ISSN:0273-2866
Box 701
Ames, Iowa 50010

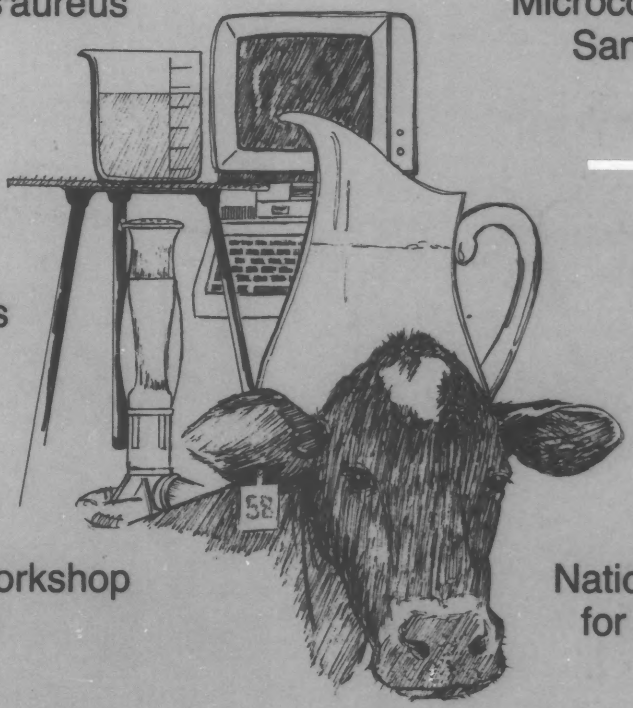
January 1984
Vol. 4, No. 1
Pages 1-40
$5.00

Dairy and Food Sanitation

A Publication of the International Association of Milk, Food and Environmental Sanitarians, Inc.

Staphylococcus aureus Reviewed

Microcomputer Uses in Sanitation Program



Coliform Mastitis

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Microbiology Workshop at Kansas State University

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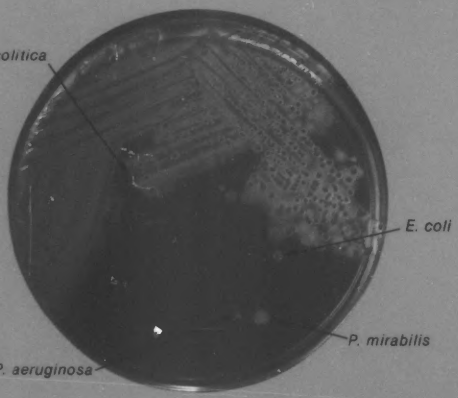

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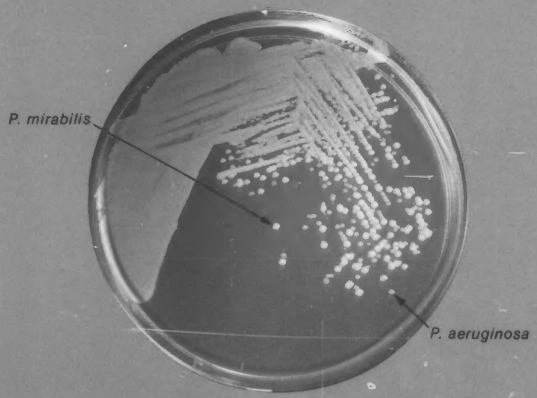

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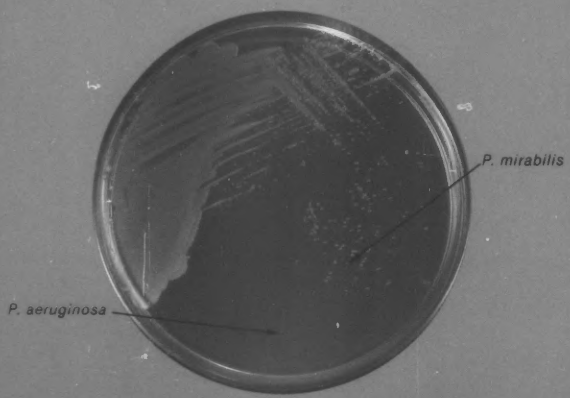

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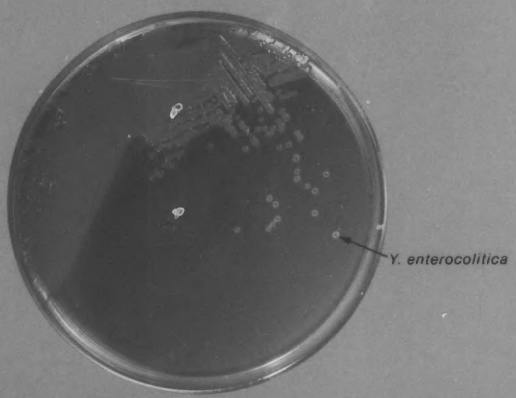

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PRESIDENT'S PERSPECTIVE

I am taking this opportunity, as your new President, to inform you on a matter of importance which relates to IAMFES news and publication thereof.

Several years ago, the IAMFES Executive Board recognized the need for two publications to better serve the needs of the membership. The publication of the many activities and reports had caused delays in the publication of research papers in the *Journal of Food Protection.* The board also recognized that a transition had taken place concerning the increased quantity and improved quality of papers published in the Journal.

In 1981, formal publication of the *Dairy and Food Sanitation* magazine occurred. This IAMFES publication has been widely accepted by public and private sector sanitarians and fieldman.

At the 1983 Annual Meeting of the Executive Board in St. Louis, we determined that publication of news items and related information about IAMFES activities in both publications is causing unnecessary redundancy and additional costs. As President of your Association, I am particularly interested in keeping costs down but at the same time making sure that all IAMFES members receive all Association news related to committees, affiliates, 3-A Standards, abstracts of research papers, and related sanitation news events. A grand total of 3718 issues of both publications are being sent monthly to members and subscribers. Actually, 1217 members receive both publications, 1655 receive only the *JFP* and 846 members receive *DFS.*

Dissemination of news of importance should be through the Association "Organ" which currently is the *JFP.* The Executive Board proposes to amend the By-Laws, Section VI, by substituting *Dairy and Food Sanitation* in the place of the *Journal of Food Protection* as the official "Organ". The Executive Board and the *JFP* and *DFS* Management Committees are interested in providing *all* members with IAMFES news and events in one publication and that all members receive that publication. With this action in mind, we believe that it will be necessary to change the dues structure. The proposed change in wording, covered below, would become effective for Calendar Year 1985:

Direct Membership* **$28**
Journal of Food Protection (in addition to the direct membership fee of $28) **$22**
***cost of membership includes one year subscription to *Dairy and Food Sanitation* Publication.**

We are very hopeful that we will be able to maintain our cost of membership at the present prices.

We are naturally interested in the constructive views of the IAMFES membership regarding our proposed actions. Please write us now while it is on your mind. We would really like to know whether your reactions are favorable or unfavorable.

Thank you for my opportunity to serve you.

Sincerely,

A. Richard Brazis
President, IAMFES

Please address your comments on the above to:
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Dairy and Food Sanitation is published monthly by the International Association of Milk, Food and Environmental Sanitarians, Inc, executive offices at PO Box 701, 413 Kellogg, Ames, IA 50010. Printed by Heuss Printing, Inc, 911 Second St, Ames, IA 50010. **Second-class postage paid at Ames, IA. Postmaster: Send address changes to IAMFES, 413 Kellogg, Ames, IA 50010-0701.**

Manuscripts: Correspondence regarding manuscripts and other reading material should be addressed to Kathy Hathaway, PO Box 701, Ames, IA 50010-0701. 515-232-6699.
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Dairy and Food Sanitation

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Coliform Mastitis - A Challenge for Dairymen and Researchers

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In 1979 A Coliform Subcommittee of the National Mastitis Council published a review of our current knowledge on coliform mastitis (Journal of Dairy Science, Vol. 62, p. 1-22). This review points out the probable sources of coliform organisms in the dairy herd and the best recommendations available in controlling coliform mastitis. Of interest is the conclusion that most of our current recommendations are based on observations on attempts to control coliform mastitis in the field. Most controlled research trials on control methods under field conditions have failed to effectively reduce coliform mastitis. Thus, there is still a great deal to learn about this type of mastitis, and there has been increased interest in coliform mastitis over the past several years. "Coliform" is a term used for infections caused by bacteria that live in the intestinal tract of animals normally and are commonly found in the manure and in bedding contaminated after use. Thus, coliforms are referred to as environmental organisms since they are common to the cow's environment and she may be exposed to them daily. The most common types of coliform organisms associated with mastitis are Escherichia coli, Klebsiella *species,* Enterobacter aerogenes *and* Citrobacter. *Coliform infections are generally less prevalent in herds than are other mastitis pathogens (2% of cows). However, a high incidence has been reported in some herds.*

Clinical Symptoms

Coliform mastitis is characteristically an acute or peracute form which appears rapidly (within 12 hours) and is accompanied by fever, reduced milk production and a quarter that is swollen, hard and sensitive. Milk may be watery or have the appearance of blood serum with clots present and an elevated somatic cell count (SCC). Clots and increased SCC may persist for days even after the organism can no longer be found by culturing. Although clinical cases are usually treated with antibiotics, many cases likely would recover spontaneously. The peracute form is the most severe with pronounced systemic signs (fever, depression, shivering, loss of appetite) and may result in death. It has been estimated that of cows with peracute coliform mastitis, 10% died, 70% dropped in milk production during that lactation and 20% returned to milk. Often cows return to normal production in subsequent lactations.

Although clinical coliform mastitis gets a lot of attention it is becoming apparent that chronic (long duration, reoccurring symptoms) and subclinical forms of the disease may not be uncommon in some herds. Bacteria may be present in small numbers and difficult to isolate by culturing, SCC are elevated, but milk appears normal.

Therapy

Of course all clinical cases of mastitis require immediate attention. Because of the production of endotoxin by coliforms, it is important to milk out the affected quarter completely and as frequently as practical, to remove bacteria, toxins and accumulated products of inflammation. The injection (i.v.) of oxytocin may be helpful for complete removal of these products from the udder. Appropriate antibiotics should be administered by intramammary infusion (and perhaps systemically) under the direction of your veterinarian. In some cases supportive therapy with electrolytes, glucocorticoids or antihistamines may be warranted. Remember that immediate consultation with your veterinarian and quick action are important.

Souces of Bacteria

Coliform infections are often confined to one quarter and result from passage of the bacteria through the teat duct into the milk where they rapidly multiply. Although this pattern occurs with other types of infections, there are some differences with coliforms. Infections caused by staphylococci and some streptococci are transferred from infected to uninfected quarters during the milking process by the milker's hands, udder cloths and milking clusters

and are reduced by disinfectant teat dips applied after milking. However, coliform infections are generally not reduced by disinfectant teat dipping, are not considered contagious organisms and do not colonize the teat end. These organisms reach the teat end at any time from the cow's environment. The major sources of coliforms are bedding material, contaminated teat cup liners, damp walkways, manure-covered exercise yards and heavily contaminated water. Thus, preventing exposure of the teat end to large numbers of coliforms between milkings is a major consideration in controlling this type of mastitis.

Time of Infection

A high proportion of clinical coliform cases are associated with calving. The majority (50-65%) of these coliform cases usually occur within the first three months of lactation. It is not clear if these infections are actually established at or near drying off and remain dormant through the dry period or if bacteria invade the gland at parturition and infection becomes established almost immediately. What is clear is the fact that the early dry period (first two weeks) and two weeks precalving are times when new infections are common, particularly by environmental organisms.

Environmental and Management Factors

Increased herd sizes, increased confinement feeding and housing and decreased access to pasture may increase the coliform concentration in the cow's environment. There is no doubt that wet bedding contaminated with manure and urine usually contains the highest numbers of coliforms. Sawdust and wood shavings have been found to be sources of *Klebsiella* in particular and support higher coliform populations than does straw. Attempts at treating sawdust by composting or with chemicals have been shown to reduce coliform numbers temporarily. However, once exposed to urine and manure, high coliform numbers may be reestablished as early as seven days after treatment.

Cows in confinement housing have the highest incidence of coliform mastitis, whereas cows on pasture have the least. This is likely due to bacterial build-up in stalls and alleyways. There is general agreement that sudden weather changes e.g. thunderstorms contribute to coliform outbreaks. There seems to be greater incidence in hot weather also. Some coliform cases have been traced to cows trying to cool off by "taking a swim" in a pond containing water with a high load of coliform.

There has been increased interest recently in the use of premilking teat disinfection for the prevention of coliform infections. English workers found that premilking disinfection of teat ends with 70% alcohol-soaked cotton followed by 4% chlorine teat dip was not effective in preventing coliform infections compared to no premilking disinfection when cows in both groups were experimentally exposed to the bacteria after previous milkings. Although this premilking treatment did reduce the number of bacteria on the teat end, the failure to prevent infections suggests partial or total penetration of the teat duct may have occurred between milkings.

The milking machine has been implicated in coliform mastitis in three ways. First, damage to the teat end, whether by the milking machine or by other means, allows for easy entry of all types of bacteria. Second, the milking machine (if contaminated with organisms) can deliver bacteria to or through the teat canal during milking by the backjetting of milk droplets toward the teat end if vacuum fluctuations occur. It has been proposed that when excessive water is used to wash cows prior to milking, bacteria - laden water may accumulate at the teat end before, during and after milking. During milking, contaminated water may be forced against the teat end by the "impact mechanism" mentioned above. Although coliforms are primarily of environmental origin, a third possible role of the milking machine in coliform mastitis is a reservoir of organisms. Inadequate sanitation of milking units as well as cracked teat cup liners can allow for buildup of bacteria on the liners. The use of automated disinfectant backflush of clusters has been suggested as a means of controlling mastitis due to environmental pathogens. However, recent research at the University of Kentucky and at Pennsylvania State University shows no clear-cut advantage to the use of backflushing in reducing new infections due to environmental pathogens. Backflushing does significantly reduce the number of bacteria on the liner and reduces new infections by contagious organisms.

Although germicidal teat dips apparently are not effective for the duration of the time between milkings when cows might be exposed to coliforms, a teat dip program should be maintained to help control contagious organisms (staphylococci and some streptococci). The use of a teat sealer that seals the teat canal between milkings may be of benefit in herds that have a coliform mastitis problem.

Control

Mastitis control, regardless of the causative organism, should be based primarily on prevention. A number of control measures for coliform mastitis are recommended, although the usefulness of some of these measures still needs to be verified in controlled studies.

1. Hygiene is of utmost importance. Keep stalls, alleyways, etc. as clean as possible.
2. Bedding materials, especially sawdust, may be a source of coliform bacteria. If a problem arises, changing to alternate bedding materials may help reduce new infections.
3. Increasing space allotted per cow and reducing amount of housing time may decrease exposure to coliforms.
4. *Don't* apply excessive amounts of water when washing cows' udders and *dry* udders and teats prior to milking
5. Dip teats in an effective germicide after each milking as part of an effective mastitis control program. Teat sealers may be helpful against coliforms in some situations.

6. Properly maintain and sanitize milking equipment to reduce the involvement of the milking machine in coliform mastitis.
7. *Thoroughly clean* the teat end with cotton soaked in 70% alcohol prior to dry treatment and be sure to use *sterile* cannulas to prevent introducing any bacteria.
8. Maintain dry cows in a clean environment (on pasture if possible). It is probably better to have cows calve on clean, dry straw than on sawdust.
9. Minimize stress on cows. Pay attention to proper lighting, humidity, temperature, and air circulation in the barn environment. Sudden changes in daily routine, feed and climate increase the risk of mastitis.
10. Fence off farm ponds and water holes to prevent cows from wading in them.

The control of coliform mastitis boils down to *good management*. There are no quick and easy solutions to the problem of coliform mastitis. Hopefully, future work in this area will aid dairymen in finding some concrete solutions to the problems that have been discussed.

Dairy and Food Sanitation, Vol. 4, No. 1, Pages 7-8 (January 1984)

Use of a Microcomputer in the Administration of Sanitation Programs in Small Communities

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This article describes the use of a microcomputer in the administration of environmental sanitation programs in a small community (population 7,000). Examples of how a microcomputer can be utilized by the sanitarian are discussed with a focus of administrative functions in managing foodservice sanitation and water sampling programs. Examples provided include: a foodservice establishment profile; word processing for report writing; a foodservice facility mailing list; and a water sample data file. In addition a brief tutorial of computer terminology is provided.

Would you like to produce formal written inspection reports in less than three minutes? Would you like to be able to find specific data from several hundred water sample reports at the touch of a finger? To accomplish these tasks in the past would have required another full-time clerk. But thanks to the marvels of the electronic age these same tasks can be performed by a microcomputer at a fraction of the cost of hiring an extra clerk. The purpose of this paper is to report on the use of a microcomputer in the administration of santiation programs in a small community.

Numerous administrative tasks faced in managing an effective food sanitation program such as maintaining files of inspection reports, scheduling inspections, maintaining training data, and producing formal inspection reports are normally not a problem in larger health departments. Most state health departments and a few larger metropolitan departments have successfully used sophisticated data processing systems such as FDA's SPIF (Sanitation Programs Information Formulator) to accomplish some of these tasks. In the past if these administrative niceties were accomplished at all they had to be done by hand in smaller communities.

As a counsulting sanitarian for the City of Alamo Heights, Texas, (population 7,000) I have used a Radio Shack Model III, 16K, microcomputer with cassette data storage and line printer in various phases of administering a foodservice sanitation program and maintaining water sample data. Even by micro standards a 16K computer is relatively small and cassette data storage considered primitive. But as one soon learns it's not the size of the system that counts, it's a question of if it "gets the job done." In this case the system described did the job. For other communities this system would have to be modified to meet specific needs.

The first task accomplished with this system was the development of a foodservice establishment profile (Fig. 1). This profile lists each foodservice facility, address, type of facility, manager training data, and inspection results. Information in the profile listing can be sorted and printed to focus on selected items. For example, the listing shown in figure one has to be sorted based on results of the last inspection. This enables the sanitarian to establish inspection priorities. It is also apparent from this listing that more emphasis needs to be placed on manager training.

