E. coli* were inoculated at levels of $\log_{10}$3-4 (low) and $\log_{10}$6-7 (high) CFU/ml or g, into the laboratory medium or salami with starter cultures (*Pediococcus* sp. or *P. acidilactici* incubated at 32 or 40 C, respectively). Viable cell counts and pH were determined during the process. Within 24 h, the final pH of the laboratory medium and salami was as low as 4.75. *E. coli* O157:H7 was not destroyed in the laboratory medium, but its number was remarkably reduced in the high inoculum salami. However, in the low inoculum salami, the pathogen was totally destroyed (non-detectable level) by fermentation with starter cultures at both incubation temperatures.

THERMAL DESTRCUTION OF *LISTERIA MONOCYTOGENES* IN REDUCED SALT UNCURED-RESTRUCTURED MEAT PRODUCT, H. Thippareddi*, Graduate Research Assistant, and Daniel Y. C. Fung, Department of Animal Sciences and Industry, Kansas State University, Manhattan, KS 66506

Heat treatment is a critical control point for controlling *Listeria monocytogenes* in restructured meat products. Elevation of heat resistance of *L. monocytogenes* when heated slowly was reported. F values of the product were calculated using 160°F and 9.3 as the reference temperature and Z value. The purpose of this study was to evaluate destruction of *L. monocytogenes* under conditions simulating commerical processing. Beef clod muscles were trimmed, chunked, mixed with tetra sodium pyrophosphate (0.5%) and held at 32°F for 12 h. The preblend was mixed with NaCl (0.2% and 2.0%) and the cell suspension of *L. monocytogenes* to give a concentration of ca. $\log_{10}$ 7.6 CFU/g in the mix. Meat was manually stuffed into water-proof casing, and the product was heated in a waterbath to simulate smokehouse heating schedule. Results are reported as mean of two replicates for each treatment.

Heating the product to 130, 140, 150, and 160°F resulted in $\log_{10}$ reductions of 0.8, 3.3, 2.6, and 3.3 in low salt and $\log_{10}$ reduction 1.4, 3.6, 3.5, and 4.0 in high salt product. Heating to 160°F resulted in an F value of 26 min. For all endpoint temperatures, heating high salt product resulted in significantly greater destruction ($p<0.05$) of *L. monocytogenes* compared to low salt product.

BACTERIAL GROWTH AND SURVIVAL IN VACUUM PACKAGED BEEF DURING EXTENDED REFRIGERATED STORAGE, Reneé A. Hart*, Research Assistant, P. B. Kenney, G. Jordan, H. Thippareddi, K. Kone, R. E. Campbell, C. L. Kastner, and D. Y. C. Fung, Kansas State University, Department of Animal Science and Industry, Call Hall, Manhattan, KS 66506-1600

Lactic acid (3.0%) and chlorine (200 ppm) were applied to intact sides of beef following rail inspection and then immediately after 8 h of spray chilling. After 4 days of storage at 4°C, these sides were then divided into 6 subprimals, and the subprimals were subdivided into 8 pieces prior to random treatment with either chlorine spray (200 ppm) or microwave irradiation. These pieces were sampled at day 4,10, 15, 20, 30, 60, 90, and 120 of vacuum storage at 1°C. One half of the subprimals was inoculated with a combination of *Listeria monocytogenes*-Scott A, *Salmonella enteritidis, Yersinia enterocolitica,* and *Escherichia coli* O157:H7 in order to evaluate the fate of these pathogens in vacuum packaged cuts with and without sanitizing treatment. Total plate counts, *L. monocytogenes*-Scott A, *S. enteritidis, Y. enterocolitica,* and *E. coli* O157:H7 were enumerated.

Reductions in total counts were observed for the treatment with lactic acid and chlorine at the carcass level. However, the same effect was not observed at the subprimal stage. With the exception of microwave treatment, *Listeria* counts declined; *Salmonella* did not proliferate; *E. coli* and *Yersinia* proliferated throughout the storage period.

EFFECT OF GROWTH NUTRIENTS ON ATTACHMENT OF *LISTERIA MONOCYTOGENES* TO STAINLESS STEEL, Kwang Yup Kim*, and Joseph F. Frank, Department of Food Science and Technology, University of Georgia, Athens, GA

The objective of this study was to determine the effect of growth nutrients on attachment of *Listeria monocytogenes* to stainless steel. Cells were grown in chemically defined medium (D10) and tryptic soy broth (TSB) at 21°C. After 4 h exposure of stainless steel surfaces to each standardized cell suspension, the numbers of attached cells were compared. Cells that were grown in D10 showed 50 times higher attachment than those grown in TSB. Addition of nitrogen, carbon, and phosphate sources did not increase the attachment in TSB. Also, reduction of component concentrations in D10 medium did not result in a significant decrease of attachment ability. The replacement of nitrogen sources in D10 with tryptone resulted in a decrease in attachment equivalent to that observed with TSB. Growth on trehalose, fructose, cellobiose, and mannose instead of glucose did not affect attachment ability of standardized cell suspension. Different levels of tryptone, ammonium chloride, phosphate, and glucose in D10 did not affect the attachment ability of *L. monocytogenes*.

SIMULTANEOUS GROWTH OF *LISTERIA MONOCYTOGENES* AND *LISTERIA INNOCUA* IN PURE CULTURE AND FOOD SYSTEMS, Ruth L. Petran*, Sr. Associate Microbiologist, and Katherine M. J. Swanson, Grand Metropolitan Food Sector, 330 University Avenue SE, Minneapolis, MN 55414

Listeria spp. have been isolated from a wide variety of sources, and in many situations *L. innocua is* more commonly found than *L. monocytogenes*. Previous work indicated that there was no significant difference between growth rates of *L. monocytogenes* and *L. innocua* strains in TSB-YE pure culture. Three *L. monocytogenes* and three *L. innocua* strains were setected to evaluate competition between the two organisms when inoculated simultaneously into cultural media and food systems. Fraser broth (FB), TSB-YE, UVM, and foods were inoculated (at ca. 10^2/ml) and incubated at 35C. Strains were selected to allow use of carbohydrate fermentation patterns to distinguish strains on purple agar base with added rhamnose. In FB, UVM, and TSB-YE, *L. innocua* populations were higher than *L. monocytogenes* by 1.1, 1.0, and 0.5 logs respectively. This occurred when media were inoculated individually or simultaneously. *L. innocua* populations were also higher in foods though differences were not as dramatic. This may explain in part why *L. innocua* is isolated more frequently than *L. monocytogenes*.

ACCELERATED GROWTH OF *LISTERIA MONOCYTOGENES* BY MOULDS, Lynn McIntyre*, and M. W. Griffiths, Department of Food Science, University of Guelph, Guelph, Ontario N1G 2W1

The identification of soft cheeses as vectors for transmission of listeriosis has prompted examination of cheese making and ripening processes. Of particular interest is the accelerated growth of *L. monocytogenes* reported in whey previously cultured with *Penicillium camemberti*. This phenomenon has been confirmed using cell-free supernatants of *Penicillium candidum* grown on a variety of media. These supernatants were prepared by centrifugation followed by filtration. The enhancement in growth of *Listeria monocytogenes* is:

i) dependent on the medium used to grow *P. candidum*.
ii) does not involve the production of proteases as reported for a similar effect observed between *Pseudomonas* spp. and listeriae.
iii) not solely due to pH effects.

THE 1991 CHOLERA EPIDEMIC IN LATIN AMERICA AND THE FDA ACTIONS IN RESPONSE, Thomas L. Schwarz, Science Policy Analyst, Food & Drug Administration, 200 C Street, SW, Washington, DC 20204-0001

Beginning in January, 1991, illnesses attributable to *Vibrio cholerae* O1, El Tor, Inaba began to be reported from Peru. The numbers of cases and resulting deaths rapidly grew. The epidemic spread geographically across South America, to Central America and Mexico. A few cases were reported in the U.S. Many federal agencies joined forces in response to the epidemic. FDA played a leading role by: coordinating various activities, conducting sampling and microbiological testing of foods imported from affected countries, searching for possible means of *Vibrio cholerae* organisms contaminating American shellfish growing waters, and developing new and perfecting existing methodologies for isolation and identification of the causative organism.

DETECTION OF LATENT COLIFORMS IN PASTEURIZED MILK, R. A. Ledford, E. T. Wolff, and K. T. Scofield, Cornell University, Richard A. Holley*, Microbiologist, John Labatt Limited, 150 Simcoe Street, London, Ontario N6A 4M3, Canada

During tests conducted Jan.-Sept. 91 by Cornell at 45 plants, 40% of 424 samples were coliform negative throughout refrigerated shelf-life. However, another 41% which were coliform negative the day of pasteurization, became coliform positive during 7-14 days refrigerated storage. The Cornell pre-incubation test for coliforms (milk is held at 37°C for 6 hours prior to plating on VRB) has been used with some success since 1983 to accelerate coliform detection presumably by providing an opportunity for their recovery from injuries. To facilitate injury recovery, pyruvate was added to pre-incubated milk and pyruvate and/or catalase was added to VRB prior to plating. As currently used the test allows prediction with 82-85% certainty that milk contains viable coliforms. Since coliforms grow at refrigerator temperature in pasteurized milk, the value of the VRB test for compliance monitoring of samples is limited to fresh samples.

IDENTIFICATION OF MILK ENZYMES FOR MONITORING HEAT-TREATMENTS APPLIED TO MILK, Yolanda Hurvi*, and M. W. Griffiths, Department of Food Science, University of Guelph, Guelph, Ontario N1G 2W1

Experimenters have sought milk enzymes, other than alkaline phosphatase, that can be used as indicators of the heat treatment applied to milk. As milk used for cheese manufacture in Canada is generally heated at sub-pasteurization temperatures, an enzyme(s) that can be used in the range 60 to 70°C is desirable.

