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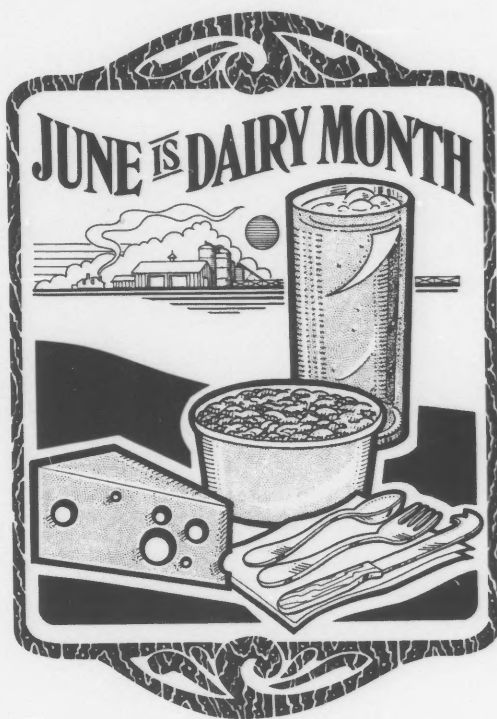
Dairy and Food Sanitation®

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

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The Beverage of
the Future?

Factors to be
Considered in
Establishing Good
Manufacturing Practices

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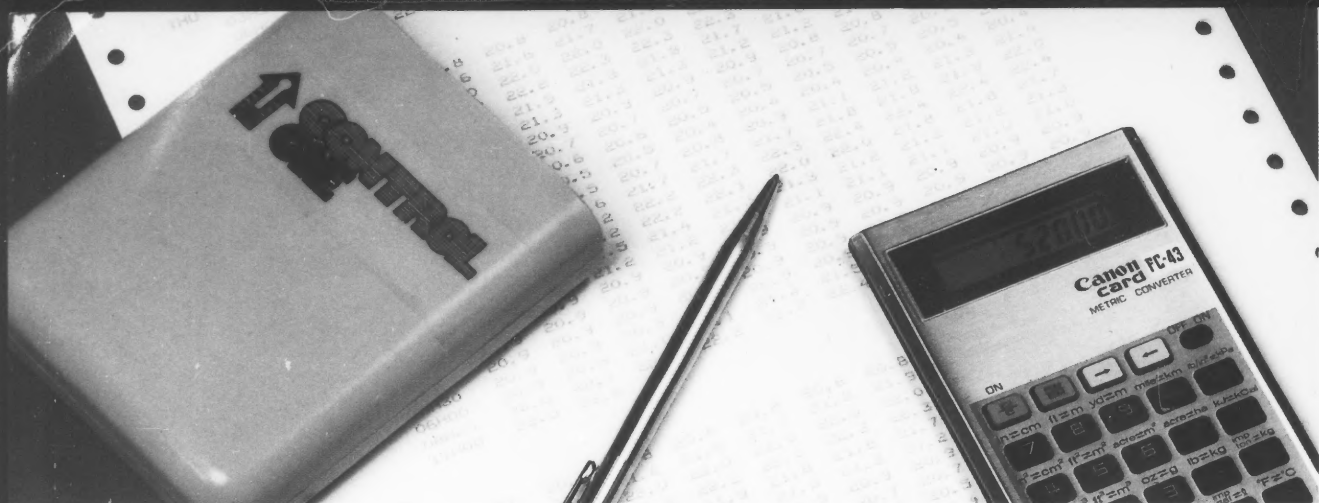


Rapid Methods
and Automation
in the Microbiological
Examination of Foods

Listeria and U.S.
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President's Message

The 75th annual meeting of our association is fast approaching.

Your Executive Board met in March with the Florida Local Arrangements Committee to finalize the '88 meeting. Excitement is running! Due to the tremendous increase in submitted papers, a fourth session has been added for Monday afternoon and a Cracker Barrel session for Tuesday evening.

The Cracker Barrel session on Tuesday evening will be conducted by our Texas affiliate. The affiliate has expended some \$75,000 (from industry and membership support) to develop training equipment to provide assistance to regulatory and industry in the area of critical controls and proper operation of pasteurization systems. The equipment will be on display at various times throughout the week. To my knowledge, this is the first formal program presentation from an affiliate. TAMFES is to be congratulated.

Continued growth within the association is being experienced. However, your Executive Board is committed to assure that growth is planned and positive. Most of all, we feel growth should be constructive to better meet the association goals of service to members.