The values of using a computerized establishment profile will increase with the number of facilities and the number of inspections conducted. If only a few facilities are inspected weekly and inspection data entered the profile listing will contain several thousand pieces of information in a matter of months. Without a computer most of this information would not be utilized in program management.

The ability to generate formal written inspection reports in letter format is probably the most useful feature of a microcomputer. By using a word processing program it is possible to develop form letters that can be tailored to specific facilities in a matter of minutes. As most sanitarians would agree written follow-up of inspections yields better compliance and corrective action. The microcomputer makes written follow-up an easy task.

Another use of this system has been the establishment of a facility mailing list. In a matter of minutes address labels

NAME	ADDRESS	TYPE	TNG	DATE	SCORE
Cat Fish Haven	1314 E 22nd	Cafe	No	02/25	075
Bens Steak/Ale	1111 Austin Hwy	Cafe	No	01/25	080
Jacks Icehouse	2415 E 16 St	Icehouse	No	01/10	082
Fred's Bar-BQ	1145 Broadway	Cafe	No	02/20	086
Dee's Drive In	1520 Broadway	Drive In	No	01/10	090
Callico Cat	1445 Broadway	Bar	No	02/20	090
Jim's	2775 Austin Hwy	Drive Inn	No	01/20	095
Burger Bar	3333 High Ave	Fast Food	Yes	02/20	095
Dairy Delight	3455 Austin Hwy	Ice Cream	No	01/20	096
Sea King	3200 Broadway	Rest	No	01/25	097
Bird's Catering	3304 Riley St	Catering	No	02/20	097
Wilson's Cafe	1555 Broadway	Cafe	Yes	02/10	098

Figure 1. *Foodservice Establishment Profile.*

can be printed for all foodservice facilities. If a food sanitation newsletter is being used the mail list program will soon pay for itself. The same program can be used to develop mailing lists for a wide range of needs.

The same system has also been used to maintain results of water sample reports (Fig. 2). Information used in this listing includes sample location, date, chlorine residual, laboratory findings, laboratory report number, and miscellaneous data. Figure two represents only a small portion of the samples collected over a long period of time. If you have ever tried to locate samples with low chlorine residuals from over a hundred lab reports then you can appreciate the power of the computer. The example shown in figure two has been sorted based on residual chlorine. If a particular sampling point has consistent low chlorine residuals this listing will help identify it.

These examples are only a few ways in which a microcomputer can be used by the sanitarian in a local health department. Any job involving recurring or extensive calculations is a job for the computer. It is also possible to use the microcomputers power in epidemiological investigations, conducting community surveys, and even preparing yearly budgets. The list could go on, but the message is the same: "the microcomputer can be a valuable tool for todays sanitarian."

SOURCE	DATE	FAC	LR	LAB #
Al Nat Bank	09,24,81	0.4	NF	21279
Fire Dept	09,24,81	0.5	NF	21281
Pizza Inn	09,24,81	0.5	NF	21275
Pizza Inn	09,24,81	0.5	NF	21276
City Hall	09,24,81	0.5	NF	21277
City Hall	09,24,81	0.5	NF	21274
Bean Pot	09,23,81	0.5	NF	21176
Bean Pot	09,23,81	0.5	NF	21175
Play School	09,23,81	0.5	NF	21179
Play School	09,23,81	0.5	NF	21181
Pizza Inn	09,23,81	0.6	NF	21180
Pizza Inn	09,23,81	0.6	NF	21182
Fire Dept	09,23,81	0.8	NF	21175
Fire Dept	09,23,81	0.8	NF	21178

Figure 2. *Listing of Water Analysis Data (LR = laboratory results).*

COMPUTER TUTOR

The following tutorial is intended to provide a brief introduction to computer terminology. Key words and phrases are capitalized.

HARDWARE includes all physical equipment, such as the CENTRAL PROCESSING UNIT (CPU); VIDEO MONITOR; and PRINTER. SOFTWARE includes programmed instructions that make the computer perform specific functions. Software is written in a programming LANGUAGE. Examples of programming languages include: BASIC (Beginners All-purpose Symbolic Instruction Code); FORTRAN (Formula Translation); and COBOL (Common Business Oriented Langauge). Most microcomputers use the BASIC programming language.

The size of a computer is determined by how much information it can hold in its MEMORY. ROM (Read Only Memory) holds permanently stored information while RAM (Random Access Memory) holds data and programmed instructions. Memory is stated in terms of how many characters the computer can hold at one time. Microcomputers range from 1K (about 1000 characters) to more than 64K. The more memory a computer has the more it can do.

Programmed instructions are provided to the computer as electronic impulses, then can be stored on CASSETTE TAPE or DISK. Cassette storage is cheaper but it is slower. Use of a cassette tape will also limit what you can do with the computer.

Costs for a microcomputer system will range from $200 to more than $5000. For $200 you would be able to purchase a 1-2K cassette system that would be helpful in field calculations. For the sanitarian in a small health department a 48K computer with disk drive and line printer costing from $2000-$5000 is recommended.

The following perodicals can be purchased at local bookstores and are highly recommended: POPULAR COMPUTING; PERSONAL COMPUTING; CREATIVE COMPUTING; BYTE.

Dairy and Food Sanitation, Vol. 4, No. 1, Pages 9-17 (January 1984)

The Behavior of *Staphylococcus Aureus* in Foods Reviewed for the Sanitarian

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Philadelphia, Pennsylvania 19118

The behavior of Staphylococcus aureus *has been reviewed with special emphasis for the sanitarian. The topics include sources and characteristics of the organism, food involved in* S. aureus *food-borne outbreaks, characteristics of the enterotoxins, and factors controlling both growth and enterotoxin formation in foods. The physical and chemical factors which control* S. aureus *growth and enterotoxin formation in foods are: temperature, salt, % brine and water activity, pH and acidity, various chemicals, level of the organism, and competing microflora present in the food. Low temperature (5°C) of storage represents the simplest means for controlling growth of the organism in food. Methods for detection and extraction of enterotoxin from food as well as its quantitation are discussed. In many instances, enterotoxin production is sensitive to extremes of the physical and chemical environment, and growth may occur without concomitant toxin formation.*

Staphylococcus aureus
A coccoid entity
Has plagued the lives of all of us
For an eternity

On skin, in clothes, food, throat, and nose
This minute monster thrives,
What do we need to interpose
To rid it from our lives?

This poem, written by student Michael E. Stiles for the introduction to his Ph.D. thesis 20 years ago (*64*), is still true today. *Staphylococcus aureus* was and is a major cause of food poisoning despite very intensive research during the intervening 20 years. In data compiled by the Centers for Disease Control (CDC) for 1978 and 1979 (the last years for which complete data are available), *S. aureus* was responsible for 26.6% and 32.4%, respectively of the confirmed cases of food poisoning in the United States. For the period 1975 to 1979, *S. aureus* caused 18.8% of the confirmed outbreaks of food-borne illness (*22,23*).

Meats, especially ham, continue to be the major vehicles of transmission. However, foods as diverse as salads, whipped butter, rice balls, Mexican food, and spaghetti have been identified as vehicles (*22,23*). Cream-filled pastries, also a major vehicle, have been the topic of a separate review (*12*). Mayonnaise and mayonnaise-based salads (ham or potato) have acquired a reputation as being the cause of food poisoning (reviewed by Smittle (*63*)). Based on their acid and pH values and salt levels and the "track record" of commercially prepared products, this reputation is scientifically unfounded. Doyle et al. (*27*) in a recent study inoculated chicken and ham salads prepared with and without mayonnaise with *S. aureus* and stored them at 4°, 22°, and 32°C, and found that mayonnaise retarded but did not prevent the growth of *S. aureus* in salads held at 22° or 32°C. They ultimately concluded that mayonnaise contributed to the safety of these foods and along with adequate refrigeration would eliminate any hazard from *S. aureus* in these foods.

The causative agent, *S. aureus*, is part of the normal flora of about 50% of the population, residing on the skin, throat, and nasopharynx (*11*). Any food which comes in contact with humans can become contaminated with the organism, and despite control efforts, adequately processed foods often contain a low number of *S. aureus*. Research from our laboratory (*48*) has indicated that *S. aureus* is killed by the heating step of the frankfurter process. Surkiewicz et al. (*66*) have found that although commercial products immediately upon removal from the smokehouse contain no viable *S. aureus* cells, these same frankfurters peeled, packaged, and ready to leave the packing plants contained low numbers of *S. aureus*.

For a food to become an agent of food poisoning, two events must occur: 1) the food must either be underprocessed or recontaminated after processing; and 2) the *S. aureus*-containing food must be temperature abused, i.e., held under temperature conditions favoring growth and toxin production by the organism. These CDC reports (*22,23*) indicate that im-

[1]*Agricultural Research Service, U.S. Department of Agriculture.*

proper holding temperatures along with inadequate cooking, contaminated equipment, and poor personnel hygiene are the major identifiable contributing factors for foodborne outbreaks. Food processing establishments seldom are implicated as the place where the food was mishandled. In contrast, food service establishments such as restaurants, schools, and camps often are cited.

S. aureus, like *Clostridium botulinum*, produces during its growth in a food a toxic protein that actually causes the food poisoning symptoms. It is possible to have a food in which *S. aureus* cannot be detected by various cultural methods, which yet cause food poisoning. This observation can be duplicated in the laboratory by feeding cell-free culture fluids to human volunteers or animals which subsequently display typical food poisoning symptoms. The time after consumption of the toxin-containing food for first symptoms can range from 30 min to 8 h, with the most occurring in 2-4 h. Symptoms are typical of a gastrointestinal syndrome, with vomiting being the primary response in a majority of cases. Symptoms usually subside within 24 h, and the individual can resume normal activities 1 or 2 days after that. There are seldom any fatalities; however, the disease has been described thusly, "It doesn't kill you, but you wish it would."

The toxin, which is a simple polypeptide protein with a molecular weight of around 30,000, can be differentiated serologically. At present there are six serotypes known, designated SEA to SEE (there are two variations of the C toxin (*10*)). In general, these proteins have no unusual physical-biochemical properties, except for their heat resistance (stability). Tatini (*67*) studied heat treatments commonly used in food processing, including pasteurization (71.7°C for 15 sec) or ultrahigh temperature heating (143.3°C for 9 sec) of fluid whole milk; smoking and heating of cured sausage to 70°-100°C; and heating of Cheddar cheese to 70°-90°C, and found that none were effective for complete destruction of SEA or SED when the toxins were present initially at levels which can be found in foods (0.5-1 μg/100 g). He also found that SEA and SED in whole milk required 15 min heating at 121.1°C for complete inactivation. Thus, toxin production by *S. aureus* cannot be permitted before a food is heat processed since most of the common heat treatments would inactivate the organism, but not any preformed toxin. In addition, the presence of detectable levels of staphylococcal enterotoxin in any food renders the food unfit for human consumption, and the food must not be permitted to enter normal channels. The consumption of as little as 1 μg of enterotoxin has been observed to elicit the food poisoning symptoms in sensitive individuals (*10*). Zehren and Zehren (*75*) analyzed the production of a large cheese processor after certain of its cheeses were implicated in a food poisoning outbreak. Only cheese containing less than 0.3 μg toxin per 100 g cheese (the lower limit of detection) was permitted to enter food channels and no further outbreaks were reported.

Although any of the six serotypes can be produced in foods, strains of *S. aureus* producing SEA are most often isolated from foods incriminated in food-borne illnesses. Interestingly, SEB-producing strains are those studied most often in the laboratory, although SEA-producing strains are those most often seen in cases of food poisoning. The reason for this is that SEB is produced in much higher levels (500-1000 μg/ml of culture fluid) vs. 0.5 to 10 μg/ml for SEA-producing strains. Thus, most data pertaining to conditions in foods such as temperature, pH, salt, and water activity which might control growth and/or toxin production were obtained with SEB-producing strains.

Food poisoning is usually distinguished as either an infection (e.g., *Salmonella, Shigella, Campylobacter*) or an intoxication (*C. botulinum, S. aureus*). With infectious organisms such as *Salmonella*, the presence of any level is considered unacceptable. In contrast, for a toxigenic organism such as *S. aureus*, certain levels are "acceptable" though not considered desirable. This is particularly true for *S. aureus* since any contact the food has with humans 'inoculates' the food with *S. aureus* (see above section on frankfurters). For *S. aureus*, the level (number of cells) is of paramount importance: levels of 10^4/g of food are considered harmless, while levels of 10^7/g are considered unsafe. The region from 10^5 to 10^7/g represent the danger zone and other factors such as the food itself, pH and acid, temperature, time, salt and water activity, and atmosphere become critical in governing toxin production.

The count of *S. aureus* at which detectable toxin is observed varies. Barber and Deibel (*7*) reported an *S. aureus* count of 1×10^7 to 4×10^7/g was the minimal number that produced SEA (lower limit of detection was 0.4 μg/100 g of an inoculated model sausage system), and 8.3×10^8/g for SEB and 2.3×10^8/g for SEE. Gilbert et al. (*32*) reported *S. aureus* colony counts of 7.5×10^5 to 9×10^9/g for food from various food poisoning incidents. Casman and Bennett (*18*) also found *S. aureus* levels of 1×10^6 to 3×10^9/g for food incriminated in food poisonings. An additional factor in food poisoning outbreaks is the observation of variability in that not everyone consuming the food comes down with symptoms. Whether this represents an uneven distribution of *S. aureus* and the toxin or differences in susceptibility of individuals is not known. Further, the amount of food consumed by the different individuals is usually unknown, further complicating the assessment of the risk.

Since *S. aureus* was first found to produce food poisoning, detection and quantitation of the enterotoxins have represented a frustrating problem. Originally, researchers used kittens, monkeys, or human volunteers. Such constitute a cumbersome procedure and preclude analysis of large numbers of samples or accurate quantitation. With the availability of quantities of pure enterotoxins, antisera were prepared and various serological procedures were developed (*5,17,19, 32*). In addition, methods for extraction of the toxins from foods were developed (*5,32*). Extraction of the toxin from the food is a significant feat in itself since the toxin can be present in the food at a level of 0.5 μg/100 g food.

Gilbert et al. (*32*) reported a recovery of enterotoxins A, B, and C from food samples of 20% - 50%. These analytical and serological procedures, although involved and cumbersome, can be scaled up to handle large numbers of samples. A trained 10-person team was able to analyze 4.07 million pounds of cheese from 2,112 vats and clear all but 59 vats for consumption (*75*).

Various modifications of the serological and toxin extraction procedures have been developed. Genigeorgis and Kuo (*29*) developed an affinity chromatographic method using sepharose gel to recover enterotoxin free of interfering food components, followed by microslide gel diffusion plate quantitation. Reiser et al. (*52*) developed an extraction - concentration - digestion procedure for toxin in foods; in conjunction with quantitation by the microslide gel diffusion plate technique, this procedure could complete analyses within 3 days. A recently developed procedure — ELISA (enzyme linked immunosorbent assay) — offers a technique for large scale testing of food extracts containing <1 ng enterotoxins/g food, and can provide this analysis in two working days (*9,28*).

Before discussing how various physical and chemical factors of the food environment influence *S. aureus* growth and toxin production, a brief discussion of metabolism is presented. Metabolism is considered to be either primary or secondary. Primary metabolism is any of the reactions or products which are necessary for the primary growth of the microorganism and generally occurs during the log phase of growth. Examples of primary metabolism and metabolites are lactic acid from lactic acid bacteria and ethanol and carbon dioxide from yeast. Secondary metabolism is any of a series of reactions and products which are formed after primary (log) growth of the microorganisms and whose exact metabolic function is not known with certainty. Examples include antibiotic and aflatoxin formation by molds. At present, SEB appears to be a secondary metabolite (formed after primary growth of the culture), while SEA seems to be a primary metabolite (formed as the culture is growing logarithmically) (*15,16*). There are some problems with these distinctions since SEA is formed in much lower quantities, making quantitation at the lower limit of detection difficult. What is important in this discussion is that many of the factors to be mentioned below will affect the primary rate of growth of *S. aureus* and these will affect the amount of SEA formed. Since SEB is considered to be a secondary metabolite, there can and should be conditions in a food which will permit growth of the organism without concomitant toxin production.

As mentioned above, the influence of various physical and chemical factors of the food environment on growth and toxin production by *S. aureus* have been studied quite extensively. Low temperature is one of the most important and represents, in a sense, an additive or process which requires no approval and is not regulated. Low temperature (below 5° C) holding of a food is one of the easiest ways to limit the proliferation of most pathogens. (Exceptions are the two relatively rare food-borne pathogens: *Clostridium botulinum* type E and *Yersinia enterocolitica*.)

Angelotti et al. (*1*) inoculated *S. aureus* into sterile custard, chicken a la king, and ham salad and observed small increases in *S. aureus* counts for custard and chicken a la king at 44°F and above, while there was no change in the number of *S. aureus* in the ham salad held over a 5-day period at temperatures of 44°-10°C. Goepfert and Kim (*33*) inoculated ground beef with *S. aureus* and observed no increase in numbers during a 5-day storage at 12.5°C. Doyle et al. (*27*) found no growth of *S. aureus* in meat salads prepared with and without mayonnaise when held at 4°C. There is some variation observed in different foods, but *S. aureus* does not appear to grow below 41°F.

The temperature minimum for inhibiting toxin production by the organism is not as restrictive as for growth inhibition. Donnelly et al. (*26*) inoculated pasteurized milk with an SEA-producing strain of *S. aureus* (either 10^4 or 10^6/ml) and held the milk at various temperatures. Neither growth nor toxin production was observed after 168 h at 10°C. However, Scheusuer and Harmon (*54*) inoculated vanilla pudding with 10^5 *S. aureus* per g and observed formation of SEA, SEB, SEC, and SED at 10°C. Genigeorgis et al. (*30*) observed SEB production in ham stored anaerobically at 10°C, though not all samples supported toxin production. Any extended exposure of a food to temperature >10°C creates the potential for a food poisoning outbreak. Even though the amount of toxin formed decreases dramatically as the holding temperature decreases to the 10°C minimum, the production of even small quantities of toxin (1-5 μg) is to be avoided since it is known that less than 1 μg of enterotoxin per 100 g of food is sufficient to produce food poisoning symptoms in individuals (*10*). The emitic dose of the various enterotoxins for monkeys does vary, ranging from 5 μg/monkey for SEA and SEB to 20 μg for SED. Corresponding data for humans are not available, though as indicated, 1 μg has been observed to elicit symptoms in humans (*10*).