Earlier work suggested that catalase could be used as an indicator of heat treatment given to milk in the range 65-70°C. Differential Scanning Calorimetry has confirmed that the denaturation temperature of bovine catalase is 64.5°C and closely correlates with the inactivation temperature. This procedure measures conformational changes in proteins by measuring the energy necessary to disrupt the native structure of the protein. It is, therefore, a useful tool to identify the thermal stability of milk enzymes. Other enzymes of potential for predicting heat treatments given to milk have been identified.

The Sheraton Centre Toronto

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July 26-29, 1992

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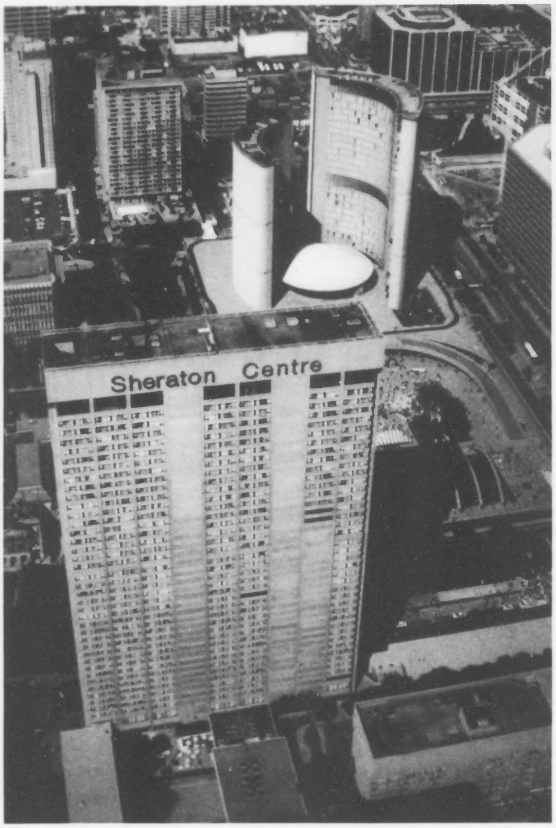

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IAMFES

Preliminary Program

79th Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians, Inc.

In Cooperation with the Ontario Food Protection Association

The Sheraton Centre, Toronto, Ontario
July 26-29, 1992

REGISTRATION TIMES

Saturday, July 25	12:00 - 5:00 p.m.
Sunday, July 26	12:00 - 7:00 p.m.
Monday, July 27	8:00 a.m. - 4:00 p.m.
Tuesday, July 28	8:00 a.m. - 4:00 p.m.
Wednesday, July 29	8:00 a.m. - 12:00 p.m.

EXHIBITOR HOURS

Sunday, July 26	7:45 - 10:00 p.m.
(Following the Opening Session)	
Monday, July 27	9:30 a.m. - 3:30 p.m.
Tuesday, July 228	9:30 a.m. - 3:30 p.m.

PRE-MEETING WORKSHOPS*

HAZARD ANALYSIS AT CRITICAL CONTROL POINTS

Instructor: Frank Bryan

Friday, July 24 - 1:00 - 5:00 p.m.
Saturday, July 25 - 8:00 a.m. to 5:00 p.m.

and

MONITORING/MEASURING ENVIRONMENTAL SANITATION IN FOOD AND DAIRY PLANTS

Instructor: J. Russell Bishop

Saturday, July 25 - 9:00 a.m. to 5:00 p.m.

*Separate Workshop Fee Applies

IAMFES BOARD MEETING

Friday, July 24	8:00 a.m. - 5:00 p.m.
Saturday, July 25	8:00 a.m. to 12:00 p.m.

COMMITTEE MEETINGS

You need not be a committee member to attend.

SATURDAY, JULY 25

1:00 - 5:00	Affiliate Council

SUNDAY, JULY 26

9:30 - 10:30	Dairy Quality and Safety (Farm Section)
10:00 - 11:00	Audio Visual Library
10:00 - 11:00	Baking Industry Sanitary Standards
10:00 - 11:00	Past Presidents Advisory
10:00 - 5:00	Communicable Diseases Affecting Man
10:30 - 11:30	Dairy Quality and Safety (Plant Section)
11:00 - 12:00	Sanitary Procedures
11:00 - 12:00	Foundation Fund
11:00 - 12:00	Nominating
1:30 - 2:30	Dairy, Food & Environmental Sanitation
1:30 - 3:30	Applied Laboratory Methods
2:30 - 3:30	Environmental Issues in Food Safety

WEDNESDAY, JULY 29

12:00 - 4:00	Program Advisory

SUNDAY EVENING, JULY 26

OPENING SESSION

7:00 **Welcome to the 79th Annual Meeting** - D. GABIS, President of IAMFES and M. BRODSKY, chairperson of the Local Arrangements Committee

7:15 **Introduction of the Ivan Parkin Lecture** - M. DOYLE, President-Elect of IAMFES

7:20 **The Ivan Parkin Lecture - "Global Issues in Food Safety"** - J. B. MORRISSEY, Assistant Deputy Minister, Agriculture Canada, Ottawa, Ontario

The Ivan Parkin Lecture is sponsored by the IAMFES Foundation Fund and is supported by the Sustaining Members.

8:00 **Cheese and Wine Reception** - Held in the Exhibit Hall. An opportunity to greet old friends, make new ones and view the excellent technical displays.

MONDAY MORNING, JULY 27

TECHNICAL SESSION
FOODBORNE PATHOGENS
Co-Conveners: J. SCOTT and K. GLASS

8:30 **Isolation of *Salmonella enteritidis* from Pooled Egg Samples as a Screening Method for Detecting Infected Laying Hens** - R. GAST, USDA, ARS, Southeast Poultry Research Lab, Athens, GA

8:45 **Survival of *Listeria monocytogenes* on the Surface of Egg Shells and During Frying of Whole and Scrambled Eggs** - R. BRACKETT and L. Beuchat, University of Georgia, Griffin, GA

9:00 **Heat Stability of *Listeria monocytogenes* in Liquid Egg** - F. BARTLETT, A. Hawke, and G. Millard, Centre for Food and Animal Research, Agriculture Canada, Ottawa, Ontario

9:15 **Health Risk Assessment of Undrawn (New York Dressed) Poultry in Ontario** - P. JOHNSON, T. Baker, M. Getz, J. Lynch, and M. Brodsky, Ontario Ministry of Agriculture & Food, Guelph, Ontario

9:30 **A Comparison of Antilisterial Activity of Two Lactic Starter Cultures in Chicken Summer Sausages** - A. MAURER, G. Baccus-Taylor, K. Glass, and J. Luchansky, University of Wisconsin, Madison, WI

9:45 **Control of *Escherichia coli* O157:H7 by Fermentation** - K. KONE and D. Fung, Kansas State University, Manhattan, KS

10:00 Break

10:15 **Thermal Destruction of *Listeria monocytogenes* in Reduced Salt Uncured-Restructured Meat Product** - H. THIPPAREDDI and D. Fung, Kansas State University, Manhattan, KS

10:30 **Bacterial Growth and Survival in Vacuum Packaged Beef During Extended Refrigerated Storage** - R. HART, P. Kenney, G. Jordan, H. Thippareddi, K. Kone, R. Campbell, C. Kastner, and D. Fung, Kansas State University, Manhattan, KS

10:45 **Effect of Growth Nutrients on Attachment of *Listeria monocytogenes* to Stainless Steel** - K. KIM, and J. Frank, University of Georgia, Athens, GA

11:00 **Simultaneous Growth of *Listeria monocytogenes* and *Listeria innocua* in Pure Culture and Food Systems** - R. PETRAN, and K. Swanson, Grand Metropolitan Food Sector, Minneapolis, MN

11:15 **Accelerated Growth of *Listeria monocytogenes* by Moulds** - L. MCINTYRE, and M. Griffiths, University of Guelph, Guelph, Ontario

11:30 **The 1991 Cholera Epidemic in Latin America and the FDA Actions in Response** - T. SCHWARZ, Food and Drug Administration, Washington, DC

TECHNICAL SESSION
DAIRY MICROBIOLOGY
Convener: R. DAGGS

8:30 **Detection of Latent Coliforms in Pasteurized Milk** - R. HOLLEY, R. Ledford, E. Wolff, and K. Scofield, John Labatt Limited, London, Ontario

8:45 **Identification of Milk Enzymes for Monitoring Heat-Treatments Applied to Milk** - Y. HURVI, and M. Griffiths, University of Guelph, Guelph, Ontario

9:00 **Adaption to Acid Promotes Survival of *Salmonella* in Cheese** - G. LEYER, and E. Johnson, University of Wisconsin, Madison, WI

9:15 **Microbiological Safety of Blue and Cheddar Cheeses Containing Naturally Modified Milk Fat** - S. SCHAFFER, S. Tatini, and R. Baer, University of Minnesota, St. Paul, MN

9:30 **Behavior of *Listeria monocytogenes* in Cold-pack Cheese Containing Nisin During Storage** -

A. AJAO, T. Yezzi, and E. Zottola, University of Minnesota, St. Paul, MN

9:45 **Extension of Shelf-Life of Cottage Cheese Using Monolaurin** - D. BAUTISTA, M. Durisin, and M. Griffiths, University of Guelph, Guelph, Ontario

10:00 Break

10:15 **The Use of Epifluorescent and Phase Microscopy in Evaluating Mixed Biofilms** -K. SASAHARA, E. Zottola, University of Minnesota, St. Paul, MN

10:30 **Elimination of Surface-Attached Bacteria by Detergent Washing and Chemical Sanitation in a Dynamic Flow System** - M. CZECHOWSKI, and M. Banner, Diversey Corporation, Wyandotte, MI