To meet the expanded needs of the membership and services being offered, a Constitution and By-Laws study committee will be appointed.

Our Long Range Planning Committee, under the leadership of Dr. Mike Wehr, has submitted their initial report to the Board. As expected, the report, including many recommendations, is comprehensive. The Board will be meeting with the Long Range Planning Committee during the annual meeting.

As last year, a Committee Chairman Breakfast with the Executive Board will held. This will give Committee Chairman an opportunity to bring any proposals directly to the Board for their support. Additionally, a Summary of Committee Report will also be scheduled throughout the formal program sessions.

Also, a Past President's Dinner will again be held. Not only does the Board feel this is an opportunity to offer continuing thanks to those who have so diligently served the association over many years, but to draw on suggestions and ideas from a great group of guys.

Your President has recently represented IAMFES as a member of the Crumbine Award Jury in selecting the 1988 recipient of this prestigious award given by the Food Service and Packaging Institute.

I believe those of you attending the 1988 meeting (Our Diamond Jubilee) will not only find the program very informative and comprehensive, but also the Hyatt Regency one of the best overall facilities ever utilized.

Plan now to attend.

Sincerely,

Leon Townsend
President

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Dairy and Food Sanitation

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Factors to be Considered in Establishing Good Manufacturing Practices for the Production of Refrigerated Foods

Refrigerated Foods
and Microbiological Criteria Committee of the
National Food Processors Association^{1,2}

¹Committee members or alternates contributing to this paper: Lloyd Moberg, General Mills, Inc.; John Y. Humber, Kraft, Inc.; Richard V. Lechowich, General Foods Corporation; V.N. Scott, National Food Processors Association; Dane Bernard, National Food Processors Association; Daniel G. Brown, Geo. A. Hormel & Co.; Gene Clyde, Westreco, Inc.; Donald A. Corlett, Del Monte USA; Forrest Dryden, Geo. A. Hormel Co.; Lloyd R. Hontz, National Food Processors Association, J.E. Kennedy, Jr., American Home Foods; Karl Olson, National Food Processors Association; Robert Otto, Heinz, USA; Les Smoot, Ralston Purina; William Sperber, The Pillsbury Company; William Sveum, The Dial Corporation; George Tharrington, Beatrice/Hunt-Wesson; Don Zink, The Campbell Soup Company.

²Correspondence regarding this paper should be sent to V.N. Scott, The National Food Processors Association, 1401 New York Ave., NW, Suite 400, Washington, D.C. 20005.

Rationale

Temperature abuse of refrigerated foods during processing, storage, distribution, retailing, or in the hands of the consumer could allow the rapid and progressive growth of infectious or toxigenic microorganisms, or the slower growth of *Clostridium botulinum* (10). Moreover, proper refrigeration does not guarantee safety from pathogenic microorganisms; several species (including nonproteolytic types of *C. botulinum*, *Yersinia enterocolitica*, *Listeria monocytogenes*, and *Aeromonas hydrophila*) may grow at refrigeration temperatures as low as 38°F (3.3°C) (1, 4, 5, 7, 11, 12, 14, 17). Therefore, it is recommended that one or more safety factors - also called "barriers" - in addition to refrigeration, be incorporated into refrigerated foods to inhibit or minimize the multiplication of pathogenic microbes during refrigerated storage or as a result of temperature abuse of product (12).

Examples of barriers could include, but not be restricted to, 1) acid pH, 2) controlled moisture or water activity, 3) competitive flora, 4) preservatives, 5) thermal processing, and 6) partial help of modified atmospheres. Among the barriers listed, modified atmospheres offer the

least degree of protection and must be carefully evaluated. Sufficient scientific evidence (e.g., inoculation studies) supporting product safety using such barriers should be available to support their effectiveness. 21 CFR Part 110 - "Current Good Manufacturing Practices in Manufacturing, Packing, or Holding Human Food", 9 CFR Part 318 - Meat Inspection Regulations, and 9 CFR Part 381 - "Poultry Products Inspection Regulations" provide guidelines applicable to refrigerated foods. The following recommendations supplement these regulations but are specific for refrigerated products. However, in contrast to the above noted regulations, these guidelines recommend the use of 40°F (4°C), in place of 45°F (7.2°C), as the upper limit for refrigerated products. While 40°F (4°C) may, at the present time, be unrealistic for practical implementation, it represents the desired goal. Refrigerated products stored at <40°F (<4°C) may achieve significant shelf-life extensions due to the maintenance of quality and organoleptic characteristics, as well as providing greater microbiological safety (8). Although some pathogens can grow below 40°F, their rate of growth in this range is quite reduced; the risk they present, even with the anticipated shelf-life extensions, is low (4, 10). Coupling low temperature refrigeration (<40°F) with an additional, effective barrier further reduces the risk. Thus, 40°F or less is a goal for which to strive, and as such is recommended in these guidelines.