With respect to refrigeration and low temperature holding of heated foods, particular attention must be devoted to the size of the containers and the rate of cooling. Shallow pans and trays serve as better containers compared to a single large pot. As an example, in a food service establishment, chicken cooked for pot pies is removed from the bone by hand; if placed back in the same large cooking container and refrigerated this chicken can provide an excellent opportunity for an *S. aureus* food poisoning outbreak. In contrast, use of a number of shallow containers will minimize the time the boned chicken is in the temperature range of 45°-10°C, the temperature range for toxin production by *S. aureus*.

Shifting from the minimum to the maximum, *S. aureus* growth and toxin production can be prevented at high holding temperatures. Angelotti et al. (*2*) observed the growth of *S. aureus* in sterile custard held at 45.5°C, but not at 46.7°C, and in sterile chicken a la king at 44.4°C, but not 45.5°C; there was no growth in sterile ham salad held at 44.4°C and above. Holding at temperatures above the maximum was lethal to the organism.

A particular interesting temperature

phenomenom was studied by Hughes and Hurst (*34*) and Hurst et al. (*35*), and while at present it has not found application in a food system, the potential is there. These investigators found that salts such as NaCl, $MgCl_2$, and KCl and sugars such as sucrose and glucose raised the maximum temperature of growth and toxin production of *S. aureus* by 2°C. Though only a relatively small increase in maximum temperature was observed, any food containing these solutes which is held close to the maximum growth temperature of *S. aureus* could become a cause of food poisoning. Since the solutes exhibiting this protection effect are often found in foods, any food which could contain *S. aureus* should be held substantially above the 45°C observed maximum temperature for *S. aureus*.

As mentioned previously, any temperature above the maximum temperature for growth (116°F or 47°C) is lethal for the organism. The greater the temperature above the maximum, the faster the killing. Angelotti et al. (*3*) had reported D values (time to bring about a one log kill (90% destruction)) ranging from 61 min at 54.4°C to 0.64 min at 65.5°C for *S. aureus* 196E in chicken a la king. Similar values were obtained in custard and with a second strain. Stiles and Witter (*65*) studied the effect of pH of a phosphate buffer heating medium on heat resistance and observed lower D values (faster killing) as pH decreased from 7.5 to 4.5. Walker and Harmon (*73*) reported greater resistance (higher D values) of *S. aureus* heated in skim milk and Cheddar cheese whey compared to heating in phosphate buffer or whole milk. Work in our own laboratory had indicated that salt (5% NaCl in distilled water) can protect *S. aureus* from both injury and death, and that the temperature of heating must be raised more than 6°C to bring about killing of the organism (*57*). Though various food components can protect from thermal injury (*58*) and increase the amount of heat needed (raise the temperature) to kill *S. aureus*, the thermal processes used for most food appear adequate to destroy any *S. aureus* present. *S. aureus* is killed by the milk pasteurization treatments (62.8°C for 30 min or 71.7°C for 15 s) (*45*); by the 'cook' given semi-preserved canned hams (heated to an internal temperature of 71.1°C) (*45*); and by the smokehouse heating schedule used in the processing of frankfurters (heated to an internal temperature of 71.1°C) (*48*). Castellani et al. (*21*) reported that a temperature of 73.9°C in the center of stuffing was sufficient to kill *S. aureus* during turkey roasting. While these data are mostly for meat products, these temperatures should be applied to all foods. Food preparers should be especially careful and measure the temperature at the coldest part of the food, usually at or near the geometric center.

As mentioned above and will be often repeated throughout this review, *S. aureus* is an extremely salt-tolerant bacterium. This characteristic is the basis for the media originally developed to isolate *S. aureus* from foods: 7½% NaCl. This salt tolerance is also why *S. aureus* grows so well in many foods, especially ham and other cured meats. In fact, addition of salt to many foods selects against other bacteria while selecting for *S. aureus*. An item of particular interest can be mentioned here. There was and is considerable concern over the addition of nitrite to cured meats. One of nitrite's major functions in cured meats is to prevent the growth of *C. botulinum*. In order to eliminate the need for nitrite to control *C. botulinum* in cured meats, it was proposed to add enough salt to give meat products with 10% brine (water activity of 0.92) (*46*). Although *C. botulinum* would be controlled, the conditions established would be just at the limit for toxin production by *S. aureus*. One problem would be substituted for another!

Before reviewing the effect of salt on *S. aureus*, a new concept regarding salt levels in foods must be introduced. This is brine concentration (% brine), a measure of salt concentration in the aqueous phase of foods which equals

$$\frac{\text{grams salt}}{\text{grams salt} + \text{grams water}} \times 100.$$

While water activity (to be mentioned below) is a better absolute indicator of whether or not a given microorganism will or will not grow in a particular food, brine concentration is more readily obtainable and applicable to foods. Riemann et al. (*53*) in their study on factors influencing growth and toxin production by *S. aureus* in semi-preserved meats, determined that very few semi-preserved meat products available to American consumers

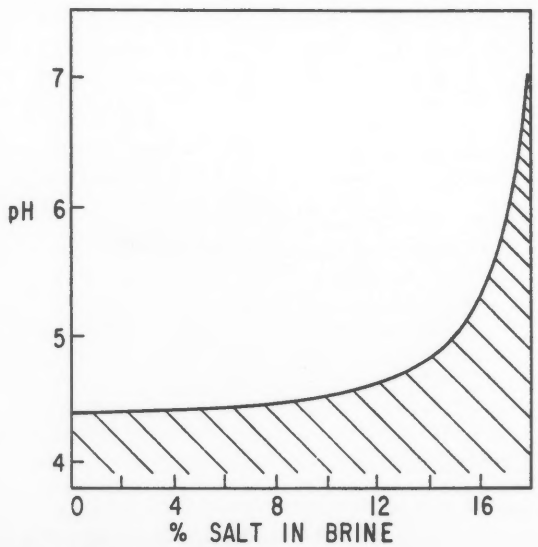

Figure 1. *Effect of pH and % brine on growth of* Staphylococcus aureus *in foods and culture media. Cross-hatching indicates food or medium in which combined pH and % brine prevented growth of the organism. Redrawn from Riemann et al. (53).*

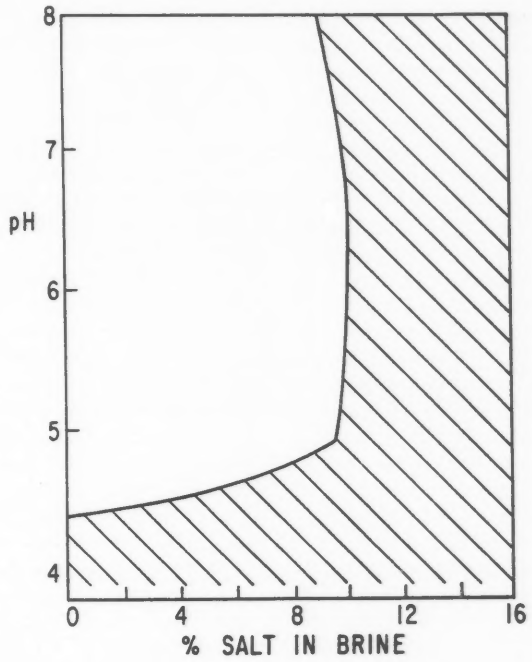

Figure 2. *Effect of pH and % brine on enterotoxin production by* Staphylococcus aureus *in food and culture media. Cross-hatching indicates food or medium in which combined pH and % brine prevented enterotoxin production by the organism. Redrawn from Riemann et al. (53).*

have sufficiently high brine concentrations to inhibit *S. aureus* completely. They also considered pH as a factor that had some influence on growth and toxin production and these data (taken from Riemann et al., (*53*)) are presented in Figures 1 and 2. These figures are composites from both food and culture media. Any product or culture medium whose pH and brine concentration fall in the upper left portion of the graph would support either growth (Figure 1) or toxin production (Figure 2). Any product whose pH and brine level fell outside the upper left quadrant (cross-hatched area) generally would not support growth or toxin production.

The minimum pH for either growth or toxin production is around 4.5. Toxin formation is more sensitive to brine level than is growth, with 10% brine being the maximum at which toxin can be formed. A last point should be made - these data generally were obtained under conditions under which other parameters (temperature, atmosphere, etc.) were ideal and with a starting inoculum of 1×10^7/g or ml. If any of these conditions becomes nonideal, the limiting pH and brine concentrations combination is changed, with the pH value increased and brine level decreased.

The specific acid used in the preparation of various foods can influence their ability to restrict the growth of *S. aureus*. Using pasteurized milk, Minor and Marth (*39*) found a gradation in pH values with different organic and inorganic acids. To achieve a 99% or 2 log value reduction in growth over a 12-h period, a final pH value of 5.2 was required for acetic, 4.9 for lactic, 4.7 for phosphoric and citric, and 4.6 for hydrochloric acid.

Extremes of many growth parameters often are not conducive to either growth or survival. Temperatures above the maximum for growth are lethal; pH values below the minimum for growth also are lethal. Minor and Marth (*40*) observed decreased viability for *S. aureus* inoculated into various fermented dairy products: cultured buttermilk, sour cream, and yogurt, with corresponding pH value ranges of 4.1-4.4, 4.3-4.4, and 3.7-4.1, respectively.

Metabolically, *S. aureus* is classified as a facultative anaerobe which will grow more rapidly and abundantly under aerobic conditions (*13*). Most of the studies on the effect of atmosphere have been performed on culture systems. Woodburn et al. (*74*) observed that shaking during incubation increased greatly the production of SEA, SEB, and SEC as compared to static incubation.

Some investigators have suggested dissolved oxygen (DO) as a better parameter to describe the influence of oxygen on growth and enterotoxin formation. Carpenter and Silverman (*15*), in their study of SEB synthesis, found growth best at 100% DO, but no SEB was synthesized. When DO decreased to 50%, growth decreased and there was a marked increase in SEB formed. Maximum SEB was formed at 10% DO. In contrast, formation of SEA appears more directly related to the amount of growth by the producing strain. In a further study, these investigators (*16*) did not find an optimum DO for SEA and concluded that SEA formation is independent of DO.

As found in culture media, enterotoxin formation in foods is more abundant under aerobic than anaerobic conditions. Genigeorgis et al. (*31*) studied enterotoxin B production in hams held aerobically at 10°, 22°, and 30°C. They found better toxin production at 30°C than at 22° or 10°C, but toxin was detected after 2 weeks in samples held at 10°C. In addition, toxic hams appeared normal even after 2 months storage at 10°C. In their study of *S. aureus* in Canadian bacon, Thatcher et al. (*70*), found that in bacon samples held at 37°C, enterotoxin was found in samples packed under atmospheres of air, 5% CO_2 + 95% O_2, and nitrogen. Only a small amount of enterotoxin was formed under vacuum. It should be noted in this study that the bacon incubated in air or $CO_2 + O_2$ mixture was obviously spoiled. Cooked peeled prawns, often involved in food poisoning outbreaks in England, were inoculated with SEB-producing strains

of *S. aureus* and held at temperatures between 22° and 36°C in either air or 95% N_2 + 5% O_2. Depending upon inoculum level, aerobically incubated prawns contained SEB after 7 days at 26°C and higher. The amount of SEB and rate of its production were best at >30°C. There was no SEB produced under the N_2+CO_2 atmosphere. All SEB-containing prawns were organoleptically spoiled at the time SEB was detected. Using a model sausage system, Barber and Deibel (*7*) observed detectable SEA after 24 h in 10%, 15%, and 20% oxygen atmospheres, and after 48 h in 5% oxygen. No SEA was produced under anaerobic conditions. Bennett and Amos (*8*) inoculated sausage, hamburger, and turkey sandwiches with enterotoxigenic *S. aureus* and stored them under nitrogen at 8°, 12°, and 26°C. At 8° and 12°C, none of the sandwiches became toxic after 31 days storage. At 26°C, sausage and hamburger sandwiches were toxic at 2 and 4 days, respectively, while remaining organoleptically acceptable. Turkey sandwiches did not support sufficient *S. aureus* growth to yield detectable amounts of toxin at any temperature. Growth and toxin formation can occur in a wide variety of foods and under the different atmospheres food might be held. In addition, toxin-containing foods often retain their organoleptic properties and probably would be eaten and cause food poisoning.

Implicit in the above discussions of how the various factors affect growth and toxin production is the interrelationship between all these factors, the starting number of *S. aureus* and the presence or absence of competing bacteria. Pathogens are generally considered to be poor competitors. Ham, often a vehicle for *S. aureus* food poisoning, provides a seemingly excellent substrate because the heat processing kills virtually all of the normal flora of the meat and the brine content limits the recontaminating organisms to those which can grow to the limited number of salt tolerant organisms such as *S. aureus*. Thus, recontamination by even small numbers of *S. aureus* followed by temperature abuse would have a strong potential for a food poisoning episode.

Low (ca 100/g) number of *S. aureus* have been shown to grow to sufficient numbers to yield detectable enterotoxin. Lee et al. (*38*) observed SEA, SEB, and SEC in macaroni dough inoculated to give a starting count of ca 50 *S. aureus*/g. Toxin was formed at both 25° and 35°C. Casman et al. (*20*) inoculated the surface of cooked and raw (low bacterial count) pork and bacon with ca 250 *S. aureus*/g, and observed both growth and SEA formation at 30°C. Depending upon salt, nitrite, and holding temperature, Genigeorgis et al. (*31*) observed both growth and SEB and SEC production in cooked pork, beef, and ham in conjunction with a starting count of 10^3/g.

Similar effects have been noted in dairy products. Ikram and Luedecke (*37*) inoculated whole milk, skim milk, whipping cream, and half and half with 10^3 *S. aureus*/g and held them at either 37° or 22°C. Growth and SEA formation occurred at 37°C, with little growth and no SEA formation occurring at 22°C. When pasteurized milk used to manufacture Cheddar cheese was inoculated with 5-80 *S. aureus*/ml and an incative starter culture, SEA was detected in cheeses ripened at 11°C (*36*). Inactivated starter cultures is one of the key factors in permitting toxin formation in these products. As previously mentioned, Zehren and Zehren determined that an active starter culture is a simple and extremely effective means of controlling *S. aureus* during Cheddar cheese manufacture (*76*).

These few examples illustrate that *S. aureus* is capable of growing and producing toxin in foods when initially present at levels of 10^2-10^3/g or ml. The normal microflora of foods usually inhibit *S. aureus* growth and subsequent enterotoxin formation. This is particularly true of various lactic acid bacteria and is seen in the above example of Cheddar cheese production. Bacteria other than lactics also can influence *S. aureus* in foods. For example, Peterson et al. (*49*) observed that the naturally occurring mixed bacterial flora of mesophiles and psychrophiles in frozen chicken pot pies and macaroni and cheese dinners prevented the growth of added *S. aureus* during the defrosting of these foods. However, while *S. aureus* growth can be restricted in competitive situations in foods, with the exception of lactic acid bacteria fermented foods, this method cannot be relied on as an adequate procedure for protecting foods from *S. aureus* hazards.

In addition to salt and pH/acids, many other compounds (chemical food ingredients or additives) can restrict *S. aureus* growth and toxin formation in foods. The list of these compounds includes sodium nitrite (cured meats), potassium sorbate (bacon, (*50*)), glucono-delta lactone + citric acid (sausage, (*24*)), phenolic-type antioxidants (dry sausage, (*51*)), and glycerol monolaurate (model sausage product (*61*)). Work from our own laboratory (*61*) and others have indicated that these compounds are more effective under anaerobic conditions, i.e., less compounds is needed to achieve the same level of inhibition under anaerobic conditions. Smoke, applied as part of the normal processing given a product such as pepperoni, can also restrict *S. aureus* (*69*).

Recently, studies have shown that many of the unit operations of food processing such as heating, acidification (fermentation or pickling), and freezing can stress or injure rather than kill microorganisms (*14,25,56, 60*). This topic has previously been reviewed for the sanitarian (*62*). Of interest and concern to the sanitarian is the observation that injured (stressed) cells are incapable of forming colonies on the selective media often used to isolate various microbial groups from foods. These media contains dyes, various chemicals, and sodium chloride (for *S. aureus*) as selective agents.

Restricting the rest of the discussion to *S. aureus*, use of a salt-containing (7½% NaCl) medium to quantitate *S. aureus* in a heat processed food could lead to an inaccurate estimation of the bacteriological quality of the food and/or false evaluation that the food was adequately heated. The inability of heated or other stressed cells to grow on the salt-containing media typically used to isolate *S. aureus* from

foods has led to the development and use of NaCl containing media, e.g., Baird-Parker agar (*4*), both for direct plating and for most probable number determination of *S. aureus* from processed foods.

In addition to the concern of not detecting injured *S. aureus* in a processed food, and thus not know the quality of the food, there is the potential that the injured cells can recover normal cellular functions and then produce enterotoxin in the food. At this point, we are not aware of any documented food poisoning outbreak due to injured *S. aureus* which have recovered in a food and then produced toxin. However, work from our laboratory (*47*) has demonstrated that injured *S. aureus* can repair (regain salt tolerance) on a model food system agar (toxin production by these cells was not determined). Heat injured *S. aureus* repaired on a ground beef agar (GBA), GBA containing 2½% NaCl, 5% KCl, 15% glycerol, 30% sucrose, 400 ppm nitrite, 500 ppm ascorbate, and lactic acid down to pH 5.5. Repair also occurred at temperatures of 20° to 45°C, also on frankfurters and chili beef soup agars, but not on pepperoni or Lebanon bologna agars. Since many food processing operations can injure *S. aureus*, and since *S. aureus* can repair under food conditions, precautions should be exercised to detect injured *S. aureus* if they are present. The recommended Bacteriological Analytical Manual procedure, Baird-Parker agar, will detect heat injured cells (*33a*). In addition, food preparations should insure the complete destruction of *S. aureus* and avoid conditions which would just injure the organism.