10:45 **A Novel System of Sanitation, Disinfection and Sterilization Effective Against Biofilms** - D. KRAMER, Sterilex Corporation, Owings Mills, MD

11:00 **Effect of Cold Temperature on Germicidal Efficacy of Quaternary Ammonium Compound, Iodophor and Chlorine on *Listeria*** - E. TUNCAN, ConAgra Frozen Foods, Columbia, MO

11:15 **Assessment of Handling Conditions and Quality of Milk in Oregon Public Schools** - F. BODYFELT and A. Gatherum, Oregon State University, Corvallis, OR

11:30 **A Comparison of Commercially Processed Fluid Milks Held at 7.2°C (45°F) for 10, 12 and 14 Days** - S. BARNARD and R. Smeltz, Pennsylvania State University, University Park, PA

SYMPOSIUM
MILK QUALITY*
Convener: K. LESLIE

8:30 **Rational Antibiotic Therapy for Mastitis - A Residue Avoidance Perspective** - R. ERSKINE, Michigan State University, East Lansing, MI

9:00 **Factors Associated with Inhibitor Violations on Ontario Dairy Farm** - S. MCEWEN, University of Guelph, Guelph, Ontario

9:30 **Cowside Antibiotic Residue Tests: Current Status on Availability, Use and Interpretation** - W. SISCHO, Pennsylvania State University, University Park, PA

10:00 Break

10:20 **Verotoxigenic *E. coli* Contamination of Milk and Associated Risk Factors** - J. WILSON, University of Guelph, Guelph, Ontario

10:45 **Milk Quality Improvement Initiatives for the Ontario Dairy Industry** - A. GODKIN, Ontario Ministry of Agriculture and Food, Fergus, Ontario

11:15 **Dynamics and Trend Analysis of Bulk Milk Quality Data** - K. LESLIE, University of Guelph, Guelph, Ontario

11:40 **Relationship of Milking Machine Design and Function to Milk Quality** - S. SPENCER, Pennsylvania State University, University Park, PA

***Co-sponsored by the National Mastitis Council**

SCIENTIFIC POSTER SESSION
Authors Present: Breaks and Lunch on Monday and Breaks on Tuesday a.m. (Teardown Tues. noon)
Convener: B. LANGLOIS

Growth and Survival of *Vibrio* spp. as Determined by pH, Acidulant, Time and Temperature - M. AROCHA, S. Loder, J. Rupnow, and L. Bullerman, Universidad Santa Maria, El Paraiso, Caracas, Venezuela

Rapid Assay for *Bacillus* Proteinases in Raw Milk as Detected by a Simple Casein Denaturation Method - F. BODYFELT, S. Feijoo, and C. Gonzalez, Oregon State University, Corvallis, OR

Application of a Recording Thermometer to Monitor Cleaning and Sanitizing Procedures for Farm Raw Milk Transport Lines - J. BRUHN, L. Collar, C. Collar, and T. Schultz, University of California, Davis, CA

Microbial and Chemical Analysis of Mexican White Soft Cheese and its Relationship with the Content of Histamine and Tyramine - M. DIAZ-CINCO, R. Okada, and J. Taylor, Centro de Investigación en Alimentación y Desarrollo, Mexico

Survival of *Salmonella typhimurium, Escherichia coli* O157:H7 and *Listeria monocytogenes* Scott A During Storage on Beef Sanitized with Organic Acids - J. DICKSON and G. Siragusa, USDA, ARS, Clay Center, NE

Use of Phenols and Liquid Smoke to Control *Listeria monocytogenes* - N. FAITH, A. Yousef, and J. Luchansky, University of Wisconsin, Madison, WI

Fate of *Listeria monocytogenes* in Modified-Atmosphere Packaged Turkey Roll - J. FARBER and E. Daley, Microbiology Research Division, Bureau of Microbial Hazards, Ottawa, Ontario

Fate of *Escherichia coli* O157:H7 in Fermented, Dry Sausage and in Modified Atmosphere Packaged Beef - K. GLASS, J. Loeffelholz, J. Ford, and M. Doyle, University of Wisconsin, Madison, WI

Frequency of False Presumptive Positive Results Obtained using a Commercial ELISA Kit to Screen Retail Ground Beef for *Escherichia coli* O157:H7 - S. INGHAM and L. Sernowski, University of Saskatchewan, Saskatoon, Saskatchewan

Incidence of Low Levels of Enterotoxin-Producing *Bacillus cereus* in Routine Surveillance Food Samples - S. JACKSON, Ontario Ministry of Health, Hamilton, Ontario

Dimorphism in *Shigella sonnei* as it Relates to Retention of Biochemical and Serological Characteristics - G. ALLEN-JUNE, P. Sherrod, W. Andrews, T. Hammack, and L. Koopman, Food and Drug Administration, Washington, DC

Accessibility to Chlorine of Bacteria Attached to or Entrapped in Poultry Skin - H. LILLARD, USDA, ARS, Athens, GA

Low Dose UV and Gamma Radiation on Shelf-life of Peaches - J. YU, S. Lukombo, S. Stevens, V. Khan, C. Wilson, and P. Pusey, Tuskegee University, Tuskegee, AL

Incidence of Bacteria on Smear-Ripened Cheeses Able to inhibit *Listeria monocytogenes* - E. RYSER, S. Maisnier-Patin, J. Gratadoux, and J. Richard, INRA, Jouy-en-Josas, France

Effectiveness of a Modified Salmonella-Tek™ Enzyme Immunoassay for the Recovery of *Salmonella* from Selected Low-Moisture Foods - P. SHERROD, G. Allen-June, T. Hammack, L. Koopman, and W. Andrews, Food and Drug Administration, Washington, DC

Microbial Growth Rate of Two Minimally Processed Vegetables Packaged in Modified Atmosphere Package - S. WANG, Horticultural Research Institute of Ontario, Vineland Station, Ontario

Ultrasonic Killing of *Listeria monocytogenes* and *Salmonella typhimurium* in Milk - D. WRIGLEY and N. Llorca, Mankato State University, Mankato, MN

Evaluation of PC Based Software in the Dairy Q.C. Laboratory - D. BLOMQUIST and R. Bakka, Klenzade, Tampa, FL

Improvement of Lactic Cultures Through Organic Solvent Treatment - C. FERREIRA, DTA-UFV, Viscosa, MG, Brazil

Virulence of an *Escherichia coli* O157:H7 Sorbitol Positive Mutant - P. FRATAMICO, USDA, ARS, ERRC, Philadelphia, PA

Quantitative Effects of pH and Lactic Acid Concentration on the Kinetics of *Listeria monocytogenes* Inactivation - M. GOLDEN, R. Buchanan, and R. Whiting, USDA, ARS, ERRC, Philadelphia, PA

Survey of Spoilage Bacteria in Raw Milk at Egyptian Markets and Farms - H. EL-HADY and R. Hafez, Cairo University, Giza, Egypt

Fate of Enterotoxigenic Staphylococci in Fish Subjected to Curing - S. SANJEEV and P. Surendran, Central Institute of Fisheries Technology, Cochin, India

Actual and Perceived Incidences of Perforation in Surgical and Examination Gloves - J. ISON, University of Kentucky, Lexington, KY

The Effect of Ultraviolet Light-C on Storage Rots and Ripening of Tomatoes - C. STEVENS, J. Liu, V. Khan, J. Lu, C. Wilson, O. Adeyeye, M. Kabwe, L. Pusey, E. Chalutz, and T. Sultana, Tuskegee University, Tuskegee, AL

VIDEO THEATRE

Monday & Wednesday - 8:30 - 12:00 and 1:30 - 5:00,
Tuesday morning 8:30 - 12:00

A list of titles and presentation times
will be published at a later date

MONDAY AFTERNOON, JULY 27

UPDATE ON FOODBORNE PATHOGENS SYMPOSIUM*
Co-Conveners: A. LAMMERDING AND J. SMITH

1:35 **Cholera in the Americas: A Foodborne Hazard?** - T. POPOVIC, O. Olsvik, and K. Wachsmuth, Centers for Disease Control, Atlanta, GA

2:05 ***Listeria monocytogenes*: Current Issues in Perspective** - J. FARBER, Health and Welfare Canada, Ottawa, Ontario

2:35 **Isolation of Verocytotoxin - Producing *Escherichia coli* from Animals and Food Products** - R. CLARKE, S. Read, J. Wilson, and H. Lior, Health of Animals Laboratory, Agriculture Canada, Guelph, Ontario

3:05 Break

3:20 **Foodborne Toxoplasmosis** - J. SMITH, USDA, ARS, ERRC, Philadelphia, PA

3:50 ***Salmonella* Control in Canada** - R. IRWIN, Agriculture Canada, Guelph, Ontario

4:20 **Update on the Status of *Salmonella enteritidis* in the U.S.A.** - J. MASON and E. Ebel, Salmonella Task Force, Hyattsville, MD

***Co-Sponsored by the Canadian College of Microbiologists**

TECHNICAL SESSION
LABORATORY METHODS
Convener: J. DICKSON

1:30 **Effective Method for Dry Inoculation of *Salmonella* Cultures** - C. HOFFMANS and D. Fung, Kansas State University, Manhattan, KS

1:45 **Evaluation of Enrichment and Plating Media for Isolation of Virulent *Yersinia enterocolitica* from Ground Meat** - L. YU and D. Fung, Kansas State University, Manhattan, KS

2:00 **Comparison of 25g and 375g Composite Samples for Detection of *Listeria*** - S. DECKER, D. Evanson, D. McIver, E. Richter, K. Jost-Keating, B. McMorrow, Silliker Laboratories, Garwood, NJ

2:15 **Development of Culture Media for the Rapid Detection of *Lactobacillus* Species in High Acid Foods Using Impedance Microbiology** - C. GRAVENS, F. Hoag, P. Rule and W. Ericsen, bioMerieux Vitek, Hazelwood, MO

2:30 **Effective Recovery of *Campylobacter* in the Presence of Mixed Culture** - F. NIROOMAND and D. Fung, Kansas State University, Manhattan, KS

2:45 **Recovery of *Campylobacter* spp. from Poultry through Enrichment in 10 ml or 100 ml Volumes** - N. STERN, USDA, ARS, Russell Research Center, Athens, GA

3:00 Break

3:15 **Rapid Method for Assessing Microbiological Quality of Egg Washwater Using Resazurin** - J. TETRO and F. Bartlett, Centre for Food and Animal Research, Agriculture Canada, Ottawa, Ontario

3:30 **Rapid Fluorometric Analysis of Acid Phosphatase Activity in Cooked Poultry Meat** - C. DAVIS and W. Townsend, USDA, ARS, Athens, GA

3:45 **Fluorometric Analysis of Alkaline Phosphatase Inactivation Correlated to *Salmonella* and *Listeria* Inactivation** - K. ECKNER, Silliker Laboratories Group, Chicago Heights, IL

4:00 **Shelf Life Prediction of Pasteurized Fluid Milk Using the Charm II System** - S. TRIVEDI, H. Zarrin, E. Zomer, and S. Charm, Charm Sciences, Malden, MA

SANITATION AND DISASTER CONTROL SYMPOSIUM
Convener: M. BANNER

1:30 **Oh God, We're Going to Die - Food Safety at Disaster Time** - D. CLINGMAN, General Mills Restaurants, Inc., Orlando, FL

2:00 **Ready? or Sorry!! The Need to Exercise Emergency Plans** - C. BYRNE, St. Louis Department of Community Health and Medical Care, Clayton, MO

2:30 **Hurricane Hugo and its Aftermath (Sanitation and Disaster Control)** - J. HALL, South Carolina Department of Health and Environmental Control, Columbia, SC

3:15 **Disaster Control/Prep. Canada** - H. QUINNELL, Health and Welfare Canada, Ottawa, Ontario

TUESDAY MORNING, JULY 28

TECHNICAL SESSION
FOODBORNE MICROBIOLOGY
Co-Conveners: P. COOK and M. CIRIGLIANO

8:30 **Predictive Modeling of Psychrotrophic *Bacillus cereus*** - J. BAKER and M. Griffiths, University of Guelph, Guelph, Ontario

8:45 **Microbial Ecology of Modified Atmosphere Packaged Pork** - L. MCMULLEN and M. Stiles, University of Alberta, Edmonton, Alberta

9:00 **Method for Classifying Foods with a Similar Microbiological Risk** - A. FRASER, C. Sawyer, S. Andrews and J. Youatt, Michigan State University, East Lansing, MI

9:15 **Processing and Fermentation of Soy Yogurt Made from Rapid Hydration Hydrothermal Cooked Soy Milk** - P. TUITEMWONG, L. Erickson, D. Fung and K. Tuitemwong, Kansas State University, Manhattan, KS

9:30 **Microbiology HACCP Determination at a Poultry Processing Plant** - G. BROCK, E. Barrett, D. Theno, and J. Lee, University of California, Davis, CA

9:45 **Combined Effects of Glycerol Monolaurate, Ethanol, and Lactic Acid Against *Listeria monocytogenes*** - D. OH and D. Marshall, Louisiana State University, Baton Rouge, LA

10:00 Break

10:15 **Lethal Effect of Dimethyl Dicarbonate on *Listeria* and *Salmonella*, and its Potential for Use in the Treatment of Fresh Produce** - M. CIRIGLIANO and P. Rothenberg, Thomas J. Lipton Company, Cresskill, NJ

10:30 **Simultaneous Production of Yeast Polygalacturonase and Lactate Dehydrogenase from Sauerkraut Brine** - J. SCHWARZ and Y. Hang, Cornell University, Geneva, NY

ACTIVITIES OF THE NATIONAL ADVISORY COMMITTEE ON MICROBIOLOGICAL CRITERIA FOR FOODS SYMPOSIUM
Co-Conveners: F. SHANK and R. CROSS

8:30 **Introductory Remarks** - F. SHANK, CFSAN, FDA, Washington, DC

8:40 ***Listeria*** - J. KVENBERG, FDA, Washington, DC

9:10 **Fresh Meat and Poultry** - D. THENO, Theno & Associates, Modesto, CA

9:35 **Hazard Analysis and Critical Control Points** - M. PIERSON, VPI & SU, Blacksburg, VA

10:00 Break

10:20 ***Campylobacter*** - R. GRAVANI, Cornell University, Ithaca, NY

10:50 **Food Handling Practices** - M. ROBERTS, Florida Department of Agriculture, Tallahassee, FL

11:20 **Concluding Remarks** - R. CROSS, USDA, FSIS, Washington, DC

AUTOMATION IN DAIRY PROCESS CONTROL SYMPOSIUM
Co-Conveners: D. SEIBERLING

8:30 **Process Design and Extended Shelf Life of Dairy Products** - D. SEIBERLING, Seiberling & Associates, Roscoe, IL

9:00 **Documentation of Automated Processes** - J. HYDE, Seiberling & Associates, Roscoe, IL

9:30 **Automatic Cleaning and Sanitation in the 90's** - R. FLOH, Diversey, Inc., Mississauga, Ontario

10:00 Break

10:15 **Aseptic Dairy Processing** - H. SCHMIDT, Alfa-Laval, Pleasant Prairie, WI

10:45 **Regulatory Aspects/Inspections - Fed. Department Agriculture Canada** - R. PULYK, Alberta Agriculture, Wetaskiwin, Alberta

TUESDAY AFTERNOON, JULY 28

GENERAL SESSION - INTERNATIONAL FOOD STANDARDS
Co-Conveners: J. SCOTT and R. HOLLEY

1:00 **The International Dairy Federation - Development of IDF Standards and Bulletins** - H. WAINESS, H. Wainess & Associates, Northfield, IL

1:30 **Food Standards and Food Safety in Japan** - N. TANAKA, U.S.-Japan Science Consulting Services, Delmar, NY

2:00 **International Labeling and Advertising Requirements: The Effect on Trade** - L. CRAWFORD, National Food Processors Association, Washington, DC

2:30 **Food Safety Issues in Europe - An Update** - M. STRINGER, Campden Food and Drink Research Association, Gloucestershire, England

ANNUAL IAMFES BUSINESS MEETING

3:15 **Welcome and Introduction** - M. DOYLE, President-Elect

3:30 **Report from the President** - D. GABIS

3:45 **Business Meeting** - D. GABIS, 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** - R. SANDERS, Past President

WEDNESDAY MORNING, JULY 29

SEAFOOD REGULATORY SYMPOSIUM
Co-Conveners: C. HACKNEY and E. TODD

8:30 **The United States Food and Drug Administration's Office of Seafood; Update on Activities** - T. BILLY, Food and Drug Administration, Washington, DC

9:00 **Canadian Seafood Inspection** - B. EMBERLY, Department of Fisheries & Oceans, Ottawa, Ontario

9:30 **Seafood Issues Within CODEX** - S. GARRETT, NMFS's National Seafood Quality and Inspection Laboratory, Pascagoula, MS

10:00 Break

10:15 **Voluntary Retail Seafood Program within the U.S. FDA** - L. EDWARDS, Food and Drug Administration, Washington, DC

10:45 **National Advisory Committee for Microbiological Critera for Foods: Seafood Issues Update** - J. KVENBERG, Food and Drug Administration, Washington, DC

11:15 **ICMFS: Update on Seafood Issues** - J. LISTON, University of Washington, Seattle, WA

DAIRY SYMPOSIUM
Co-Conveners: D. HENNING and M. GRIFFITHS

8:30 **Psychrotropic *Bacillus* spp. - More Than Just Spoilage Organisms?** - J. BAKER, F. Bodyfelt, and M. Griffiths, University of Guelph, Guelph, Ontario

9:00 **Bioluminescence: An Enlightening Technology** - M. GRIFFITHS, University of Guelph, Guelph, Ontario

9:30 **Bifidobacteria in Dairy Products** - V. MISTRY, South Dakota State University, Brookings, SD

10:00 Break

10:15 **Biofilms, a Cleaning and Sanitizing Perspective** - B. CORDS, Ecolab, St. Paul, MN

10:45 **Laboratory Management System (Microbiology)** - M. LAMMERS, Diversey Corporation, Wyandotte, MI

CONSUMER'S AND SCIENTIST'S VIEWS ON IRRADIATION AND FOOD SAFETY SYMPOSIUM
Co-Conveners: M. BRODSKY and N. STERN

8:30 **The Consumer's View of Food Safety** - R. JACKSON, Consumers' Association of Canada, Kitchener, Ontario

9:00 **Food Safety - An Epidemiologist's Perspective** - J. HOCKIN, Laboratory Centre for Disease Control, Ottawa, Ontario

9:30 **Limitations of Our Current Approach for Assessing Microbiological Food Safety** - R. BUCHANAN, USDA, ARS, ERRC, Philadelphia, PA

10:00 Break

10:15 **Safety Ramifications of Food Irradiation** - J. BORSA, AECL Research, Pinawa, Manitoba

10:45 **Public Perceptions Toward Irradiation of Foods** - Media Presentation

11:15 **Round Table Discussion - Closing the Gap Between Perception and Reality or, How Do We Get There from Here?**

WEDNESDAY AFTERNOON, JULY 29

SEAFOOD SAFETY SYMPOSIUM
Co-Conveners: C. HACKNEY and E. TODD

1:30 **Enteric Viruses and Seafood Safety** - M. KILGEN, Nicholls State University, Thiibodaus, LA

2:00 **Bacterial Pathogens** - C. HACKNEY, VPI & SU, Blacksburg, VA

2:30 **New Insights into Seafood Toxin Research** - E. TODD, Sir Frederick G. Banting Research Centre, Ottawa, Ontario