As indicated above, salt, in high enough concentrations, can restrict the growth of *S. aureus*. Salt as well as other solutes limits or completely inhibits the growth of various microorganisms by restricting the amount of water available to the cells. The water available to the cells is generally expressed as water activity (A_w) which is defined by the equation:

$$A_w = \frac{P}{P_o}$$

where P is the vapor pressure of the test (unknown) solution or food and P_o is the vapor pressure of water at the same temperature. Further, $A_w \times 100$ is the equilibrium relative humidity of the solution or food. Increasing the amount of salt or other solutes present decreases the A_w of the growth medium or food. For a more detailed discussion of A_w, consult the classic paper by Scott (*55*), and also Troller (*71*) and Troller and Stinson (*72*) for reviews of the effect of water relations among various food-borne pathogens, expecially *S. aureus*. For Tables of A_w or various foods and A_w limits of various microorganisms and groups of microorganisms (food spoilage organisms as well as pathogens), Banwart (*6*), Tables 4.6 and 4.8, respectively should be consulted.

This review was not intended to be a comprehensive one dealing with *S. aureus* in foods, but rather, was restricted to those areas of interest to sanitarians. In this last section, the reader is referred to the literature for additional information. Here again, the following is not comprehensive. Minor and Marth, in addition to their book, "Staphylococci and Their Significance in Foods" (*45*), wrote a very readable series of papers entitled "*Staphylococcus aureus* and staphylococcal food intoxications. A review," in which they discussed: A) the nature of the organism, its characteristics, physiology, and isolation (*41*), B) enterotoxins and epidemiology (*42*), and staphylococci in C) dairy foods (*43*), and D) meat, bakery products, and other foods (*44*).

Riemann et al. (*53*) have reviewed the various mechanisms for controlling *S. aureus* in semi-preserved (nonshelf stable or keep-refrigerated) meat products and concluded that low temperature storage rather than low pH or high brine (salt) levels is an extremely functional way to preserve these products. The pH and brine levels needed to inhibit *S. aureus* growth and toxin production would yield meat products with limited appeal to the current American consumer. Further, since American consumers are interested in reducing their salt intakes, salt is not a viable means of restricting *S. aureus* in meats.

Bryan (*11*) provided an earlier review of many of the same topics considered in this review, though from a different point of view. Tatini (*68*) has summarized the effects of various food environments on *S. aureus* growth and enterotoxin formation. Bergdoll (*10*) has reviewed the area of *S. aureus* intoxication in depth, drawing upon much of his own research and experience at the Food Research Institute (University of Wisconsin, Madison). His work provides an up-to-date and readable discussion of the area. The recent review by Smith et al. (*59*) provides an in depth discussion of environmental factors controlling enterotoxin synthesis, especially in foods.

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Laughlin Receives 1983 Food Industry Sanitation Award

Paul Laughlin, recently retired Vice President of Environmental Health for Nabisco Brands, Inc., was honored with the 1983 Food Industry Sanitarian Award, one of the highest honors given by the National Environmental Health Association, at its annual convention in Norfolk, Virginia in July.

Laughlin, who has had a long and distinguished career in public health in the food industry, was cited for "outstanding contributions to environmental health in the food industry" by Joel Simpson of Dobbs Houses, Inc., Chairman of NEHA's Food Industry Award Committee, as he presented the award. The award is financed by contributions from: Dobbs Houses, Inc., General Foods, Marriott Corp., Mexican Foods of America, Nabisco Brands, National Automatic Merchandising Association, and Red Lobster Inns of America.

Laughlin has been an active leader in professional environmental health organizations and has worked with numerous federal, state, and local health officials in promoting environmental health.

Paul's commitment ot food protection and sanitation are evidenced in the long and impressive list of professional organizations in which he has been actively involved. Paul is a founding member of the Environmental Management Association and has served as that organization's president and treasurer. He is a Founder Diplomat of the American Academy of Sanitarians, immediate past chairman of the Board of Directors of the Baking Industry Sanitation Standards Committee, a past member of the Board of Directors of the New York State Environmental Health Association, and Chairman, Grocery Manufacturers Association Pesticide Registration Working Group. He also maintains memberships in the American Society of Mechanical Engineers, the American Public Health Association, and the Association of Operative Millers.

Pima County, Arizona Health Dept. Wins Food Protection Award for 1983

The local health department serving the environmental health needs of the Tucson, Arizona, Metropolitan Area, including surrounding Pima County, has been named the winner of the 1983 Samuel J. Crumbine Consumer Protection Award for conducting an outstanding program of food and beverage sanitation.

The Pima County Health Department received the award at the annual meeting of the American Public Health Association in Dallas, Texas, November 16, 1983. Accepting the Award on behalf of the department was Pima County health officer, Patricia Nolan, M.D., and the Director of the Environmental Health Division, James Robertson, RS, MPH.

The Crumbine Award is presented annually by the Single Service Institute, the trade association of manufacturers of disposables for food service and packaging. The Award honors the local health authority which has demonstrated outstanding achievement in the design and execution of a public health program of consumer protection in food and beverage service. A panel of seven jurors, made up of public health professionals and consumer representatives, selects the winning entry.

Established by the Single Service Institute in 1954, the Crumbine Award takes its name from the Kansas State Health Officer and public health pioneer who in 1909 first banned common drinking cups from public facilities.

The Pima County Health Department is responsible for providing all public and environmental health services, including food protection, to more than one-half million residents of a 9,240 square mile area of southern Arizona bordering Mexico.

According to Charles W. Felix, Vice President of the Single Service Institute, the Jury placed special emphasis on the following exceptional features of the Pima program:

The clarity of the County's objectives for its food protection program; the extent of the Environmental Health Division's outreach into the community and the execptional rapport developed between regulated and regulators; a first rate "in house" food handler training program and a remarkable number of innovative approaches to traditional services.

The Crumbine Award consists of a bronze medal and an engraved plate mounted on a walnut plaque. Engraved bronze medallions are also presented to individual public health officials who are directly responsible for the winning agency's program.

National Dairy Council Honored

The nation's largest group of nutrition professionals has selected National Dairy Council as the first recipient of the Presidents' Circle Nutrition Education Award. The

honor recognized the council's outstanding efforts to promote healthy diets and wise food choices among Americans.

The award was presented jointly by the American Dietetic Association and the American Dietetic Association Foundation in Anaheim, California, on September 13, 1983. It is the first time the ADA has bestowed the award since establishing it in 1982.

Audrey Wright, president of the ADA Foundation, cited the Dairy Council's "uniquely creative (and) unusual approach to nutrition education information which is free from specific commercial endorsements." Specifically mentioned were NDC's exceptional, innovative educational materials and programs.

Acknowledging the careful research and preparations of the programs cited, the award lauds the Dairy Council for "excellence in disseminating scientifically sound nutrition information." The Presidents' Circle Award is made only when the two associations deem it appropriate; it is not an annual recognition.

"This award is the most significant in the organization's history," said M. F. Brink, Ph.D., president of NDC who accepted the award.

"This would not have been possible," Brink said, "without the team effort of National Dairy Council and its 33 affiliated units. It is a tribute to the dedicated developers who researched and devised the programs, the creative thinking that led to exciting graphics packages, and the innovative ideas that make it easier and more effective for people to learn the concepts of scientifically sound nutrition." Brink observed that education materials have, since NDC's inception in 1915, "elevated consumer awareness to the value of including dairy foods in a nutritionally adequate diet. Education is a vital marketing cornerstone in the dairy industry's efforts to create a favorable climate for its products among the general public."

National Dairy Council, is a nonprofit nutrition research and education organization based in Rosemont, Illinois. A headquarters staff works with about 300 affiliated unit staff members in 47 states to contribute to the well-being of Americans. NDC's programs extend to the professionals who act as a primary source of information for the ultimate beneficiary--the American Public.

"The award," Brink added, "will enhance the believability and credibility of the dairy industry's nutrition education message with other groups including education, science and health professionals."

The Presidents' Circle Nutrition Education Award is a cooperative effort between ADA, representing 50,000 dietitians and nutritionists, and the ADA Foundation. Both organizations monitor food trends to protect the public from diet ventures based on ill-founded information.

"The national dietitian organizations described NDC as a leader in nutrition education thus recognizing the quality of the dairy industry's nutrition education and research program's, which continue to build lifelong values for milk and dairy foods." The symbol of the Presidents' Circle Award is a life-size apple created from Steuben crystal glass.

M. F. Brink, Ph.D., president of National Dairy Council (left), accepts the Presidents' Circle Nutrition Education Award from Audrey Wright, president of the American Dietetic Association Foundation.

Norton Company Names New Manager

The Norton Company Performance Plastics Division recently named Stephen R. Little to the position of Market Development Manager for Dairy, Food and Beverage tubing and Custom Extruded Profiles.

Little came to Norton from a similar position at Dunlop Tire Co., where he was manager of market planning. Earlier he was manager of market research for the International Division of the General Tire and Rubber Company.

Little attended the University of Akron, where he earned a Bachelors in Marketing and a Masters in Business Administration. He served in the Vietnam conflict as a helicopter pilot.

The Norton Company Performance Plastics operates several manufacturing plants and a research center in northern Ohio. It is part of the Norton Company, an international manufacturer of abrasives and diversified products, listing annual sales of over one billion dollars.

New Public Relations Manager Joins Babson Bros. Co.

Babson Bros. Co., builders of Surge dairy farm equipment, announces the recent addition to their staff of Robert Benedict as Public Relations Manager.

Mr. Benedict will serve various public relations functions as well as reporting and editing for company publications.

He is a 1977 Ohio State University graduate with a B.A. in Journalism and was previously a partner in Chel-Brook Farms, Camden, Ohio, breeders of registered Holstein dairy cattle.

Mr. Benedict started with Babson Bros. in May and has relocated to the Oak Brook office.

ABC Research Sponsors Seminar

Food ingredients; microbial control; food quality assurance; biotechnology in the food industry; and various technical aspects pertaining to fruit juices will be covered in a two-day technical seminar sponsored by ABC Research Corporation February 28-29, 1984.

The sessions comprising the 10th Annual ABC Technical Seminar will feature experts from the food industry and academic professionals allied with food science and technology, ABC President William L. Brown said.

The session concerning food ingredients will examine Flavors For Tomorrow; Function and Use of Asparatame; the Application of Edible Gums in Food Systems; and the Utilization of Minced Fish in Various Food Systems.

The talks concerning microbial control will be on Sterilization of Spices - Irradiation vs Gaseous Sterilization; Aseptic Processing of Dairy Products; Retort Pouch Uses for Seafood Products; a panel will discuss *Clostridium botulinum*- Microorganisms; Package Systems; and Lactic Acid Cultures for Meat Preservation.

World Hunger - Problem and Solutions will be the subject of Dr. E. T. York, Chairman of the Board for International Food and Agricultural Development, Washington, DC/Gainesville, FL.

A session on Quality Assurance will cover different segments of the food industry. The food service industry, retail food stores and meat industry will be discussed. A separate session on product recall will be presented.

The session on Biotechnology in the Food Industry will see an overview discussion including the Prospects for applications of Genetic Technology; and also Applications of Genetic Technology to the Food Industry.

The final session will feature a talk on Juice Adulteration and an Update on Aseptic Juice Processing.

Details concerning the Seminar can be obtained by contacting Sara Jo Atwell, Administrative Assistant, ABC Research Corporation, PO Box 1557, Gainesville, FL 32602. 904-372-0436.

NASFT's 9th Winter Show

The 9th Winter International Fancy Food & Confection Show will open in San Francisco 20% larger than last year and with more than 320 exhibitors occupying about 65,000 square feet.

Sponsored by the National Association for the Specialty Food Trade, the exhibition will be held at the Moscone Convention Center, Feb. 26-28, 1984.

For information, contact Jean Frame, Executive Director, NASFT, 215 Park Avenue South, New York, NY 10003. 800-255-2502 or 212-505-1770.

Once considered staid and steady, the specialty food industry has become a fast moving business, according to NASFT president Morris H. Kushner of Crescent Reese Foods, Inc. This has been having a favorable impact on specialty foods, gourmet cookware and accessories, and wine, he said.

"This could be the most successful Winter Show NASFT has ever sponsored," Kushner said.

DFISA '83 Meeting a Success

"In all respects, Food & Dairy Expo '83 was our most successful offering to the food and dairy processsing community," announced Fred J. Greiner, executive vice president of Dairy and Food Industries Supply Association. DFISA, the international trade show's sponsor, staged this year's Expo in Chicago's McCormick Place, October 22-26.

Attendance at Expo '83 reached a grand total of 17,305--the highest recorded figure since the mid-sixties. Of this total, 8,977 attendees were processors and 5,412 were exhibitors. The official figure also includes 1,776 suppliers and distributors and 1,140 visitors.

The number of international visitors at Food & Dairy Expo '83 represents an 11% increase above the Expo '81 statistic. More than 70 foreign nations were included in this total.

Mr. Greiner attributed the success of Expo '83 to the turn-around in the economy and to the many exhibits of interest to a broad spectrum of the industry.

Highlights of Expo '83 included state-of-the-art aseptic and tamper-evident packaging machinery, microprocessor control systems, premium ingredients and flavorings, refrigerated transport equipment, and the unveiling of other food, dairy and liquid processing innovations.

Food and Dairy Expo '85 will be held at the Georgia World Congress Center in Atlanta, Georgia, October 5-9, 1985. For information on the show and other DFISA services, contact Dairy and Food Industries Supply Association, 6245 Executive Boulevard, Rockville, Maryland 20852. 301-984-1444.

Nominations for the 1984 ACDPI Research Award Sought

Deadline for submitting nominations for the 1984 American Cultured Dairy Products Institute Research Award is February 8, according to Institute Vice President Dr. C. Bronson Lane. The award (sponsored by

Nordica International) consisting of $1,000 and a permanent plaque is given annually to a college professor for outstanding research contributions in the cultured products field.

The guidelines for eligibility are as follows:

1. The work (on cottage cheese, buttermilk, sour cream, yogurt or other fluid and semi-fluid products made by the action of cultures) for which the award is made must have been completed within the past 10 years at a college or university.

2. The recipient must have been a full time faculty member at the college or university during the time the work was done.

3. The person must not be a previous recipient of the ACDPI Research Award.

The individual selected for this year's award will be recognized at the 1984 ACDPI Annual Meeting/Klinic/National Cultured Product Evaluation Sessions to be held in Dallas, Texas on March 18-21.

Nomination letters should be sent directly to Dr. C. Bronson Lane, ACDPI, PO Box 7813, Orlando, FL 32854.

NASFT's 30th Annual Summer Show Changed to Washington, DC.

The 30th Annual International Fancy Food & Confection Show will be held in Washington, DC at the Washington Convention Center, June 24-27, 1984.

The show originally was scheduled to be held in Atlanta at the Georgia World Congress Center, according to Jean Frame, Executive Director of the National Association for the Specialty Food Trade, sponsors of the event.

NASFT's show is now among the top 1% of trade shows in the U. S. A., Mrs. Frame said. This past June, the show was held at the Washington Convention Center where it occupied more than 130,000 square feet. It is expected to reach around 150,000 square feet by next June.

NASFT has more than 600 members, including domestic and foreign manufacturers, importers, distributors and brokers, national, regional and state trade organizations, both American and foreign.

For more information contact: Gene Bennett, NASFT, 215 Park Ave. South, New York, NY 10003. 800-255-2502 or 212-505-2502.

Student Essay Contest Set

The winner of the first American Cultured Dairy Products Institute Student Essay Contest will be recognized at the Institute's Annual Meeting in Dallas, Texas on March 18-21, according to Board Chairman DuWayne Beckerleg, Bancroft Dairy, Madison, Wisconsin.

Guidelines for the Contest - established in recognition of ACDPI's 25th Anniversary last year - are as follows:

1. The contest will be limited to college/university undergraduate junior and senior students. (Graduate students are not eligible).

2. The essay should cover one of two topics related to cultured dairy products:

a) Research needed to solve a current or anticipated problem. This may relate to any phase of cultured dairy products research such as product formulation, nutritional considerations, processing technologies, etc.

b) Sales/marketing ideas for current or proposed cultured dairy foods. These could include suggestions for innovative promotion programs to increase product consumption or means of enhancing the image of the dairy industry and/or its cultured products.

3. Length of the manuscript should be approximately ten double-spaced typewritten pages.

Deadline for submitting papers for the 1983-1984 school year has been extended to February 1. Essays should be sent directly to Dr. Charles White, Dairy Science Department, Louisiana State University, Baton Rouge, Louisiana 70803-4404.

The winner will receive an all expenses paid trip to the Institute's '84 conclave, be given an opportunity to present his/her paper at a delegate general session, and be provided with a $250 cash award.

National Institute of Public Health and Environmental Hygiene

January 1, 1984 the National Institute of Public Health, the National Institute for Water Supply and the Institute for Waste Research integrated into one institute with the name "National Institute of Public Health and Environmental Hygiene" (RIVM). After finishing the second part of the new buildings in Bilthoven the whole institute will be located in Bilthoven in 1986. The new institute has three main divisions, namely Microbiology and Immunology (Head: Dr. E. J. Ruitenberg), Pharmacology and Toxicology (Head Dr. R. Kroes) and Chemistry and Physics (Head: Ir. P. Santema). Dr. H. Cohen has been appointed Director-General, and Prof. Dr. E. H. Kampelmacher Deputy Director-General of the new institute as of January 1, 1984.

Food Science and Nutrition Department Honored at University of Minnesota

The Department of Food Science and Nutrition at the University of Minnesota was recently honored by inclusion in a group of 19 departments and programs (out of a total of over 200 such units in the University) rated

by the University's central administration and a faculty consultative group as especially meritorious, most with top national ratings. Food Science and Nutrition is the home of the University of Minnesota's programs of research and education in the science and technology of dairy products and processing. The units selected for this honor will each receive an allocation for faculty salary increases from the University's special merit/retention fund.