3:00 Break

3:15 **Chemical Contaminants** - J. RODRICKS, Environ Corporation, Arlington, VA

3:45 **Seafood HACCP Programs** - R. MARTIN, National Fisheries Institute, Arlington, VA

FOOD IRRADIATION SYMPOSIUM
Convener: N. CHUAQUI-OFFERMANNS

1:30 **Food Irradiation: Introductory Overview** - J. BORSA, AECL Research, Pinawa, Manitoba

2:00 **Safety and Wholesomeness of Irradiated Food** - D. THAYER, USDA, ARS, Philadelphia, PA

2:30 **Reduction of Foodborne Disease Through the Use of Radiation Processing** - R. ENGEL, International Programs, FSIS, USDA, Washington, DC

3:00 Break

3:15 **International Regulatory Status and Harmonization of Food Irradiation** - D. DERR, USDA, FSIS, S&T, Washington, DC

3:45 **Marketing Irradiated Food** - W. HARGRAVES, Vindicator, Plant City, FL

4:15 **Status on United States Regulations for Irradiation as a Quarantine Treatment** - R. ROSS and J. Fons, USDA Animal and Plant Health Inspection Service, Washington, DC

COMPUTER/PREDICTIVE MODELLING
Conveners: R. BUCHANAN and D. WHITING

1:30 **The Use of Probability Models in Assessing the Safety of Foods with Respect to *Clostridium botulinum*** - K. DODDS, Health & Welfare Canada, Ottawa, Ontario

2:00 **The Development and Validation for the Growth of Foodborne Bacteria** -- R. BUCHANAN, USDA, ARS, ERRC, Philadelphia, PA

2:30 **Modeling Bacterial Inactivation/Survival** - R. WHITING, M. Golden, and B. Marmer, USDA, ARS, ERRC, Philadelphia, PA

3:00 Break

3:15 **Predicting Microbial Behavior Under Changing Conditions** - C. CUSTER, USDA, FSIS, S&T PPID, Washington, DC

3:45 **The Application of Microbial Modeling in the Food Industry - Modeling Dairy Products** - M. GRIFFITHS, University of Guelph, Guelph, Ontario

Special Events

Sunday, July 26, 1992

8:00-10:00 Early Bird Reception - Cheese & Wine

Monday Evening, July 27, 1992

7:00 CASA Loma Dinner

Wednesday Evening, July 29, 1992

6:00-7:00 Reception
7:00 Annual Awards Banquet

Events by Invitation

Monday Morning, July 27, 1992

7:00 IAMFES Committee Chairperson Breakfast Meeting

Tuesday Evening, July 28, 1992

5:30-6:30 Presidential Reception
7:00 Past Presidents' Dinner

1992 IAMFES Annual Meeting Exhibitors

(as of March 15, 1992)

Advanced Instruments, Inc.,	Needham Heights, MA
Anderson Instruments, Inc.,	Fultonville, NY
Aquionics, Inc.,	Erlanger, KY
Atkins Technical, Inc.,	Gainesville, FL
Becton-Dickinson Microbiology Systems,	Cockeysville, MD
L.J. Bianco and Associates, Inc.,	Northbrook, IL
Biotrace, Inc.,	San Diego, CA
bioMerieux Vitek Systems, Inc.,	St. Louis, MO
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Charm Sciences, Inc.,	Malden, MA
Custom Control Products, Inc.,	Racine, WI
DQCI Services, Inc.,	St. Paul, MN
Difco Laboratories,	Mississauga, ON
Diversey Inc.,	Mississauga, ON
Foss Food Technology Corp.,	Brampton, ON
Gist-brocades Food Ingredients, Inc.,	King of Prussia, PA
Glengarry Biotech,	Cornwall, ON
Idetek, Inc.,	Sunnyvale, CA
IDEXX Laboratories, Inc.,	Portland, ME
Klenzade, A Service of Ecolab, Inc.,	St. Paul, MN
Meritech, Inc.,	Englewood, CO
Meyer Service & Supply Ltd.,	Long Sault, ON
NASCO - Whirl-Pak,	New Hamburg, ON
Nelson-Jameson, Inc.,	Marshfield, WI
Organon Teknika Corporation,	Durham, NC
Promega Corporation,	Madison, WI
Radiometer America, Inc. (Bach Simpson, Ltd.),	Westlake, OH
Raven Biological Laboratories, Inc.,	Omaha, NE
R-TECH (Results Technology),	Minneapolis, MN
Rio Linda Chemical Co., Inc.,	Sacramento, CA
Silliker Laboratories Group, Inc.,	Chicago Heights, IL
SmithKline-Beecham Animal Health,	Exton, PA
3-A Symbol Council,	Cedar Rapids, IA
3M Microbiology Products,	St. Paul, MN
Unipath Co., Oxoid Division,	Ogdensburg, NY
Walker Stainless Equipment Co., Inc.,	New Lisbon, WI

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Goody Bag Stuffers ..... Bob Tiffin
Sunday Wine and Cheese ..... Coleen Stevens
Patrick Kwan
Monday Night Gala ..... Coleen Stevens
Patrick Kwan
Tuesday Night Past Presidents Dinner . Doug Cunningham
Bill Kempa
Patrick Kwan
Coleen Stevens
Wednesday Night Awards Banquet ..... Patrick Kwan
Coleen Stevens
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Spouse/Companion Tours

A Get-Acquainted Tour of Toronto and CN Tower

Monday, July 27, 1992
9:00 a.m. - 12:00 noon
Cost: $17 (US), $20 (CDN)

Explore the unique personality of the world's "newest great city" on this get-acquainted tour of Toronto!

With emphasis on the blending of residential, commercial and recreational facilities and the eye-catching combination of old and new, your guide will share interesting and unusual anecdotes about Toronto and its residents as you tour through distinct areas of the city, including: the downtown financial district with its stunning skyline of skyscrapers, many of which are constructed from a different material (for example, the Royal Bank building with windows containing real gold dust); the midtown section, where fashionable boutiques and galleries of Yorkville are just a stones' throw from the Victorian Gothic of the Ontario Parliament Buildings; and uptown Toronto, where the playing fields of two of Canada's most prestigious private schools back on to the residences of a few of its more famous personalities!

Some of the other attractions included in today's look at Toronto will be the Royal Ontario Museum and McLaughlin Planetarium; Roy Thomson Hall; Old Towne of York, where Toronto had its beginnings; O'Keefe and St. Lawrence Centre for the Arts; Old and New City Halls; Ontario Parliament Buildings; the Eaton Centre, with its stunning glass domed galleria; Chinatown; the Art Gallery of Ontario and innovative Village by the Grange residential and shopping developments; parks; theatres, and numerous other places of interest in and around the city.

Then to complete your morning, "Zoom" to the clouds via a thrilling 58-second ride in a glass sided elevator up the CN Tower, the world's tallest free standing structure and marvel at modern technology. Whilst revelling in the magnificent bird's eye panoramic view of Toronto from 1,150 feet above the ground, your knowledgeable guide will also conduct a unique aerial tour of the city and its surrounding area.

Historic Tour of Downtown and Restored Theatres

Monday July 27, 1992
2:00 p.m. to 5:00 p.m.
Cost: $12 (US), $14 (CDN)

Take an exciting tour "behind the scenes" and discover the hidden world that transforms fantasies to realities! Third in the world behind New York and London, Toronto is proud of its first class theatres and concert halls, however, the ultimate treasures are found in two magnificently restored vaudeville houses of the 1920's. Look back to a time of extravagance with visits to the historic Elgin and Winter Garden Theatres the only active stacked theatres in the world. The restorations for this complex began in March 1987 and lasted for 33 months with artists, historians, carpenters, plasterers, painters and many others painstakingly repairing or re-creating every detail of the original theatres' design. Vaudeville was presented here until 1930 when the Elgin became exclusively a movie house. Situated directly above is the Winter Garden Theatre, which opened in February 1914. As this theatre was strictly a vaudeville house, it too became passé and had its last performance in 1928, after which its doors were simply closed and the theatre left to slumber for sixty years. Walking through the Winter Garden Theatre with its hand painted walls and leaves suspended from the ceiling is reminiscent of a stroll through an English fantasy garden. Both the Elgin and the Winter Garden Theatres are designated national historic sites.

Following your theatre tour, this Historic walking tour of Downtown will continue by highlighting two of Toronto's most imposing buildings which are reflections of the city's past and present - The Old and New City Halls. Located across the street from each other, these two buildings share an important part of the city's architectural and historic identity. Begin your walking tour at New City Hall with a view of the Peace Garden, Henry Moore's famous sculpture "The Archer", and finally the beautiful rotunda inside.

Across the street from new City Hall, but light-years removed in architectural style, stands Old City Hall. It was completed just in time to ring in the 20th century at 1/10 the cost of the New City Hall. Marvel at the magnificent wood paneling, high ceilings and marble columns, and elaborate 300 foot high clock tower.

Finally, your guide will escort you to the Church of the Holy Trinity which, set against the Eaton Centre's high-tech glitter, looks more impressive today than it did even a century ago. Right next door is the home of the first rector of Holy Trinity, Rev. Henry Scadding. This Georgian/Gothic style house was built in 1857 and its intriguing balcony once commanded a view down to the harbour and around the entire town.

Niagara Falls and Niagara-on-the-Lake

Tuesday, July 28, 1992
8:00 a.m. to 5:00 p.m.
Cost: $42 (US-Adults), $30 (US-Children)
$49 (CDN-Adults), $35 (CDN-Children)

This spectacular showcase of Niagara has been specially designed to offer delegates attending the IAMFES 1992 Convention an excellent opportunity to experience first hand, the beauty and excitement of the Niagara Peninsula.

Begin your day with a pleasant journey to the Niagara Peninsula and feel the thrill of excitement and anticipation as your approach the majestic and thunderous Falls! Upon arriving at this magnificent splendor, your first impressions will be that of the powerful surging waters of the Canadian and American Falls. First your guide will take you on a short orientation tour of the area, pointing out such attractions as the Oaks' amphitheatre, the scenic tunnels, the Maid of the Mist and superb gardens. Then time will be available for those who wish to climb aboard the *Maid of the Mist* tour boat for a thrilling and exciting close-up look at the base of the thundering falls. (Tour boat ride at your own expense).

On leaving the Falls for Niagara-on-the-Lake, journey along the Niagara Parkway, where participants will have a chance to see the impressive Niagara Gorge, with its swirling whirlpool rapids; the massive power stations which provide hydro-electricity to southern Ontario and the north-eastern part of New York; the floral clock, one of the largest of its kind in North America.

A picnic lunch today will take place in the area of one of the famous battlefields of the war of 1812 between British and American armies at Queenston Heights Park. The picnic area is located on the brow of the Niagara escarpment and has a spectacular view of the broad Niagara River and fruitlands.

After lunch you will continue your trip on to Niagara-on-the-Lake, a charming 19th Century town which, as the first capital of Upper Canada, has a rich history and culture. The home of the world renowned Shaw Festival which draws both international performers and audiences, this tranquil town offers participants an opportunity to meander through quaint boutiques and tree-lined streets. Visit an old fashioned apothecary, explore some of the fine examples of 19th Century homes, and perhaps indulge in freshly made fudge and preserves.

Blue Jay Baseball and dinner at Windows

Tuesday, July 28, 1992
7:30 p.m. to 11:00 p.m.
Cost: $40 (US), $47 (CDN)

Let's go Blue Jays!

Enjoy an evening watching the Toronto Blue Jays play in the fabulous SkyDome Stadium. The SkyDome-billed as "like no other in the world" is being talked about by virtually every sports fan in North America. This incredible multi-use facility provides 55,000 to 70,000 fans with spectacular views in all directions and outstanding sight lines for a variety of activities, including all major sporting events and star-studded concerts. It is more than merely a sports stadium. This magnificent complex also includes a 450 room hotel with 77 rooms overlooking the playing field, a health club, a movie theatre, bars and restaurants.

Windows on SkyDome is an elegant, three tiered restaurant overlooking the stadium and features a delicious buffet dinner. A section of this unique restaurant, has been specially reserved for delegates attending the IAMFES 1992 Convention. Some tables offer full viewing of the playing field and others offer monitor viewing only, therefore seating will be assigned on a "first come-first serve" basis.

79th IAMFES Annual Meeting Registration Form -Canadian Funds

Sheraton Centre Hotel — Toronto, Ontario — July 26-29, 1992
(Use photocopies for extra registrations)

FOR OFFICE USE _____ _____
Date Rec'd._____ First initial Last name
ID#_____ Registration #_____

If you wish to use a Credit Card, please use the U.S. Form.

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

Registration		Amount	Total Amount
	IAMFES Member (Banquet included)	$115 ($155 on-site)	
	Non-Member (Banquet included)	$172 ($213 on-site)	
	IAMFES Student Member	$ 29 ($ 29 on-site)	
	IAMFES Member One Day (Circle: Mon/Tues/Wed)	$ 58 ($ 80 on-site)	
	Non-Member One Day (Circle: Mon/Tues/Wed)	$ 86 ($109 on-site)	
	Spouse/Companion (Name): _____	$ 23 ($ 23 on-site)	
	Children (16 & Under), Name: _____	$ 23 ($ 23 on-site)	

Membership Information: For information on becoming a Member of IAMFES, please contact Julie at (800)284-6336.

			# of tickets	
Other Fees: (Per Person)	Cheese & Wine Reception (Sun., 7/26)	FREE		
	CASA Loma Dinner (Mon., 7/27) - Adult	$ 47 ($ 52 on-site)		
	IAMFES Awards Banquet (Wed., 7/29)	$ 30 ($ 35 on-site)		
Spouse/Companion Events:	A Get-Acquainted Tour of Toronto and CN Tower (Mon., 7/27)	$ 20 ($ 25 on-site)		
	Historic Tour of Downtown and Restored Theatres (Mon., 7/27)	$ 14 ($ 19 on-site)		
	Niagara Falls and Niagara-on-the-Lake (Tues., 7/28) - Adult	$ 49 ($ 54 on-site)		
	Children (16 & Under) --	$ 35 ($ 40 on-site)		
	Blue Jay Baseball and dinner at Windows (Tues. P.M., 7/28)	$ 47 ($ 52 on-site)		

CANADIAN REGISTRATION FORM

Total Amount Enclosed $_____
CANADIAN FUNDS ON CANADIAN BANK

Registration Information

Send payment with registration to IAMFES, 502 E. Lincoln Way, Ames, IA 50010-6666. Make checks payable to IAMFES. Pre-registration must be post-marked by July 1, 1992. The pre-registration deadline will be strictly observed. For additional information contact Julie Heim at 1-800-369-6337, 1-800-284-6336 (Canada).

Refund/Cancellation Policy

The IAMFES policy on meeting cancellation/refunds is as follows: "Registration fees, minus a $15.00 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 a colleague with written notification to IAMFES."

Exhibitor Information

An exhibition of products and consultant services will be at the Sheraton Centre Hotel. For more information on exhibiting at the conference, please contact Scott Wells at 1-800-369-6337 (US), 1-800-284-6336 (Canada).

79th IAMFES Annual Meeting Registration Form - U.S. Funds

Sheraton Centre Hotel — Toronto, Ontario — July 26-29, 1992
(Use photocopies for extra registrations)

FOR OFFICE USE _____ _____
Date Rec'd._____ First initial Last name
ID#_____ 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

Credit Card payments may be sent via Fax today! 515-232-4736

		Amount	# of tickets	Total Amount
Registration				
	IAMFES Member (Banquet included)	$100 ($135 on-site)		_____
	Non-Member (Banquet included)	$150 ($185 on-site)		_____
	IAMFES Student Member	$ 25 ($ 25 on-site)		_____
	IAMFES Member One Day (Circle: Mon/Tues/Wed)	$ 50 ($ 70 on-site)		_____
	Non-Member One Day (Circle: Mon/Tues/Wed)	$ 75 ($ 95 on-site)		_____
	Spouse/Companion (Name):_____	$ 20 ($ 20 on-site)		_____
	Children (16 & Under), Name: _____	$ 20 ($ 20 on-site)		_____
***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		_____
	POSTAGE CHARGES: OUTSIDE THE U.S. - SURFACE RATE	$ 15 per journal		_____
	AIRMAIL	$ 95 per journal		_____
Other Fees: (Per Person)				
	Cheese & Wine Reception (Sun., 7/26)	FREE	_____	_____
	CASA Loma Dinner (Mon., 7/27)	$ 40 ($ 45 on-site)	_____	_____
	IAMFES Awards Banquet (Wed., 7/29)	$ 25 ($ 30 on-site)	_____	_____
Spouse/Companion Events:				
	A Get-Acquainted Tour of Toronto and CN Tower (Mon., 7/27)	$ 17 ($ 22 on-site)	_____	_____
	Historic Tour of Downtown and Restored Theatres (Mon., 7/27)	$ 12 ($ 17 on-site)	_____	_____
	Niagara Falls and Niagara-on-the-Lake (Tues., 7/28)	$ 42 ($ 47 on-site)	_____	_____
	Children (16 & under)	$ 30 ($ 35 on-site)	_____	_____
	Blue Jay Baseball and dinner at Windows (Tues. P.M., 7/28)	$ 40 ($ 45 on-site)	_____	_____

U. S. REGISTRATION FORM

Credit Card Payments: Please Circle: VISA/MASTERCARD/AMERICAN EXPRESS

Card #_____ Exp. Date _____

Name on Card_____ Signature _____

Total Amount Enclosed $_____
U.S. FUNDS DRAWN ON U.S. BANK

Registration Information

Send payment with registration to IAMFES, 502 E. Lincoln Way, Ames, IA 50010-6666. Make checks payable to IAMFES. Pre-registration must be post-marked by July 1, 1992. The pre-registration deadline will be strictly observed. For additional information contact Julie Heim at 1-800-369-6337 (US), 1-800-284-6336 (Canada).

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Guest Room Committment
GOOD UNTIL JULY 2, 1992
Make Your Reservation Now

HOTEL RESERVATIONS
IAMFES

79th Annual Meeting
July 26-29, 1992
The Sheraton Centre
Toronto, Ontario, Canada

Please check accommodation requested:

❑ Single (1 person)
❑ Double (2 persons 2 beds)
❑ King (2 persons 1 bed)
❑ Triple ❑ Quad

Special Requests _____

All room rates are subject to prevailing taxes. (5% PST and 7% GST and city occupancy levy).
Reservations must be received by hotel prior to arrival.

NAME _____

SHARING WITH (Name) _____

COMPANY NAME _____

ADDRESS _____

_____ CITY _____

STATE/PROVINCE _____ COUNTRY _____ ZIP _____

TELEPHONE _____

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

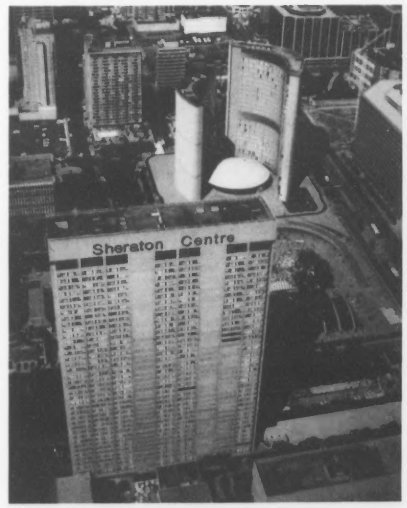
SPECIAL REQUESTS _____

After July 2, 1992 reservations will be accepted on a space availability basis only. Reservations will be held until 4:00 p.m. on the date of arrival, unless guaranteed by one night advance deposit, payable by money order, certified check or a Major Credit Card.