College deans were told to nominate only departments of exceptional quality and preferably ranked in the top 10 percent of similar programs in the country. Food Science and Nutrition was nominated by the deans of both Agriculture and Home Economics, the colleges by which it is joinly administered. The department has been headed by Dr. Elwood F. Caldwell since 1972, the year in which it was formed by a three-way merger of smaller units.

National Conference for Food Protection Set for May 9-11, 1984

A National Conference for Food Protection will be held in Washington, DC, May 9-11, 1984, according to an announcement of its organizers, the Study Committee for a National Conference for Food Protection. The Study Committee is a coalition of some ninety trade associations, professional societies, government agencies and food companies who share a common concern for food safety in the United States.

In making the announcement, Study Committee chairman, Charles W. Felix, said: "The Conference is being designed to enable industry, government and the consumer to share perspectives on the toxicological and microbiological aspects of food safety problems and, at the same time, to identify the needs, direction and opportunities of food production, processing, handling and regulation through the year 1990."

A further goal of the Conference, according to Mr. Felix, will be to establish an organization for the continuing study of food safety problems and for promotion of the recommendations of the Conference.

"We intend to avoid the shortcoming of the First National Conference on Food Protection held in Denver in 1971," said Felix. "Because there was no follow up mechanism built into that Conference, many of its recommendations fell by the wayside, and it has taken 13 years to pick up the thread of what was otherwise an excellent beginning to a national dialogue on food safety."

Unlike the 1971 Conference, the 1984 Conference will not be limited to microbiological concerns, but will also address toxicological problems, education and training, food processing and preservation, standards and regulations, and new foods, including the impact of genetics and the space program on food production.

The two-day Conference is expected to draw more than 400 participants from across the United States. They will meet at the Hyatt Regency Crystal City in Arlington, Virginia.

The Conference will be supported through a registration fee of $95 and through contributions from interested parties. A $5,000 grant from three members of the Single Service Institute -- James River-Dixie/Northern, Inc., Keyes Fibre Company, and Amoco Chemicals Corporation -- has enabled the Study Committee to make preparations for the meeting.

More information about the National Conference for Food Protection may be obtained by contacting Charles W. Felix, Chairman, Study Committee for a National Conference, 1025 Connecticut Avenue, NW, Suite 1015, Washington, DC 20036. 202-347-0020.

Winter Dairy Promotion to Focus on Fitness

The dairy industry's first promotion of 1984 will remind consumers of the health benefits of real dairy foods. Scheduled from January 2 through mid-February, the promotion is sponsored by American Dairy Association (ADA) and regional dairy promotion organizations.

Using the theme, "Shape Up For Life," the sales event ties in with Americans' interest in maintaining physical well-being through balanced eating and regular exercise. ADA's new exercise/diet booklet, foodstore displays and food publicity for the period stress the vital dietary role of dairy products as sources of calcium and other nutrients.

The full-color booklet, "Shape Up For Life With Dairy Foods," contains a total fitness guide with five basic exercises, warm-up routine and advice on planning an aerobic exercise program.

It provides five days' calorie-counted menus for men and women and a four-food-group chart. More than 2 million booklets will be distributed by dairy organizations across the country in foodstores and health-related facilities and via a newspaper advertisement and publicity in selected markets.

ADA's advertising, sales promotion, publicity and "REAL" Seal Program are part of the total dairy products promotion efforts of United Dairy Industry Association.

1984 ACDPI Meeting To Be Held In Dallas

Over 300 delegates from throughout the U.S., Canada, Mexico, and sundry European countries are expected to attend the 1984 American Cultured Dairy Products Institute Annual Meeting/Kulture and Kurds Klinic/ National Cultured Product Evaluation Sessions, according to Institute Vice President Dr. C. Bronson Lane. Site for the March 18-21 events will be the Marriott Hotel - Quorum Center, Dallas, Texas.

Confirmed speakers for the tri-faceted function include: Charles Sapp, H. E. Butt Grocery Co.; Claude Chevalier, Dairy Bureau of Canada; John Muldowney, United Dairy Industry Association; Wes Gross, The Southland Corp.; Dennis Keck, Van Dam Machine Corp. of America; Joe Kagan, Dinast Assoc.; Dan Conolly, Land O' Lakes; Chet Smith, The Kroger Co.; Dr. Khem Shahani, University of Nebraska; Dr. Paul Swenson, H. P. Hood Co.; Darrell Bigalke, Food and Dairy Quality Management, Inc.; Erik Lundstedt, International Consultant; Dr. Clair Hicks, University of Kentucky; Dr. Charles White, Louisiana State University; Keven O'Rell, The Dannon Company; Dr. Ed Custer, Mississippi State University; Wesley Casteel, Casteel Co.; Fran Lavicky, Nordica International; Bob Wight, Ziegler and Sons, Inc.; Earl Connolly, Fantasy Flavors, Inc.; Dr. Floyd Bodyfelt, Oregon State University.

Buttermilks, sour creams, cottage cheeses, and yogurts submitted by manufacturers will be analyzed by experts during the national product evaluation sessions, and awards given for individual product excellence. Over-all products winner will receive the coveted Neil C. Angevine Superior Quality Award at the Tuesday evening (March 20) recognition Banquet.

Additionally, the program includes a President's reception honoring DuWayne Beckerleg and a Monday (March 19) luncheon where the recipient of the 1984 ACDPI Research Award (sponsored by Nordica International) will be recognized.

A tour of the Southland Corporation's Special Foods Division processing plant in Sulphur Springs, Texas is also on tap for the conferees.

For additional information, contact Dr. C. Bronson Lane, ACDPI, PO Box 7813, Orlando, FL 32854.

Kansas State University Offers Rapid Methods Workshop

An eight-day intensive workshop on rapid methods and automation in microbiology will be held at Kansas State University July 14 - 21, 1984.

The workshop, directed by Dr. Daniel Y. C. Fung, an internationally known scientist in this area, will provide hands-on experience in the rapidly developing field of automated instrumentation and diagnositc kits in applied microbiology.

More than 15 companies will participate in the workshop and will provide the newest instruments and kits for students to use in working with these modern systems. In addition, Dr. Nelson A. Cox of Russell Research Center, Athens, Georgia, and Dr. Millicent C. Goldschmidt of the University of Texas will present lectures in diagnostic kits and automated instrumentations.

The course will carry 7.2 Continuing Education Credits of the American Society for Microbiology. Interested persons should contact Dr. Daniel Y. C. Fung at Call Hall, Kansas State University, Manhattan, KS 66506. 913-532-5654.

Letter to the Editor

State of Wisconsin \ DEPARTMENT OF HEALTH AND SOCIAL SERVICES

DIVISION OF HEALTH
MAIL ADDRESS
1 WEST WILSON STREET
P O BOX 309
MADISON WISCONSIN 53701

November 29, 1983

A. Richard Brazis, Ph.D., President
IAMFES
P. O. Box 701
Ames Iowa 50010

Attention: Kathy Hathaway, Executive Secretary

Dear Dr. Brazis:

I just received my November issue of Dairy and Food Sanitation and was so pleased with the make up and the reports of the International meeting that I thought I would tell you while it was still fresh in my mind.

Many times we members just take things for granted, being very quick to critize but not too alert to giving a pat on the back for a job well done.

The individuals responsible for putting the minutes and the report of the proceedings together should be given a special vote of thanks and additional praise.

I believe this issue should be used extensively by the membership committee and members at large in creating an awareness among non-members of what our organization is all about and also creating a desire in wanting to be a member. I believe Earl Wright should be given special attention for developing a staff capable of doing a first class job, Grade A if you please!

I plan to retire on January 20, 1984 but hope to remain an active and interested member. I have been a member since Wisconsin became an affiliate quite some time ago. I will certainly look forward to seeing the sanitarian attain his rightful place in the professional ranks. There has been tremendous progress in the past 41 years.

I wish to express my thanks to Earl and wish him and his wife many happy and healthful years in his new career as a resident of Arkansas. We certainly were proud of him as a native of Wisconsin.

Again, keep up the excellent work!

Sincerely,

C. K. Luchterhand

C. K. Luchterhand, R.S., Chief
Section of Milk Certification
and Sanitarian Registration

CKL/ba

From the Editor

To all article reviewers and book reviewers for *Dairy and Food Sanitation*. Thank you for your time and effort in reviewing articles and/or books for publication in *Dairy and Food Sanitation*. I look forward to working with you in 1984. K. R. Hathaway, Editor, *Dairy and Food Sanitation*.

Food Science Facts
For The Sanitarian

Robert B. Gravani
Cornell University
Ithaca, NY

With this edition, Dairy and Food Sanitation begins a new monthly feature called Food Science Facts. This column is being written by Dr. Robert B. Gravani, of the Department of Food Science at Cornell University. It is written in a concise, easy to read style and is intended primarily as a training aid for food industry personnel. Food Science Facts can be easily reproduced from the journal and used:

as handout materials in training courses or programs;
on employee bulletin boards;
in response to questions;
in newsletters or other publications; and
for reference.

Food facts will cover a variety of subjects and can be used with many audiences including food processing personnel, food service managers and workers, warehousemen, fieldmen and consumers.

Facts can be reproduced but a credit would be appreciated.

We hope that you enjoy this monthly feature and use it in your teaching, training and regulatory activities. Let us know the innovative ways that you use this information.

BACTERIA

Bacteria are all around us and carry out a number of functions vital for life. Many are beneficial and are responsible for the fermented dairy and meat products that we enjoy. Other bacteria cause food to spoil, while a small percentage are harmful to us. Because bacteria are invisible to the naked eye, their existence and activities are often over-looked or ignored until problems occur. Some basic information about bacteria is given in this column.

Unlike animals and plants that are composed of many cells, bacteria are single celled organisms. Each bacterium is self-sufficient and is able to live independently. Bacteria come in a variety of shapes and are impossible to see without a microscope. Since they are about 1/25,000*th* of an inch long, they must be magnified about 1,000 times to be seen. To illustrate how small they really are, 400 million bacteria clumped together would be about the size of a grain of sugar.

BACTERIAL GROWTH

Bacteria grow in a very unique way; they increase in numbers, not in size. This process is called cell division. Under ideal conditions, cell numbers can double every half hour, therefore, one becomes two, two become four, four become eight, and so on. If you start with one bacterial cell, after 12 hours there would be as many as 33,000,000!

The rate at which bacteria grow is different for each type or organism and is affected by many factors.

Factors Affecting Microbial Growth:

1) *Water* -- Bacteria need water to dissolve the food they use for energy and growth. Water allows the food to get into the cells, is used for the many chemical reactions necessary for life and growth, and allows waste products to escape.
2) *Food/Nutrients* -- All bacteria require energy to live and grow. Energy sources such as sugars, starch, protein, fats and other compounds provide the nutrients.
3) *Oxygen* -- Some bacteria require oxygen to grow (aerobes) while others can grow only in the absence of oxygen (anaerobes). However, many bacteria grow under either condition and they are facultative anaerobes.
4) *Temperature* -- Bacteria in general are capable of growing over a wide range of temperatures and are usually classified according to the temperature at which they grow.

   a) Psychrotrophic bacteria are those that are capable of growing at 32°F - 45°F but their optimum is from 68°F - 86°F. They cause off flavors and defects in food products stored under refrigeration.

   b) Mesophilic (medium temperature loving) bacteria. Most bacteria are capable of growing at 60°F - 110°F and belong in this group. Most food poisoning bacteria grow at these temperatures.

c) Thermophilic (hot loving) bacteria. These microorganisms grow at higher temperatures such as 110°F - 150°F.

Temperature is the most widely used method of controlling bacterial growth. Bacteria grow slowly at temperatures below 45°F and thermal destruction occurs at temperatures above 140°F. But in the temperature "danger zone" - between 45°F and 140°F - many bacteria are not controlled.

5) *pH* -- pH is a measure of acid or alkali in a product. It is indicated on a scale from 0 to 14, with 7 being neutral. Below 7 is acid while above 7 is alkaline. Most bacteria grow well at neutral pH, but many can reproduce in a pH range of 4.5 - 10.0.

TYPES OF BACTERIA

Beneficial Bacteria

Most bacteria are very useful to mankind. They live in a variety of places and grow whenever conditions are suitable. A few beneficial functions of bacteria are the production of food products including: Dairy products (yogurt, cheese and buttermilk), Sauerkraut, Fermented meat products such as summer sausage, and vinegar.

They help fix nitrogen in the soil and are responsible for decomposing organic materials, which returns important nutrients back to the soil. The beneficial aspects of microorganisms far outweigh their harmful effects.

Disease Producing Bacteria

These bacteria produce diseases in humans, animals and plants and are called pathogenic bacteria. They are a relatively few in number and produce disease by 1) growing on or in certain tissues or 2) producing harmful poisons or toxins which people and animals consume.

Spoilage Bacteria

As bacteria live and grow they produce changes in food products that damage flavor, texture and composition. Specific bacteria can cause milk to sour or develop off flavors, meat to spoil or wine to turn to vinegar. The temperature of food must be carefully regulated in order to control bacterial growth.

Spore Forming Bacteria

When certain bacteria grow, they have the ability to develop resistance to extreme heat, dryness and chemicals. These bacteria are called spore formers because they develop a "shell" which is capable of protecting the cell under adverse conditions. The spore is the "resting stage" of the live bacteria and it can begin to grow into an active cell when proper growth conditions are provided. Since spores are resistant to heat, higher temperatures and pressure are used in food canning to destroy them.

Dairy Quality

by **Darrell Bigalke,** *Food & Dairy Quality Mgmt., Inc., St. Paul, MN*

The Importance of In-Plant Temperature Monitoring and Control in the Production of High Quality Milk Products

Milk is no doubt one of nature's perfect foods -- for people and bacteria. It has sufficient nutrients, desirable pH, lack of inhibitory substances, sufficient oxygen, and desirable moisture, which results in an ideal growth media for microorganisms. Milk is pasteurized and not sterilized; consequently, bacterial contamination will likely exist. This leaves the potential for growth in packaged milk of both thermoduric psychrotrophic bacteria (i.e. organisms surviving pasteurization) and post-pasteurization contaminants. The only means of controlling growth of these organisms in fluid milk is proper refrigeration.

For years, dairy scientists have discussed the importance of temperature control in maintaining quality of fluid milk. To further illustrate the importance of temperature control, consider the following situation. Assume that we have a post-pasteurization contamination rate of one psychrotrophic organism per liter. The psychrotrophic organism is *Pseudomonas fragii,* which could expect to have a generation time of ten hours at 38F and five hours at 45F. Consider products A and B with product A having a fill temperature, storage temperature and distribution temperature of 45F, and product B having a fill temperature, storage temperature and distribution temeprature of 38F. At these temperatures, we would expect product A to have a Standard Plate Count (SPC) of 42,000,000 per milliliter in eight days, while product B would be expected to have a SPC of 600 per milliliter in the same time due to the growth rate of this psychrotrophic contaminant at these respective temperatures. These populations are calculated based on the formula for microbial exponential growth which is...Log B = Log A + N Log 2...where Log B equals the population at the end of a given time, Log A equals the initial population, and N equals the number of generations (4).

Another means of looking at the importance of temperature control is to consider the amount of time needed to develop microbial off-flavors (requiring about 10,000,000 organisms per milliliter). At a contamination rate of one organism per liter with product A stored at 45F and product B at 38F, product A would have a detectable microbial off-flavor at seven days, while product B would require fourteen days for these off-flavors to occur.

In addition to promoting bacterial growth through ineffective refrigeration, there is another incentive to initiate an effective temperature control program. The Grade "A" Pasteurized Milk Ordinance (PMO) states "it shall be unlawful to sell or serve any pasteurized milk or milk product which has not been maintained at a temperature of 45F or less"(5). The literature (1,2,3) has shown that process, fill and storage temperatures often exceed 45F. Careful attention is needed to assure that this is not the case. Bandler (1) suggested the use of a "plant temperature survey form". Weekly or daily use of such a survey along with hourly fill temperature checks should be considered to assure proper monitoring of process temperatures.

A dairy quality control program must put high priority on temperature control because this is the only available method of controlling microbial growth in fluid milk. Temperature monitoring and control must start with milk as it is received. An effective means of documentation in controlling receiving milk temperatures is to install and maintain recording thermometers. Also, recording thermometers should be maintained on raw milk storage tanks and procedures must be established to monitor and control the length of time raw milk is stored before processing (should be less than 24 hours).

Temperature control and monitoring from pasteurization to bottling should include the following: (1) temperature monitoring at the HTST discharge, (2) surge tank, (3) filler bowl, and (4) the carton. The end result of this monitoring and control should be to fill product at a temperature no higher than 38F. When monitoring temperatures at these lo-

cations, Bodyfelt and Davis (3) and Bandler (1) have suggested the use of the YSI Model 42SF tele-thermometer equipped with a flat surface probe.

To maintain a 38F fill temperature, the following suggestions may be useful:

1. Have adequate refrigeration so the discharge temperature at the HTST is no higher than 35F.
2. Insulate piping from the HTST to storage tanks and from storage tanks to fillers.
3. Use refrigerated storage tanks.
4. Install plate coolers at the filler.
5. Cool lines with chlorinated cold water or water that has been pasteurized and cooled before starting production.

As Bandler (1) suggests, a plant cooler should not be thought of as a means of cooling fluid milk products, but as a means of maintaining temperature. With this in mind, fill temperatures become extemely important. Every dairy should have a comprehensive fill temperature monitoring and control program.

In summary, a common rule of thumb advocated by dairy scientists is that for each five degree increase in temperature, the expected shelf-life can be reduced by one-half. In other words, if a product maintains a shelf-life for 20 days at 35F, at 40F the expected shelf-life would be 10 days and at 45F the expected shelf-life would be 5 days. Temperature control must start at the processing plant where the maintenance of fill temperatures not to exceed 38F should be a top priority. Also, temperature control of storage and distribution must continue to maintain high quality fluid milk products with an acceptable shelf-life.