CREDIT CARD #_____ CREDIT CARD_____

EXPIRATION DATE _____

CARD HOLDERS SIGNATURE_____



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$325 - Large Suite

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or FAX (416)947-4801

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Susan W. Noone
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Lyle E. Jerrett
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Tallahassee

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Macoupin County Public Health Dept.
Gillespie

Ross A. Caputo
Pharmaceutical Systems, Inc.
Mundelein

Kim Thiede
Kraft Food Ingredients, Inc.
Champaign

Indiana

Mike Busart
Citrus Hill Manufacturing Co.
Plymouth

Steven R. Kubiak
American Maize-Products Co.
Hammond

Iowa

Azadeh Khojasteh
Iowa State University
Ames

Mark Nielsen
Wapsie Valley Creamery Inc.
Independence

Maryland

Lynda B. Koopman
FDA
North Potomac

Don Lynch
Katrina Inc.
Hagerstown

Michigan

Pamela Denolf
Pure-Pak, Inc.
New Hudson

Sherman L. McDonald
Rio Linda Chemical Company
Lansing

Mike Woodland
Frigo Cheese Company
Cornell

Minnesota

Karla Faucher
Sandoz Nutrition
Minneapolis

Thomas L. Kenefick
Kraft General Foods
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Missouri

Vicki Collett
Ralston Purina
St. Louis

New Jersey

Jeff Anderson
Progresso Foods
Vineland

William S. Kopacka
Applied Research Institute
Perth Amboy

Gary L. Moore
Kings Super Markets
West Caldwell

New Mexico

Mary Alice Black
Environmental Department
Deming

Gunther Diehl
Environmental Department
Alamogordo

Charles Hendrickson
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David Reese
Environmental Department
Silver City

North Carolina

Gary Cartwright
International Paper
Research Triangle

To receive information on membership with IAMFES Circle 360 on this card

IAMFES

DFES
4/92

International Association of Milk, Food and Environmental Sanitarians Inc

Reader requests for information are sent to the appropriate company. Follow-up on reader requests are the responsibility of the company advertising.

The Advertisements included herein are not necessarily endorsed by the International Association of Milk, Food and Environmental Sanitarians, Inc.

Name _____ Title _____

Company _____

Address _____

City _____ State/Prov. _____

Country _____ Zip _____

Phone Number _____

Please send information on items circled below: Deadline 60 days from issue date

101	114	127	140	153	166	179	192	205	218	231	244	257	270	283	296	309	322	335	348
102	115	128	141	154	167	180	193	206	219	232	245	258	271	284	297	310	323	336	349
103	116	129	142	155	168	181	194	207	220	233	246	259	272	285	298	311	324	337	350
104	117	130	143	156	169	182	195	208	221	234	247	260	273	286	299	312	325	338	351
105	118	131	144	157	170	183	196	209	222	235	248	261	274	287	300	313	326	339	352
106	119	132	145	158	171	184	197	210	223	236	249	262	275	288	301	314	327	340	353
107	120	133	146	159	172	185	198	211	224	237	250	263	276	289	302	315	328	341	354
108	121	134	147	160	173	186	199	212	225	238	251	264	277	290	303	316	329	342	355
109	122	135	148	161	174	187	200	213	226	239	252	265	278	291	304	317	330	343	356
110	123	136	149	162	175	188	201	214	227	240	253	266	279	292	305	318	331	344	357
111	124	137	150	163	176	189	202	215	228	241	254	267	280	293	306	319	332	345	358
112	125	138	151	164	177	190	203	216	229	242	255	268	281	294	307	320	333	346	359
113	126	139	152	165	178	191	204	217	230	243	256	269	282	295	308	321	334	347	360

This second Reader Service Card is provided to allow co-workers to also respond to companies of interest.

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4/92

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103	116	129	142	155	168	181	194	207	220	233	246	259	272	285	298	311	324	337	350
104	117	130	143	156	169	182	195	208	221	234	247	260	273	286	299	312	325	338	351
105	118	131	144	157	170	183	196	209	222	235	248	261	274	287	300	313	326	339	352
106	119	132	145	158	171	184	197	210	223	236	249	262	275	288	301	314	327	340	353
107	120	133	146	159	172	185	198	211	224	237	250	263	276	289	302	315	328	341	354
108	121	134	147	160	173	186	199	212	225	238	251	264	277	290	303	316	329	342	355
109	122	135	148	161	174	187	200	213	226	239	252	265	278	291	304	317	330	343	356
110	123	136	149	162	175	188	201	214	227	240	253	266	279	292	305	318	331	344	357
111	124	137	150	163	176	189	202	215	228	241	254	267	280	293	306	319	332	345	358
112	125	138	151	164	177	190	203	216	229	242	255	268	281	294	307	320	333	346	359
113	126	139	152	165	178	191	204	217	230	243	256	269	282	295	308	321	334	347	360

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CIRCLE READER SERVICE NO. 318

Services / Products

Equipment For Sale

Employment Opportunities

Employment Opportunities

Coming Events

1992

May

•**3-6, Centennial Conference of the Ice Cream Short Course** to be held at the J.O. Keller Conference, The Pennsylvania State University, 306 Ag. Administration Building, University Park, PA 16802. For further information call (814)865-8301, FAX (814)865-7050.

•**4-5,Food Safety for Zero Defects Seminar**, sponsored by ASI Food Safety Consultants', will be held in St. Louis, MO. For more information call Christine VerPlank or Nancy Sullivan toll-free at (800)477-0778 or, in MO, (314)725-2555, or write, ASI, P.O. Box 24198, St. Louis, MO 63130.

•**4-6, Food Processing Automation Conference**, sponsored by the Food & Process Engineering Institute, will be held at the Hyatt Regency, Lexington, KY. For more information, contact Jon Hiler, Conference Manager, FPEI, 2950 Niles Road, St. Joseph, MI 49085-9659; Phone (616)429-0300, FAX (616)429-3852.

•**6, Reclamation and Environmental Concerns in the Food Industry**, sponsored by ASI Food Safety Consultants', will be held in St. Louis, MO. For more information call Christine VerPlank or Nancy Sullivan toll-free at (800)477-0778 or, in MO, (314)725-2555, or write, ASI, P.O. Box 24198, St. Louis, MO 63130.

•**7, Employee Health, Hygiene and Practices in the Food Industry**, sponsored by ASI Food Safety Consultants', will be held in St. Louis, MO. For more information call Christine VerPlank or Nancy Sullivan toll-free at (800)477-0778 or, in MO, (314)725-2555, or write, ASI, P.O. Box 24198, St. Louis, MO 63130.

•**11-12, Florida Association of Milk, Food & Environmental Sanitarians Annual Meeting (Taste of the Future - Food Safety)**, will be held at the Marriott, International Drive. For more information contact John Chrisman, General Mills at (407)850-5330.

•**11-13, Pennsylvania Association of Dairy Sanitarians and Dairy Laboratory Analysts Conference** will be held at the J. O. Keller Conference Center on the Penn State University Park Campus. For more information call (814)865-8301, or write to the Dairy Sanitarians Conference, The Pennsylvania State University, 306 Ag. Administration Building, University Park, PA 16802.

•**11-14, Purdue Aseptic Processing and Packaging Workshop** to be held at Purdue University. For more information contact James V. Chambers, Food Science Department, Smith Hall, Purdue University, West Lafayette, IN 47907, Phone: (317)494-8279.

•**11-14, The Powder & Bulk Solids Conference/Exhibition** will be held at the O'Hare Exposition Center, Rosemont, IL. For more information, contact Eileen Oswald, Group Vice President, Cahners Exposition Group, 1350 E. Touhy Avenue, P.O. Box 5060, Des Plaines, IL 60017-5060; telephone: (708)390-2515.

•**13-15, Microscopy/Photomicrography**, sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information contact ATCC/Workshops, 12301 Parklawn Drive, Rockville, MD 20852; (301)231-5566; FAX (301)770-1805.

•**15-17, Food Safety for Dietitians** will be held at the Holiday Inn Decatur Conference Plaza, Atlanta, GA. For more information contact the Department of Nutrition and Dietetics, College of Health Sciences, Georgia State University, Atlanta, GA 30303-3083 (or call Toni Scoggins (404)651-3066; FAX 404/651-3231).

•**19-22, Hybridomas & Monoclonal Antibody Techniques**, sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information contact ATCC/Workshops, 12301 Parklawn Drive, Rockville, MD 20852; (301)231-5566; FAX (301)770-1805.

•**20-22, South Carolina Public Health Association, Inc.**, will meet at the Myrtle Beach Hilton, Myrtle Beach, SC. For more information contact Joyce Mathis at (803)737-4067.

•**25-29, Trace Elements in Health and Disease**, Third ISTERH (International Society for Trace Elements Research in Humans) Conference, and Fourth NTES (Nordic Trace Elements) Conference, to be held in Stockholm, Sweden. For more information contact ISTERH/NTES 1992, Scientific Secretariat, Dr. Lars-Olof Plantin, Clinical Research Centre, Huddinge Hospital, S 141 86 HUDDINGE, Sweden; Phone: +46-8 746 55 68; FAX: +46-8 746 74 83.

June

•**2-3, Milk Procurement Workshop**, sponsored by the organizations of the International Dairy Foods Association, will be held at the Loews Giorgio Hotel Denver, Denver, CO. For more information contact IDFA Marketing & Training Institute, Attn: Registrations, 888 Sixteenth Street, NW, 2nd Floor, Washington, DC 20006-4103; (202)296-4250.

•**2-3, Texas Association of Milk, Water and Food Protection's Annual Meeting** will be held at the Howard Johnson South Plaza, Austin, TX. For more information please contact Janie Park, TAMFES, P.O. Box 2363, Cedar Park, TX 78613-2363, (512)458-7281.

•**2-4, Short Course on "Feta and Other White Brined Cheeses"**, offered by the Minnesota-South Dakota Dairy Foods Research Center, will be held in the Department of Food Science and Nutrition, University of Minnesota, St. Paul. For more information, contact Sybil Woutat at (612)624-1764.

•**5, Tennessee Association of Milk, Water and Food Protection's Annual Meeting** will be held at the Ramada Airport, Nashville, TN. For more information contact Dennis Lampley at (615)360-0157.

•**10-12, Freezing & Freeze-Drying of Microorganisms**, sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information contact ATCC/

Workshops, 12301 Parklawn Drive, Rockville, MD 20852; (301)231-5566; FAX (301)770-1805.

•**14-17, International Conference on Seafood Irradiation** to be held at the Omni Royal Orleans, New Orleans, LA. For more information contact M. Kilgen or M. Cole at (504)448-4700, Nicholls State University, Thibodaux, LA 70310.

July

•**10-17, International Workshop on Rapid Methods and Automation in Microbiology XII** and Mini-Symposium (July 10-11) at Kansas State University. Contact Daniel Y.C. Fung, Director, (913)532-5654 or FAX (913)532-5681, 207 Call Hall, KSU, Manhattan, KS 66506.

•**14-16, Basic Pasteurization Course**, sponsored by the Texas Association of Milk, Food and Environmental Sanitarians, will be held at the Holiday Inn, Emerald Beach, 1102 S. Shoreline Blvd., Corpus Christi, TX. For registration information contact Ms. Janie F. Park, TAMFES, P.O. Box 2363, Cedar Park, TX 78613-2363, (512)458-7281.

•**26-29, 79th Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians** will be held at the Sheraton Centre, Toronto, Ontario. For more information, please contact Julie at IAMFES, (800)369-6337 (US), (800)284-6336 (Canada) or FAX (515)232-4736.

August

•**4-7, Fermentation Microbiology**, sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information contact ATCC/Workshops, 12301 Parklawn Drive, Rockville, MD 20852; (301)231-5566; FAX (301)770-1805.

-•**9-14, The 49th Annual Meeting of the Society for Industrial Microbiology**, Workshop I - "Controlling Biotechnology Risks: A Holistic Approach to Safety and Environmental Protection" (August 9); and Workshop II - "Clean Room Management" (August 9), to be held at the Town & Country Hotel, San Diego, CA. For more information contact the Society for Industrial Microbiology at (703)941-5373 or FAX (703)941-8790.

•**10-14, Biotechnology: Principles and Processes** to be held at the Massachusetts Institute of Technology. For more information contact the Director of Summer Session, MIT, Room E19-356, Cambridge, MA 02139, Phone: (617)253-6721.

•**11-14, Fermentation Microbiology**, sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information contact ATCC/Workshops, 12301 Parklawn Drive, Rockville, MD 20852; (301)231-5566; FAX (301)770-1805.

•**24-28, Advanced Recombinant DNA Methodology**, sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information contact ATCC/Workshops, 12301 Parklawn Drive, Rockville, MD 20852; (301)231-5566; FAX (301)770-1805.

•**25-28, International Dairy Federation** Seminar on "Milkfat & Protein Processing" will be held in Munich. For more information contact Verband der Deutschen Milchwirtschaft, c/o Mr. T. Kützemeier, Meckenheimer Allee 137, D-5300 Bonn 1 (Germany), Tel: 228/638270; FAX: 228/638425.

September

•**1-4, Diagnostic Virology**, sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information contact ATCC/Workshops, 12301 Parklawn Drive, Rockville, MD 20852; (301)231-5566; FAX (301)770-1805.

•**14, Radiation Safety Seminar**, sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information contact ATCC/Workshops, 12301 Parklawn Drive, Rockville, MD 20852; (301)231-5566; FAX (301)770-1805.

•**14-15, Food Safety for Zero Defects**, sponsored by ASI Food Safety Consultants', will be held in St. Louis, MO. For more information call Christine VerPlank or Nancy Sullivan toll-free at (800)477-0778 or, in MO, (314)725-2555, or write, ASI, P.O. Box 24198, St. Louis, MO 63130.

•**16, Reclamation and Environmental Concerns in the Food Industry**, sponsored by ASI Food Safety Consultants', will be held in St. Louis, MO. For more information call Christine VerPlank or Nancy Sullivan toll-free at (800)477-0778 or, in MO, (314)725-2555, or write, ASI, P.O. Box 24198, St. Louis, MO 63130.

•**17, Employee Health, Hygiene and Practices in the Food Industry**, sponsored by ASI Food Safety Consultants', will be held in St. Louis, MO. For more information call Christine VerPlank or Nancy Sullivan toll-free at (800)477-0778 or, in MO, (314)725-2555, or write, ASI, P.O. Box 24198, St. Louis, MO 63130.

•**23-25, Freezing & Freeze-Drying of Microorganisms**, sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information contact ATCC/Workshops, 12301 Parklawn Drive, Rockville, MD 20852; (301)231-5566; FAX (301)770-1805.

•**24, Consumer Food Trends**, sponsored by the American Association of Cereal Chemists, will be held at AACC, 3340 Pilot Knob Road, St. Paul, MN. For more information, contact Marie McHenry, AACC Short Course Coordinator, (612)454-7250; FAX (612)454-0766.

October

•**5-6, The Eleventh Annual Midwest Food Processing Conference "Consumers: Driving Force For Our Future"** sponsored by the Chicago, Iowa, Minnesota and Wisconsin IFT sections, will be held at the Radisson Hotel in LaCrosse, Wisconsin. For more information, contact Ellen Bragg, MFPC Publicity Chairperson, Cargill, Inc., Salt Division, P.O. Box 5621, Minneapolis, MN 55440; phone: (612)475-6929.

•**14-15, Annual Conference of the North Central Cheese Industries Association** will be held at the Holiday Inn, Brookings, SD. For further information, contact E. A. Zottola, Executive Secretary, NCCIA, P O Box 8113, St. Paul, MN 55108.

•**20-22, Basic Pasteurization Course**, sponsored by the Texas Association of Milk, Food and Environmental Sanitarians, will be held at the Le Baron Hotel, 1055 Regal Row, Dallas, TX. For registration information contact Ms. Janie F. Park, TAMFES, P.O. Box 2363, Cedar Park, TX 78613-2363, (512)458-7281.

•**26, GMPs for the Food Industry**, sponsored by ASI Food Safety Consultants', will be held in Chicago, IL. For more information call Christine VerPlank or Nancy Sullivan toll-free at (800)477-0778 or, in MO, (314)725-2555, or write, ASI, P.O. Box 24198, St. Louis, MO 63130.

November

•**8-12, PACK EXPO 92, The World of Packaging Technology**, sponsored by Packaging Machinery Manufacturers Institute (PMMI), will be held at the McCormick Place, Chicago, IL. For more information contact Bonnie E. Kilduff, Exposition Manager, PMMI at (202)347-3838 or FAX (202)628-2471.

1993

May

•**6-12, INTERPACK 93, 13th International Trade Fair for Packaging Machinery, Packaging Materials and Confectionery Machinery**, will be held at the fairgrounds in Dusseldorf, Germany. For further information on exhibiting at or attending INTERPACK 93, contact Dusseldorf Trade Shows, Inc., 150 North Michigan Avenue, Suite 2920, Chicago, IL 60601,(312)781-5180; FAX (312)781-5188.

To insure that your meeting time is published, send announcements at least 90 days in advance to: IAMFES, 502 E. Lincoln Way, Ames, IA 50010-6666.

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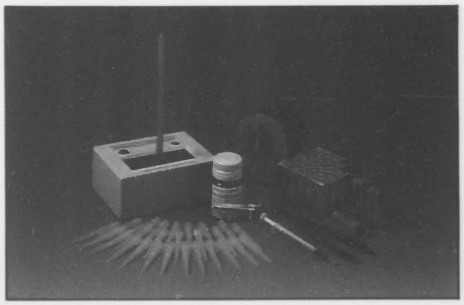

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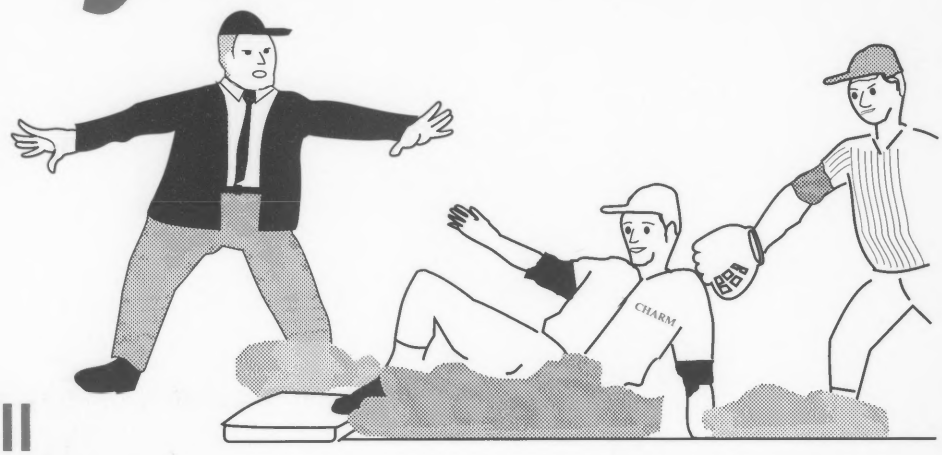

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