1. Bandler, D. K. 1972. Total temperature control. American Dairy Review 34(11):22,48-51.
2. Bodyfelt, F. W. and W. D. Davidson 1975. Temperature Control 1. A procedure for profiting temperatures of dairy products in stores. Milk Food Technol. 38(12):734-737.
3. Bodyfelt, F. W. 1980. Don't "precondition" your dairy products to spoil. Dairy Record, July, 1980 pp. 50-91.
4. Nickerson, J. T. and A. J. Sinskey 1972. Microbiology of foods and food processing. American Elsevier Publishing Company, Inc., New York.
5. U. S. Department of Health, Education, and Welfare, Public Health Service. Grade "A" Pasteurized Milk Ordinance. U. S. Government Printing Office, Washington, DC.

The Challenge of Change is Topic for the 1983 Wisconsin Association Annual Meeting

The Challenge of Change was the Wisconsin Association of Milk and Food Sanitarians theme for their annual meeting held September 22 & 23, 1983. The meeting was held at the Olympia Spa & Resort in Oconomowoc, WI.

The keynote address was given by John Robinson, 63rd Assembly District State Representative. Frank L. Bryan, Center for Disease Control, Atlanta, Georgia, gave a report on Food Sanitation: A World Perspective.

The Sanitarian of the Year Award was presented to Dr. Elmer H. Marth, Mr. Ronald Swiggum was awarded a scholarship by the Joint Committee on Education and Allan Ver Voort was presented with a past-president plaque.

New officers were named: Jon R. Dresser, President; David Myers, Vice-President; Gene Lindauer, 1st Vice President; Neil Vassau, Secretary-Treasurer; and Allan Ver Voort, Past President.

Norm Kirschbaum, Administrator of the Food Division, Wisconsin Dept. of Agriculture, Trade and Consumer Protection was Master of Ceremonies for the Awards Luncheon on September 22nd.

Corrections for South Dakota Officers

In the November issue of *Dairy and Food Sanitation* the South Dakota Environmental Health Assn. officers were incorrectly listed. All correspondence should be directed to Morris V. Forsting, SD State Dept. of Health, 1320 S. Minnesota Ave., Suite A, Sioux Falls, SD 57105.

The other officers are James F. Lawler, Pres., U.S. Public Health Service, Federal Bldg.-309, Aberdeen, SD 57401. Cathy Meyer is the President-Elect. Her address is the SD State Dept. of Health, P.O. Box 903, Mitchell, SD 57301.

Ronald Swiggum accepts the scholarship awarded by the Joint Committee on Education of the Wisconsin Association of Milk and Food Sanitarians and the Wisconsin Environmental Health Association. Mr. Swiggum is a student enrolled in the Allied Health Professions program at the University of Wisconsin, Eau Claire.

Dr. Elmer H. Marth (l) receives the 1983 Sanitarian of the Year Award from Paul Pace (r) during the awards luncheon.

Allan Ver Voort (l) receiving the Past Presidents Plaque from newly installed President Jon R. Dresser (r).

New Members

Ministere de l'Agriculture
des Pecheries et de l'Alimentat
Gaspe, Quebec, Canada

Douglas F. Campbell
Laurel, MD

Zone Dir. North Zone
Health & Welfare Canada
Edmonton, Alberta, Canada

Douglas Arthur Knutson
Zim's Dairy Products, Inc
Juda, WI

Donald T. Hunnicutt
HRS Polk Co. Health Dept.
Winter Haven, FL

Judy Herrmann
Daily Laboratories
Peoria, IL

Charles Nemec
Anderson Clayton Foods
Richardson, TX

Paul Tegen
Burlington, VT

Dr. Ken Lee
University of Wisconsin
Madison, WI

Biblioteca do Instituto Zimotecnico
Brasil

Changleem Lee
Korea Institute of Animal Sciences
Korea

Library 2RS
Ralston Purina Company
St. Louis, MO

Yancheng Lin
Brooklyn, NY

G. Macatee
Ministry of Agric. & Food
Vernon, Brit. Col., Canada

Dr. Donald E. Boswell
Conshohocken, PA

Tarleton State Univ. Library
Stephenville, TX

P. Gilbert
Capsule Labs.
Rivonia, South Africa

Curtis J. McKay
Dept. Fisheries & Oceans
Prince Albert, Sask., Canada

Robert F. Roberts
University of Vermont
Burlington, VT

Richard Paape
Galloway-West
North Fond Du Lac, WI

Health & Welfare Canada
Health Protection Officer
Victoria, BC, Canada

University Library
Marathwada Agric. Univ.
Maharashtra, India

John Butts
Land O'Frost
Lansing, IL

Richard E. Smitherman
Blytheville AFB, AR

Jets Bahrain
Birmingham, AL

Health & Welfare Canada
Health Protection Officer
Kelowna, BC, Canada

Daniel K. Sheppard
Diversey Wyandotte Corp.
Portland, OR

Jim Jacobson
Vitamilk Dairy
Seattle, WA

Geoffrey Havens
University of Connecticut
Storrs, CT

Barbara Bronson
Mankato, MN

R. T. French Co. Library
Rochester, NY

Jay W. Brown
Salt Lake City, UT

Glaxo Laboratories, Ltd. Library
Palmerston North, New Zealand

Toritsu-Tachikawa-Tandai
Tokyo, Japan

Jens Friis Jensen
Pasilac, Inc.
Minneapolis, MN

Food & Drug Administration
San Francisco, CA

Ir. Mariyati M. Sukarni
Institut Pertanian Bogor
Bogor, Indonesia

Darold G. Murray
WI Dept. of Agriculture
Cottage Grove, WI

Libary, BC Inst. of Tech.
Burnaby, BC, Canada

Claudine Siu Mun-Yee
Hong Kong

Manvel Ostroff
Cumberland City Health Dept.
Bridgeton, NJ

Thomas L. Edmonson, Jr.
Wichita Falls Health Center
Wichita Falls, TX

Bruce A. Marzolf
Eden Prairie, MN

Irving Fukunaga
Dept. of Health
Honolulu, HI

Harold D. Anderson
Torrington, WY

Charles I. Graves
Lonza, Inc.
Chagrin Falls, OH

Medical Library
Fort Eustis, VA

Donald Sakiyama
Precision Testing Lab.
Hayward, CA

Ralph May
Columbus, OH

John E. Bogardus, Jr.
Johnson City, TN

Thomas Joseph Quanty
Mid America Dairymen
Springfield, MO

John C. Hounschell
Joplin Health Dept.
Joplin, MO

Michael K. J. Popovici
Ithaca, NY

Central TNUVA
Milk Division
Tel-Aviv, Israel

Steve Gignac
Associated Milk Producers
Champaign, IL

Dept. of Health Academy
New York, NY

Bibliographical Serv. Unit
Humberside College
Hull, England

Donna E. Gordon
Mid-Valley Dairy Co.
Fairfield, CA

Mike Barron
Yoplait, USA
Carson, CA

Fran P. Kaiser
Carnation Co.
Los Angeles, CA

Robert Leong
Reliable Industries, Inc.
Metro Manila, Philippines

Emerson GE
3M Company
St. Paul, MN

YOUR IDEAS ARE HELPFUL .....

In order to differentiate *Dairy and Food Sanitation* from the *Journal of Food Protection,* a NEW cover begins with this issue.

The sketch on the cover of the January issue is just one of the many that will appear throughout the year. You will find the inside format has also been changed.

Research has proven that because both journals are the same color and look basically the same from the outside, many people thought they were one in the same.

As a member/subscriber you realize the practical use of *Dairy and Food Sanitation.* So, *Dairy and Food Sanitation* will now LOOK practical, more like a magazine instead of a highly technical journal.

Your comments on the information provided in *DFS* are important. Please take a few minutes to fill out this questionaire and mail today. This form has been conveniently placed for tear out.

Mail today to K. R. Hathaway, IAMFES, PO Box 701, Ames, IA 50010, no later than March 15, 1984.

Please check those that apply...

1. What type of articles are of the most interest to you?
   - ☐ Dairy
   - ☐ Food
   - ☐ Environment
   - ☐ Other _____

2. Affiliate News. Which area(s) are of interest to you?
   - ☐ Highlights from state/province annual meetings
   - ☐ Membership promotion ideas
   - ☐ Updates from the Ames Office

3. New Product News. Which area(s) are of most interest to you?
   - ☐ Laboratory
   - ☐ Sanitation
   - ☐ Water/Environment
   - ☐ Food Processing
   - ☐ Packaging
   - ☐ Dairy
   - ☐ Other _____

4. News and Events. What area(s) would you like to see more of?
   - ☐ Upcoming Events
   - ☐ Extension Service Reports
   - ☐ Company Promotions
   - ☐ Awards Presented
   - ☐ New Manuals and Brochures
   - ☐ General
   - ☐ Other _____

5. JFP Abstracts
   - ☐ I find them useful
   - ☐ I don't use them
   - ☐ I don't really care if they are published
   - ☐ Other _____

6. New Cover for DFS
   - ☐ Like it
   - ☐ Like previous "journal" look better
   - ☐ Don't really care
   - ☐ Other _____

7. Which section do you read the most, please number 1 through 11, with 1 being the first thing you read
   - ☐ Articles
   - ☐ News and Events
   - ☐ New Product News
   - ☐ Dairy Quality
   - ☐ NMC column
   - ☐ Food Science Facts (first appearing in this issue)
   - ☐ Book Reviews
   - ☐ Calendar
   - ☐ Affiliate News
   - ☐ JFP Abstracts
   - ☐ Committee Reports

8. Additional Comments on DFS _____

_____

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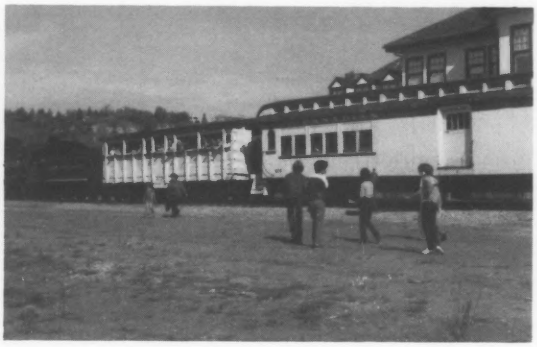
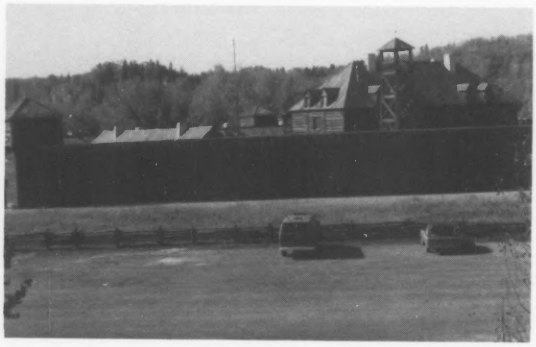
ENJOY A VOYAGE TO YESTERDAY!

During the 71st Annual Meeting of the IAMFES to be held in Edmonton, Alberta, August 5-9, 1984, you'll have the opportunity to step back in time more than one hundred years, to experience what life used to be like in frontier and pioneer days - and learn about those who made Edmonton the vibrant, vital city that it is today. The sights and sounds of the past are part of the atmosphere at Fort Edmonton Park where you will stroll down the boardwalk of 1885 Street, tour a real frontier fort, ride on an authentic steam driven train, and top off the evening with a barbequed dinner of world-famous Alberta beef. Then wake up the next morning to a Klondike Breakfast held in retrospect of the Gold Rush of yet another era in Edmonton's history. You - and your family - are sure to have a wonderful time. Join us in Edmonton in '84!





Come To Edmonton in '84!

You are extended a warm Western Canadian invitation to attend the 71st Annual Meeting of IAMFES, August 5-9, 1984 at the Edmonton Inn, Edmonton, Alberta. We promise you an enjoyable, educational and memorable meeting - bring the whole family and plan a vacation around it! We've planned a special Western BBQ and Klondike Breakfast as part of the "good times" you'll have here in Edmonton. You shouldn't miss it!

71st IAMFES Annual Meeting
Edmonton Inn, August 5-9, 1984
Edmonton, Alberta, Canada

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- ☐ Past President
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- ☐ Speaker
- ☐ 30 year Member
- ☐ 50 year Member
- ☐ Non-Member
- ☐ Student

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(Refundable if cancelled prior to June 30, 1984)

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Registration	☐ $30	☐ $10	☐ Free	☐ $40
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Fort Edmonton Park & Western BBQ	☐ $20	☐ $20	☐ $20	☐ $20
Klondike Breakfast	☐ $8	☐ $8	☐ $8	☐ $8
BEST BUY Banquet & Reception	☐ $20	☐ $20	☐ $20	☐ $20
Complete Package**	☐ $75	☐ $45	☐ N/A	☐ $80
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*Indicate attendance **Includes registration/all functions

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☐ Free	☐ Free	☐ Free	☐ Free
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☐ $9	☐ $9	☐ $9	☐ $9
☐ $22	☐ $22	☐ $22	☐ $22
☐ $85	☐ $55	☐ N/A	☐ $90
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23rd ANNUAL MEETING OF THE NATIONAL MASTITIS COUNCIL, INC.

FEBRUARY 14-15, 1984
KANSAS CITY HILTON AIRPORT PLAZA
KANSAS CITY, MISSOURI

February 14, 1984
Tuesday

11:00 A.M.	*Presidential address,* Mr. Arlen Schwenke, Morrison, MO
11:20 A.M.	Fresentation of certificates to National Members
11:40 A.M.	*Liner Massage and Teat Condition,* Dr. Graeme Mein, Institute of Dairy Technology, Werribee, Victoria, Australia
12:30 P.M.	Lunch Break
	Presiding - Charles McDuff
1:30 P.M.	*Effects of Pre-milking Udder Hygiene on Milk Quality,* Dr. D. M. Galton and Dr. W. G. Merrill, Cornell University
1:55 P.M.	*Sanitizing Bovine Udders for Milking,* Dr. Robert B. Bushnell, University of California
2:20 P.M.	*Efficacy of an Automated Iodine Backflushing System in Prevention of Intramammary Infection,* Dr. R. J. Harmon and Mr. J. S. Hogan, University of Kentucky
2:40 P.M.	*Effects of an Iodophor Backflushing System in Prevention of Intramammary Infection,* Mr. T. Wyatt Smith, The Pennsylvania State University
3:00 P.M.	Panel of preceeding speakers. Charles McDuff, moderator
3:15 P.M.	Milk Break
3:30 P.M.	*The Use of Computers in Mastitis Control,* Dr. John H. Kirk, Michigan State University
3:55 P.M.	*Dealing with Subclinical Mastitis: Lactation Therapy Based on Somatic Cell Counts,* Mr. M. McDermott, Dr. H. N. Erb, Dr. R. P. Natzke, Ms. Frances Barnes-Pallesen and Mr. D. Bray, Cornell University
4:20 P.M.	*A Preview of the New Laboratory and Field Handbook on Bovine Mastitis,* Ms. Frances Barnes-Pallesen, New York State Mastitis Control Program
4:45 P.M.	NMC Business Meeting
5:15 P.M.	Adjourn
7:30 P.M.	*Technology Transfer Session,* Dr. Stephen P. Oliver, University of Massachusetts, Chairman
9:30 P.M.	Adjourn

February 15, 1984
Wednesday

Session on Residue Avoidance Program

8:30 A.M.	*Residue Avoidance: The Total Effort,* Dr. Basil Eastwood, Extension Service, USDA
8:45 A.M.	*Overview of National Residue Avoidance Program,* Mr. John Adams, National Milk Producers Federation.
9:00 A.M.	*Reducing Antibiotic Contamination of Meat and Milk in Dairy Cows,* Dr. Duane Rice, University of Nebraska.
9:20 A.M.	*Residue Avoidance Program: The Ohio Project,* Dr. Larry Heider, Ohio State University
9:40 A.M.	*Residues in Colostrum and Milk Following Antibiotic Therapy in Dairy Cows,* Dr. Stephen Oliver, University of Massachusetts
10:00 A.M.	Panel Discussion on Residue Avoidance, Dr. Keith Sterner, moderator
10:15 A.M.	Milk Break
10:30 A.M.	*A Practitioner's Approach to Mastitis Microbiology - Acute and Subclinical,* Dr. Douglas Van Damme, Baldwin, WI
11:00 A.M.	*Working with Problem Herds,* Dr. Don Wesen, North Carolina State University
11:30 A.M.	*Effects of Intramammary Devices on Milk Somatic Cells, Milk Yield and New Infection Rate,* Dr. Max Paape, USDA, Beltsville, MD
12:00 Noon	*Vacuum Fluctuation and Mastitis,* Dr. Graeme Mein, Werribee, Australia
12:30 P.M.	Adjourn

Past IAMFES Award Winners

EDUCATOR-INDUSTRY AWARD
1973 - Walter A. Krienke
1974 - Richard P. March
1975 - Dr. K. G. Weckel
1976 - Burdet H. Heinemann
1977 - Dr. Elmer H. Marth
1978 - James B. Smathers
1979 - Dr. Joseph Edmondson
1980 - James R. Welch
1981 - Francis F. Busta

In 1982 this award was split into the Educator Award and the Harold Barnum Award (for industry)

EDUCATOR AWARD
1982 - Floyd Bodyfelt
1983 - John Bruhn

HAROLD BARNUM AWARD
1982 - Howard Ferreira
1983 - C. Dee Clingman

CITATION AWARD
1951 - Dr. J.H. Shrader and William B. Palmer (posthumously)
1952 - C. A. Abele
1953 - Clarence Weber
1954 - C. K. Johns
1955 - Dr. R. G. Ross
1956 - K. G. Weckel
1957 - Fred C. Baselt
1958 - Milton R. Fisher
1959 - John D. Faulkner
1960 - Dr. Luther A. Black
1961 - Harold S. Adams
1962 - Franklin W. Barber
1963 - Dr. Merle P. Baker
1964 - W. K. Moseley
1965 - H. L. Thomasson
1966 - Dr. J. C. Olson
1967 - William V. Hickey
1968 - A. Kelly Saunders
1969 - Karl K. Jones
1970 - Ivan E. Parkin
1971 - Dr. L. Wayne Brown
1972 - Ben Luce
1973 - Samuel O. Noles
1974 - John C. Schilling
1975 - Dr. A. R. Brazis
1976 - James Meany
1977 - None Given
1978 - Raymond A. Belknap
1979 - Harold E. Thompson, Jr.
1980 - Don Raffel
1981 - Henry V. Atherton
1982 - None Given
1983 - William B. Hasting

SANITARIANS AWARD
1952 - Paul Corash
1953 - Dr. E. F. Meyers
1954 - Kelley G. Vester
1955 - B. G. Tennent
1956 - John H. Fritz
1957 - Harold J. Barnum
1958 - None Given
1959 - William Kempa
1960 - James C. Barringer
1961 - Martin C. Donovan
1962 - Larry Gordon
1963 - R. L. Cooper
1964 - None Given
1965 - Harold R. Irvin
1966 - Paris B. Boles
1967 - Roger L. Stephens
1968 - Roy T. Olson
1969 - W. R. McLean
1970 - None Given
1971 - Shelby Johnson
1972 - Ambrose P. Bell
1973 - None Given
1974 - Clarence K. Luchterhand
1975 - Samuel C. Rich
1976 - M. W. Jefferson
1977 - Harold Bengsch
1978 - Orlowe Osten
1979 - Balus Walker, Jr.
1980 - John A. Baghott
1981 - Paul Pace
1982 - Edwin L. Ruppert
1983 - None Given

HONORARY LIFE MEMBERSHIP AWARD
1957 - Dr. J. H. Shrader
1958 - H. Clifford Goslee
1959 - Dr. William H. Price
1960 - None Given
1961 - Sarah Vance Dugan
1962 - None Given
1963 - C. K. Johns and Dr. Harold Macy
1964 - C. B. and A. L. Shogren
1965 - Fred Basselt and Ivan Parkin
1966 - Dr. M. R. Fisher
1967 - C. A. Abele and L. A. Black
1968 - Dr. M. P. Baker and Dr. W. C. Frazier
1969 - John Faulkner
1970 - Harold J. Barnum
1971 - William V. Hickey
1972 - C. W. Dromgold and E. Wallenfeldt
1973 - Fred E. Uetz
1974 - H. L. Thomasson and K. G. Weckel
1975 - A. E. Parker
1976 - A. Bender Luce
1977 - Harold Heiskell
1978 - Karl K. Jones
1979 - Joseph C. Olson, Jr.
1980 - Alvin E. Tesdal
1981 - Robert M. Parker
1982 - None Given
1983 - Orlowe Osten

SHOGREN AWARD
1972 - Iowa Affiliate
1973 - Kentucky Affiliate
1974 - Washington Affiliate
1975 - Illinois Affiliate
1976 - Wisconsin Affiliate
1977 - Minnesota Affiliate
1978 - None Given
1979 - New York Affiliate
1980 - Pennsylvania Affiliate
1981 - Missouri Affiliate
1982 - South Dakota Affiliate
1983 - Washington Affiliate

JFP Abstracts

Abstracts of papers in the January Journal of Food Protection.

To receive the* Journal of Food Protection *in its entirety each month call 515-232-6699, ext. A.

Determination of the Thermal Death Time of *Vibrio cholerae* in Blue Crabs (*Callinectes sapidus*), Lawrence M. Shultz, James E. Rutledge, Robert M. Grodner and Stanley L. Biede, Department of Food Science, Louisiana Agricultural Experiment Station, Louisiana State University Agricultural Center, Baton Rouge, Louisiana 70803

J. Food Prot. 47:4-6

The D-values of *Vibrio cholerae* were determined in peptone water and in crab meat homogenate. In peptone water, the D-values in minutes were 1.70 at 49°C, 1.04 at 54°C, 0.63 at 60°C and 0.36 at 63°C. In crab meat homogenate, the D-values in minutes were 8.15 at 49°C, 5.02 at 54°C, 2.65 at 60°C, 1.60 at 66°C and 0.30 at 71°C. Whole crabs injected with 10^6 *V. cholerae* were cooked by boiling or steaming. No *V. cholerae* was recovered from crabs cooked in boiling water (100°C) for 15 min or in steam (100, 115.6 or 121.1°C) for 10 min when *V. cholerae* was injected into the crab's dorsal swim fin muscle. The rate of heat penetration during cooking of crabs was also determined.

Incidence of Nitrite-Depleting Lactic Acid Bacteria in Cured Meats and in Meat Starter Cultures, Karen L. Dodds and David L. Collins-Thompson, Department of Environmental Biology, University of Guelph, Guelph, Ontario N1G 2W1, Canada

J. Food Prot. 47:7-10

Lactic acid bacteria were isolated from commercial packages of chicken loaf, bologna, Thuringer sausage and summer sausage. The bacteria were identified. The ability of these isolates to deplete nitrite was assessed during growth studies in broth cultures. The *Lactobacillus plantarum* components of four commercial meat starter cultures were also studied. All of the starter cultures and 68% of the isolates caused 59 to 93% depletion of 200 μg of nitrite per ml of APT broth over 24 h at 30°C. Two mechanisms of nitrite depletion were observed: chemical depletion due to acid production during growth, and enzymatic depletion. To assess enzymatic depletion of nitrite, the pH was maintained at 6.2. Six isolates were found to deplete nitrite up to 100% within 24 h at 22°C due to enzymatic activity. The starter cultures possessed weak enzyme activity, depleting nitrite by 10 to 28% over 24 h.

Effects of Ascorbic Acid on Display Life of Ground Beef, S. D. Shivas, D. H. Kropf, M. C. Hunt, C. L. Kastner, J. L. A. Kendall and A. D. Dayton, Departments of Animal Sciences and Industry and Statistics, Kansas State University, Manhattan, Kansas 66506

J. Food Prot. 47:11-15

Fresh ground beef containing 20 and 25% fat was either treated with 0.01, 0.05 or 0.10% crystalline ascorbic acid or remained as non-treated controls. Samples were displayed in polyvinyl chloride (PVC) film for up to 10 d (24 h/d) at 2 to 3°C under 1076 lux G. E. Natural light. Measures of display life included visual color scores, reflectance measurements, sensory panel scores, thiobarbituric acid (TBA) values and microbial standard plate counts (SPC). At days 1, 3 and 5 of display, average and worst point visual color scores were judged brighter for all ascorbic acid treatments compared to controls. Lower metmyoglobin percentages, higher %R630nm/%R580nm and higher CIE a^* readings at days 3, 5 and 10 for the ascorbic acid-treated product supported visual color results. Higher fat (25%) and higher ascorbic acid levels (0.05 and 0.10%) gave brighter visual color responses at 5 d of display than the 20% fat product and that containing 0.01% ascorbic acid. More intense sensory panel beef flavor was associated with the 0.05 and 0.10% ascorbic acid treatments. More off-flavor was found in the higher fat product (25%). TBA values were not different for fat level comparisons, but were lower for the 0.05 and 0.10% ascorbic acid treatments. At day 5 of display, SPC were not affected by ascorbic acid treatment. The 25% fat product had lower SPC at day 5.

Changes in Size of Casein Micelles Caused by Growth of Psychrotrophic Bacteria in Raw Skim Milk, Jonathan P. Burlingame-Frey and Elmer H. Marth, Department of Food Science and The Food Research Institute, University of Wisconsin-Madison, Madison, Wisconsin 53706

J. Food Prot. 47:16-19

Raw skim milk was inoculated (1%, v/v) with a proteolytic psychrotrophic bacterium that previously was isolated from milk. The inoculated skim milk was incubated at 7°C for 0, 3, 5 and 7 d. The pH values for the milk were 6.6, 6.5, 6.45 and 5.95, and the numbers of psychrotrophs/ml were 1.0×10^4 8.9×10^7, 9.0×10^8 and 2.5×10^8 for days 0, 3, 5 and 7, respectively. Samples of milk were negatively stained, examined with transmission electron microscopy and distribution of sizes of casein micelles was determined. The average and (mode) sizes of micelles were 849 (789), 1030 (634), 761 (634) and 405 (316) Angstroms for milks after days 0, 3, 5 and 7, respectively. Another set of samples was prepared from skim milk immediately after it was acidified to pH values of 6.6, 6.5, 6.45 and 5.95. The average and (mode) sizes of micelles were 891 (766), 875 (615), 913 (766) and 840 (615) Angstroms for milks having pH values of 6.6, 6.5, 6.45 and 5.95, respectively. Changes in size of micelles in the incubated samples resulted from bacterial activity other than small changes in pH.

Source and Persistence of *Salmonella muenster* in Naturally Contaminated Cheddar Cheese, D. S. Wood, D. L. Collins-Thompson, D. V. Irvine and A. N. Myhr, Departments of Environmental Biology and Food Science, Ontario Agricultural College, University of Guelph, Guelph, Ontario, Canada N1G 2W1

J. Food Prot. 47:20-22

Public health authorities in Oxford, Middlesex and Elgin Counties, Ontario, seized raw milk Cheddar cheese due to presence of *Salmonella muenster*. Investigations by these units and the University of Guelph traced the source of *Salmonella* to one particular milk supplier shipping to a cheese factory. Analysis of milk samples from a herd of 35 cattle revealed only one cow shedding *S. muenster* directly into the milk (ca. 200 CFU/ml). Eleven of 181 vats of cheese, produced at the factory between May and October 1982, were positive for *Salmonella* at the curd stage. Only 2 vats of the finished raw milk Cheddar, however, were positive. One lot of *Salmonella*-positive cheese was still positive after the legally required 60-d holding period and remained so for 125 d.

Effect of Different Packaging Treatments on Microbiological and Sensory Evaluation of Precooked Beef Roasts, M. C. McDaniel, J. A. Marchello and A. M. Tinsley, Department of Animal Sciences and Nutrition and Food Sciences, University of Arizona, Tucson, Arizona 85721

J. Food Prot. 47:23-26

Thirty boneless top round roasts were used in each of two trials to determine the effects of various packaging treatments on precooked roast beef acceptability. Roasts were dry roasted to an internal temperature of 60°C, cooled for 1 h and packaged by one of three methods: (a) vacuum packaging, (b) packaging in 100% CO_2 atmosphere or (c) packaging in 15% CO_2:30% O_2:55% N_2 atmosphere. Roasts were held at 4°C for up to 21 d. Enumeration of mesophiles and psychrotrophs, sensory evaluations and shrinkage percentages were determined at 0, 7, 14 and 21 d of storage to evaluate acceptability. Counts of mesophiles and psychrotrophs from 100% CO_2-treated roasts were significantly lower ($P<0.05$) than counts from vacuum-packaged roasts after 14 and 21 d of storage, whereas counts from gas mixture-treated roasts were not ($P>0.05$) different. After 7 d of storage, microbial numbers were similar, regardless of treatment. Sensory evaluation analyses showed that vacuum-packaged roasts exhibited little deterioration of quality characteristics at 21 d of storage, whereas both gas-treated roasts demonstrated quality deterioration by 14 and 21 d of storage. Vacuum-packaged roasts were preferred by panelists at 14 and 21 d, but CO_2-treated roasts were preferred at 7 d. No treatment effects were evident upon shrinkage until 21 storage days. At 21 d, vacuum-packaged roasts exhibited the lowest moisture loss.

Venezuelan White Cheese: Composition and Quality, Ivelio Arispe and Dennis Westhoff, Central University of Venezuela, Caracas, Venezuela and the University of Maryland, Food Science Program, College Park, Maryland 20742

J. Food Prot. 47:27-35

A survey was made at the retail level in the Venezuelan market to study the basic compositional and microbial characteristics of queso blanco, the most typical cheese in Venezuela. The commercial type labeled as pasteurizado blando "soft" was characterized by a high moisture content (50.6%), 2.5% sodium chloride, 21.4% fat and 19.2% protein, and a pH of 5.7. A second commercial type labeled as duro "hard" was characterized by lower moisture content (39%), 5.0% sodium chloride, 27.4% fat, 24.5% protein, and a pH of 5.3. Significant variation was found in these major compositional factors indicating a general lack of quality and/or extreme diversity of the manufacturing conditions used. Microbiological analysis revealed the presence of: (*a*) *Salmonella*, (*b*) extremely high numbers of total fecal coliforms and *Escherichia coli*, (*c*) high numbers of *Staphylococcus aureus* and enterotoxigenic *S. aureus*, and (*d*) other microorganisms including *Bacillus cereus, Clostridium perfringens, Lactobacillus* and yeast and molds. A statistical relationship between growth and numbers, and the presence of other indicators, pathogens, and compositional factors was investigated.

Complexation, Stability and Behavior of L-Cysteine and L-Lysine with Different Iron Sources, S. M. Flynn, F. M. Clydesdale and O. T. Zajicek, Department of Food Science and Nutrition, Massachusetts Agricultural Experiment Station, University of Massachusetts, Amherst, Massachusetts 01003 and Department of Chemistry, University of Massachusetts, Amherst, Massachusetts 01003

J. Food Prot. 47:36-40

Effective stability constants for cysteine and lysine with five different iron sources were evaluated along with their behavior in solution. The values obtained for ferric chloride-cysteine, ferrous sulfate-cysteine, ferric chloride-lysine, ferrous sulfate-lysine, hydrogen-reduced lysine, and electrolytic-reduced lysine were 6.81×10^{2} to 2.78×10^{3}, 1.33×10^{5} to 1.36×10^{5}, 6.00×10^{-4} to 7.64×10^{-3}, 6.37×10^{-4} to 4.82×10^{-3}, 9.34×10^{-2} to 1.38×10^{-1}, and 4.18×10^{-4} to 7.27×10^{-4}, respectively. No measurable complexation occurred with hydrogen- and electrolytic-reduced iron with cysteine nor with ferric orthophosphate and cysteine or lysine. The stability of soluble ferric cysteine over the pH range 2.0 to 7.4 indicates that this complex has the potential to be used as an iron additive in food. Approximately half of the hydrogen and electrolytic reduced iron and only 0.11% of ferric orthophosphate were soluble in acid, whereas ferric chloride and ferrous sulfate were completely soluble. Qualitative evaluation of the iron-amino acid systems over a range of pH from 2.0 to 12.0 indicated that there was a mixed valence state of free iron in most cases with low pH favoring reduction and high pH oxidation, until precipitation of iron hydroxides occurred.

Color Stability and Sensory Attributes of Chicken Frankfurters Made With Betalains and Potassium Sorbate Versus Sodium Nitrite, K. P. Vereltzis and E. M. Buck, Department of Food Science and Nutrition, University of Massachusetts, Amherst, Massachusetts 01003

J. Food Prot. 47:41-45

Chicken frankfurters made with 0.48% liquid beet juice concentrate containing betalains plus 0.20% potassium sorbate were compared to frankfurters made with sodium nitrite. The color of frankfurters made with natural pigments was more stable than nitrite-franks when exposed to light and oxygen over a 20-d storage period. Sensory panelists were unable to detect a difference between the flavor or texture of the experimental franks when tested under red light to mask color differences. There were no significant differences between Warner Bratzler shear values for franks from the two treatments.

Rapid Cultural Method to Detect *Salmonella* in Foods, Hellmut Rappold, Robert F. Bolderdijk and Jozef M. De Smedt, Laboratories of Leonard Monheim, Montezumulaan 1, B 2410 Herentals, Belgium

J. Food Prot. 47:46-48

The influence of reduced incubation time (8 h) on productivity of the Muller Kauffman tetrathionate and modified Rappaport broths incubated at 43°C was studied using naturally and artificially contaminated dry foods. Inoculation of selective enrichments from pre-enrichments and streaking on selective agar media were carried out on the same day, thus providing presumptive evidence of *Salmonella* one day earlier than with conventional cultural techniques. With modified Rappaport broth, the number of *Salmonella*-positive samples was the same after 8 and 24 h of selective enrichment. With Muller Kauffman tetrathionate, 3 false-negative results were obtained after 8 h of incubation. Salmonellae were detected at a level of less than 1 cell per 500 g of product (MPN).

Behavior and Viability of Third-Stage Larvae of *Terranova* sp. (Type HA) and *Anisakis simplex* (Type 1) Under Coolant Conditions, Thomas L. Deardorff, Richard B. Raybourne and Robert S. Desowitz, Department of Tropical Medicine and Medical Microbiology, University of Hawaii, John A. Burns School of Medicine, Leahi Hospital, Honolulu, Hawaii 96816

J. Food Prot. 47:49-52

This study reports effects of storage at cold temperatures on behavior and survival of third-stage larvae of *Terranova* sp. (type HA) and *Anisakis simplex* (type I) in marine fishes. Snappers, caught near the Hawaiian Islands, were examined to determine whether type HA and type I larvae could migrate from the viscera of ungutted fishes into edible musculature when maintained at 12, 8, and 0°C. Our data are suggestive that both type HA and type I larvae possess the ability to migrate. Temperatures of 12, 8, and 0°C had no noticable adverse affect on viability of both larval types within fish tissues; however, both larval types were extremely sensitive to temperatures below freezing. Death of both larval types encysted within Hawaiian snappers occurred by day 4 at -5°C and within 24 h at -10, -15, and -20°C. Other type I larvae, collected from fishes (*Sebastes* spp.) imported to Hawaii from the western Pacific, survived for slightly longer periods at -5, -10, -15, and -20°C when compared with type I larvae from Hawaiian fishes. Subjecting Hawaiian snappers to at least -20°C for 1 d and imported rockfishes to at least -20°C for 5 d is recommended to inactivate the living anisakines before ingesting any raw fish products.

Direct-Acid-Set Cottage Cheese Whey as a Base for a Shelf-Stable Athletic-Type Drink, K. L. Crippen and I. J. Jeon, Department of Animal Sciences and Industry, Kansas State University, Manhattan, Kansas 66506

J. Food Prot. 47:53-57

A shelf-stable athletic-type beverage was developed from direct-acid-set cottage cheese whey. First, the pH of the whey was adjusted to 5.2 with a saturated potassium hydroxide solution. The whey was heated with stirring to 90°C and held for 10 min to coagulate the protein, which then was removed by filtering or centrifuging. Calcium hydroxide was added to increase the pH to 5.6, and then potassium hydroxide was added to bring the pH up further to 6.5. The whey was filtered or centrifuged again to remove the cloudiness caused by addition of calcium hydroxide and additional protein precipitation. Beta-galactosidase was added and whey was held at 5°C for 18 h to hydrolyze the lactose. Then, one part water was mixed with two parts whey before saturated citric acid was added to make an acceptable orange-flavored beverage. The beverage then was heated to 88°C and stored in 8-fl. oz. bottles capped with Teflon-lined closures. The levels of electrolytes, such as sodium and potassium, in this product were similar to those in commercially available athletic-type drinks. In two separate trials, involving 28 persons each, the whey-based drink, when compared with a commercial product, was preferred 64% and 46% of the time, respectively. During storage some of the added sucrose was hydrolyzed into glucose and fructose; however, a taste panel did not detect a change in sweetness in the stored products. The heat process used (88°C for 5 min) appeared to be adequate for commercial sterility. The stability of the product during storage was good and estimated to be longer than 6 months. Ingredient cost of the whey-based athletic-type drink was $0.14 per 32 fl. oz.

Microbiological Quality of Frozen Breaded Onion Rings and Tuna Pot Pies, B. A. Wentz, A. P. Duran, A. Swartzentruber, A. H. Schwab and R. B. Read, Jr., Division of Microbiology, Food and Drug Administration, Washington, D.C. 20204 and Minneapolis Center for Microbiological Investigations Minneapolis, Minnesota 55401

J. Food Prot. 47:58-60

The microbiological quality of precooked or partially cooked frozen breaded onion rings and tuna pot pies was determined by a national sampling at the retail level. The number of units examined and the geometric means for aerobic plate counts at 30 and 35°C, respectively, were 1,590 units of onion rings, 340 and 250/g; tuna pot pies, 1,290 units, 2,400 and 1,600/g. Geometric means for coliform organisms, *Escherichia coli* and *Staphylococcus aureus* in onion rings were <3, <3 and <10/g, respectively; those for tuna pies were 5, <3 and <10/g.

Inhibitory Effect of *Lactobacillus bulgaricus* on Psychrotrophic Bacteria in Associative Cultures and in Refrigerated Foods, Nadia M. Abdel-Bar and Natholyn D. Harris, Department of Nutrition and Food Science, Florida State University, Tallahassee, Florida 32306

J. Food Prot. 47:61-64

The purposes of this study were two-fold: (*a*) to determine growth inhibition of *Pseudomonas fragi, Achromobacter liquefaciens* and *Staphylococcus aureus* due to *Lactobacillus bulgaricus* in associative cultures, and (*b*) to evaluate use of *L. bulgaricus* to control growth of natural flora in refrigerated tuna and potato salads and ground beef. The antagonistic effects of three concentrations of *L. bulgaricus* were studied after storage for 5 d at 6°C. Data were analyzed using a Student t Test. Pronounced inhibition was observed toward test organisms. Total growth inhibition of *P. fragi* and *A. liquefaciens* was attained due to the third level of *L. bulgaricus* (1.4×10^6 - 5.7×10^6 cells/ml). Natural flora in test foods were also greatly inhibited. Total growth inhibition of bacteria was attained in potato salad due to the third level of *L. bulgaricus* (3.9×10^6 cells/g). It was suggested that organic acids and hydrogen peroxide were partially responsible for the inhibition.

Comparison of Selective Plating Media for Enumeration of *Bacillus cereus* in Foods, S. M. Harmon, D. A. Kautter, and F. D. McClure, Division of Microbiology, Food and Drug Administration, Washington, D.C. 20204

J. Food Prot. 47:65-67

Enumeration of *Bacillus cereus* on raw sprouts of mung beans and wheat was compared in three agars: mannitol-egg yolk-polymyxin (MYP), polymyxin pyruvate-egg yolk-mannitol-bromthymol blue, and trypticase-soy-polymyxin blood. Ten different strains of *B. cereus* were used to seed the sprouts. Rates of recovery for the three media were not significantly different. However, with MYP agar, *B. cereus* could be differentiated more easily from other microorganisms and required fewer confirmatory tests.

Evaluation of Bacterial Diagnostics Kits and Systems at an Instructional Workshop, Daniel Y. C. Fung, Millicent C. Goldschmidt and Nelson A. Cox, Department of Animal Sciences and Industry, Kansas State University, Manhattan, Kansas 66506, Dental Branch, Dental Science Institute, University of Texas Health Center, Houston, Texas 77025 and U.S. Department of Agriculture, Agricultural Research Service, Richard B. Russell Agricultural Research Center, Athens, Georgia 30613

J. Food Prot. 47:68-73

Ten commercial bacterial diagnostic systems (AMS, API 20E, AUTOBAC IDX, CATHRA, ENTERIC-TEK, ENTEROTUBE II, MICRO-ID, MINITEK 4 h, MINITEK 24 h and SPECTRUM 10) were evaluated by use of 12 coded enteric bacteria (*Arizona hinshawii, Citrobacter freundii, Enterobacter cloacae, Hafnia alvei, Klebsiella pneumoniae, Morganella morganii, Proteus mirabilis, Proteus vulgaris, Salmonella typhimurium, Serratia marcescens, Shigella dysenteriae* and *Shigella flexneri*) in two separate workshops (July, 1981 and July, 1982) consisting of 40 participants. Results indicated that most commercial systems provided satisfactory diagnosis (89% to 100%) of these organisms compared to conventional methods. The uniqueness of this study lies in the fact that a group of microbiologists from a variety of geographic locations, training and backgrounds were able to use these systems accurately after only a single exposure to many of the techniques in a workshop environment.

Selecting a Miniaturized System for Identification of *Enterobacteriaceae,* N. A. Cox, D. Y. C. Fung, M. C. Goldschmidt, J. S. Bailey and J. E. Thomson, United States Department of Agriculture, Agricultural Research Service, Food Protection and Processing Research Unit, Richard B. Russell Agricultural Research Center, Athens, Georgia 30613; Kansas State University, Department of Animal Sciences and Industry, Manhattan, Kansas 66506; and Dental Branch, Dental Science Institute, The University of Texas Health Center at Houston, Texas 77025

J. Food Prot. 47:74-77

The most commonly used commercial diagnostic kits for identification of *Enterobacteriaceae* are API, Enteric-Tek, Enterotube II, Micro-ID, Minitek and Spectrum-10. The accuracy of identification by all systems does not vary significantly, and falls within the acceptable range. Therefore, a bacteriologist who is considering the use of these products should evaluate factors other than accuracy when making a choice. Twenty-three professional microbiologists who had previous experience with these systems listed advantages and disadvantages of each system, and evaluated the conventional procedure for identification. The comments were summarized and presented in tabular form. The current cost per isolate of each system and the cost of the identification manual, reagents and incidental costs were also determined. These data provide the potential user with comparative information on price, shelf-life, versatility, time required for inoculation, incubation and manipulation after incubation, possible difficulties in determining positive and negative reactions, and potential safety factors for laboratory personnel.

***Salmonella* Detection in Foods: Present Status and Research Needs for the Future,** Jean-Yves D'Aoust, Health Protection Branch, Health and Welfare Canada, Tunney's Pasture, Ottawa, Ontario, Canada K1A 0L2

J. Food Prot. 47:78-81

Standard cultural procedures generally require 4 to 5 d for presumptive evidence of *Salmonella* in foods. Attempts at greater method brevity have resulted in the use of selective enrichment cultures as test material for short immunological tests including fluorescent antibody (FA), enrichment serology (ES), enzyme-linked immunosorbent assay (ELISA), direct immunoenzyme (DI) and membrane filter-disc-immunoimmobilization (MFDI) assays. Nonimmunological tests such as the lysine-iron-cystine-neutral red (LICNR) broth and a ^{14}C-dulcitol radiometric technique have also been applied to enrichment broth cultures. Sensitivity of short (4 to 6 h) incubation of selective enrichment broths has yet to be established. The need for rapid, cost-efficient preenrichment-dependent analytical schemes is clear. Investigations on the modification of the *Limulus* amoebocyte lysate (LAL) test to detect *Salmonella* cell wall antigens in preenrichment cultures or application of the ELISA, the hydrophobic-grid-membrane (HGMF) techniques or other rapid diagnostic tests to preenrichment cultures are indicated.

Calendar

1984

Feb. 7 & 8, FOOD PROCESSORS SANITATION WORKSHOP. Presented through the cooperation of sanitation organizations, industry trade associations, and the University of California Cooperative Extension. Mission de Oro, Santa Nella, California. For more information contact Paulette De Jong, Food Science and Technology, University of California, Davis, CA 95616, 916-752-1478.

Feb. 15-16, DAIRY AND FOOD INDUSTRY CONFERENCE. The Ohio State University. For more information contact: John Lindamood, Dept. of Food Science and Nutrition, 2121 Fyffe Road, The Ohio State University, Columbus, OH 43210.

Feb. 21-22, KENTUCKY ASSOCIATION of Milk, Food & Environmental Sanitarians spring meeting, Executive Inn, Louisville. For more information contact Dale Marcum, Box 139, Frankfort, KY 40602. 502-564-3340.

Feb. 27-28, 10th ANNUAL TECHNICAL SEMINAR, ABC Research Corp. To be held at the Holiday Inn, University Center, Gainesville, FL. For more information contact: Sara Jo Atwell, Admin. Asst., ABC Research, PO Box 1557, Gainesville, FL 32602. 904-372-0436.

March 18-20, FOOD SANITATION INSTITUTE MID-YEAR EDUCATIONAL CONFERENCE & EXPOSITION, Holiday Inn, Downtown, Baltimore, Maryland. For more information contact: Jean M. Day, Exeuctive Director, Food Sanitation Institute, 1019 Highland Ave., Largo, FL 33540. 813-586-5710.

March 18-21, AMERICAN CULTURED DAIRY PRODUCTS INSTITUTE ANNUAL MEETING AND CONFERENCE, Kultures and Kurds Klinic, National Cultured Product Evaluations Sessions. Marriott Hotel, Quorum Center, Dallas, Texas. For more information contact: C. Bronson Lane, ACDPI, PO Box 7813, Orlando, FL 52854.

March 19-23, MID-WEST WORKSHOP IN FOOD SANITATION, The Ohio State University. For information contact: John Lindamood, Dept. of Food Science and Nutrition, 2121 Fyffe Road, The Ohio State University, Columbus, OH 43210.

March 22-24, DAIRYMEN'S INSTITUTE AND DAIRY FIELDMEN'S CONFERENCE. University of Missouri - Columbia. Contact: Dr. Barry Steevens, S-103 Animal Sciences Research Center, Columbia, MO 65211. 314-882-3459.

March 25-28, MEATEX (Meat Technology and Food Processing Exhibition). At the National Exhibition Centre in Birmingham, England. For more information contact: Tom Webb, British Trade Development Office, 212-593-2258.

March 27-28, WESTERN FOOD INDUSTRY CONFERENCE, University of California, Davis, CA 95616. For more information contact: John C. Bruhn or Shirley Rexroat, Dept. of Food Science & Technology, University of California, Davis, CA 95616. 916-752-2192.

March 27-30, MICROBIOLOGICAL QUALITY ASSURANCE IN INDUSTRY, at the University of Sussex, Falmer, Brighton, England. For more information contact: Beverly Humphrey, Scientific Symposia, Ltd., 33-35 Bowling Green Lane, London EC1R 0DA, England.

April 1-3, FOOD INDUSTRY CERTIFICATION/RECERTIFICATION PESTICIDE UPDATE WORKSHOP, Holiday Inn, Harvey, Illinois. For more information contact: Jean M. Day, Executive Director, Food Sanitation Institute, 1019 Highland Ave., Largo, FL 33540. 813-586-5710.

April 2-3, FOOD TECHNOLOGY CONFERENCE AND SUPPLIER'S EXHIBITION. Breckenridge Concourse Hotel, St. Louis International Airport. Co-sponsored by St. Louis IFT and University of Missouri - Columbia. Contact: Mr. Keith Haffer, The 7-Up Company, 8900 Page Boulevard, St. Louis, MO 63114.

April 2-4, STATISTICAL QUALITY CONTROL SHORT COURSE - Statistical Methods Applied to Productivity Improvement and Quality Control - for the Food Processing Industy: Statistical Methods and Techniques. University of California, Davis. Registration Fee: $180. For further information contact: Robert C. Pearl, Food Science & Technology Dept., University of California, Davis, CA 95616. 916-752-0980.

April 4-6, STATISTICAL QUALITY CONTROL SHORT COURSE - Statistical Methods Applied to Productivity Improvement and Quality Control - for the Food Processing Industry: Application of SQC to the Jobs of Quality. University of California, Davis. Registration Fee: $180. For further information contact: Robert C. Pearl, Food Science & Technology Dept., University of California, Davis, CA 95616. 916-752-0980.

April 9-11, BIOTECHNOLOGY OF MARINE POLYSACCHARIDES is the topic of the third annual MIT Sea Grant Lecture and Seminar at Massachusetts Institute of Technology, Cambridge, MA. For more information contact: Therese Z. Henderson, MIT Sea Grant Information Center, 77 Massachusetts Ave., Bldg. E38-302, Cambridge, MA 02139. 617-253-7041.

April 16-18, MIAMI INTERNATIONAL SYMPOSIUM ON THE BIOSPHERE. For more information contact: Ms. Grace Mayfield, Miami International Conference on the Biosphere, Clean Energy Research Institute, University of Miami, PO Box 248294, Coral Gables, FL 33124.

April 16-18, CONFERENCE OF THE MISSOURI MILK, FOOD AND ENVIRONMENTAL HEALTH ASSOCIATION. Ramada Inn, Columbia, MO. Contact: Dr. J. E. Edmondson, 201 Eckles Hall, Dept. of Food Science and Nutrition, Columbia, MO 65211. 314-882-2630.

April 24-25, FAMFES ANNUAL EDUCATIONAL CONFERENCE, Cypress Gardens Quality Inn, Cypress Gardens, FL. For more information contact: Franklin W. Barber, 1584 Cumberland Ct., Ft. Meyers, FL 33907.

April 25-27, WORKSHOP II IN FOOD FLAVOR: A HANDS ON COURSE IN FLAVOR APPLICATIONS. Write: G. Reineccius, Department of Food Science and Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, MN 55108.

April 25, SOUTHERN CALIFORNIA FOOD PROCESSORS SANITATION WORKSHOP FOR THE FOOD PROCESSING AND FOOD SERVICE INDUSTRIES. Presented by the University of California Cooperative Extension with assistance from industry trade associations and food industry personnel. Inn at the Park, Anaheim, California. For more information contact: Paulette De Jong, Food Science and Technology, University of California, Davis, CA 95616. 916-752-1478.

April 25-27, SOUTH DAKOTA ENVIRONMENTAL HEALTH ASSOC. ANNUAL MEETING. Staurolite Inn, South Dakota State University, Brookings, SD. For more information contact: Morris V. Forsting, Secretary-Treasurer, 1320 S. Minnesota Ave., Room 101, Sioux Falls, SD 57105.

May 6-11, FOOD SANITATION INSTITUTE EXECUTIVE LEADERSHIP INSTITUTE IN ENVIRONMENTAL SERVICES MANAGEMENT, University of Illinois, Champagne, IL. For more information contact: Jean M. Day, Executive Director, Food Sanitation Institute, 1019 Highland Ave., Largo, FL 33540. 813-586-5710.

May 7-11, INTERNATIONAL MILK PROTEIN CONGRESS. For more information contact: International Milk Protein Congress, Congress Secretariat, PO Box 399, 5201 AJ's-Hertogenbosch, The Netherlands.

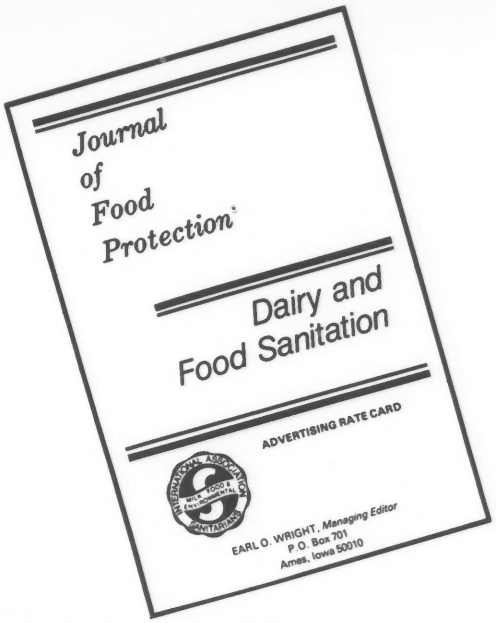
May 9-11, NATIONAL CONFERENCE FOR FOOD PROTECTION, Hyatt Regency Crystal City, Arlington, VA. For more information contact: Charles W. Felix, 1025 Connecticut Ave., NW, Suite 1015, Washington, DC 20036. 202-347-0020.

May 15-17, SANITATION - BACK TO BASICS II, Food Sanitation Institute Western Regional Educational Conference, Oakland Airport Hilton, Oakland, California. For more information contact: Jean M. Day, Executive Director, Food Sanitation Institute, 1019 Highland Ave., Largo, FL 33540. 813-586-5710.

May 27-30, THE CANADIAN INSTITUTE OF FOOD SCIENCE AND TECHNOLOGY'S 27TH ANNUAL CONFERENCE, Hyatt Regency Vancouver Hotel, 655 Burrard Street, Vancouver, B.C., 604-687-6543. For more information contact: Jerry Heddinger, Publicity Chairman, Qwest Food Ltd., 260 E. 5th Ave., Vancouver, B.C., V5T 1H3, 604-873-2647.

June 3-6, BBEX (British Baker International Baking Exhibition). At the Conference and Exhibition Centre, Harrogate, England. For more information contact: Tom Webb, British Trade Development Office, 212-593-2258.

Aug. 5-9, IAMFES ANNUAL MEETING, Edmonton Inn, Edmonton, Alberta, Canada. For more information contact: Peggy Marce, Alberta Association of Milk, Food & Environmental Sanitarians, PO Box 8446, Station F, Edmonton, Alberta, Canada T6H 5H3 or call IAMFES at 515-232-6699.



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