Definitions

For the purposes of this document, the following definitions are used:

Refrigerated Foods: Any finished food that is not shelf stable, may or may not be hermetically packaged, and must be maintained under proper refrigeration conditions at all times to retard the growth of spoilage or pathogenic microorganisms and to prevent the production of microbial toxins.

While many of the recommendations discussed in this document will apply, these guidelines do not specifically address traditional dairy products, cured meat and poultry products, fresh meats, poultry and seafoods, and raw, uncut

agricultural commodities.

Barrier: A safety factor of a physical, biological, or chemical nature which retards or prevents the growth of microorganisms including those which may be infectious or toxigenic.

General Provisions

The inhibition of multiplication by psychrotrophic spoilage or pathogenic microorganisms in refrigerated foods will require the incorporation of one or more additional barriers into the product. Refrigeration alone is insufficient to guarantee microbiological safety of refrigerated foods, since it is likely that at some point during distribution, display or consumer handling, proper refrigeration will not be maintained (3, 16).

The Hazard Analysis Critical Control Point (HACCP) program should be used to assure the quality and safety of refrigerated foods (9, 15). Application of the HACCP principles should be made for each specific food product. Through the use of HACCP, the potential for microbial hazards in manufacturing and distribution - and their associated risks - are evaluated (2, 13). Critical Control Points are identified and the necessary monitoring programs are established to ensure food safety.

These HACCP principles involve:

1. Describing the product and its intended use;
2. Preparing flow diagrams for the manufacturing and distribution sequence;
3. Conducting risk analysis for product and ingredients; and
4. Entering on the flow diagram, the Critical Control Points and the associated monitoring activity.

In addition to use of the HACCP program, Good Manufacturing Practice (GMP) plant sanitation guidelines should be provided and strictly adhered to for each manufacturing facility.

Ingredients

1. Food ingredients should be evaluated as part of the HACCP program to assess the microbiological risk, and to determine hazard characteristics (2, 13). Ingredients may be of significant risk if:

Hazard A: They contain potentially harmful microorganisms (i.e., "sensitive" ingredients);

Hazard B: The manufacturing process does not contain a controlled processing step that effectively destroys harmful microorganisms; and/or

Hazard C: There is substantial potential for microbiological abuse (i.e., temperature abuse) in distribution or in consumer handling that could render the product harmful when consumed.

The National Academy of Sciences/National Research Council (9) developed criteria for acceptance of food based on the above hazard characteristics. While their program was centered on *Salmonella*, it can be expanded to cover

other foodborne pathogens. Based on the above hazard characteristics, foods are placed in one of five categories:

Category I: foods intended for use by infants, the aged, and the infirm;

Category II: foods with all three hazards (i.e., A, B and C);

Category III: foods with two hazards (i.e., A + B or A + C or B + C);

Category IV: foods with one hazard (i.e., A or B or C);

Category V: foods with none of the hazards.

The more of these hazards that a food contains, the greater the risk. Thus, the proposed sampling plan for those foods in the categories of higher consumer risk is more stringent, sampling greater volumes. The proposed criteria for the acceptance of food lots are published (9). Briefly, Category I foods would require testing of sixty 25 g samples, Category II foods would require testing of twenty-nine 25 g samples, and Categories III, IV and V foods would be tested at thirteen 25 g samples. Negative findings in each category would indicate a 95% probability of ≤ 1 tested pathogenic microorganism per 500 g, 250 g, or 125 g of food, respectively.

2. Ingredients could be particularly hazardous if they were used in a nonsterile product designed and intended for consumption by infants, the aged or the infirmed; or if they had one or more of the general hazard characteristics mentioned in Item #1 (9).

3. Microbiological specifications for ingredients should be used whenever necessary to minimize the potential risk from hazardous microorganisms. Testing by food processors or ingredient suppliers should be done on a regular basis to verify conformance to specifications.

4. Refrigeration ($<40^{\circ}\text{F}$; $<4^{\circ}\text{C}$) or frozen storage ($<32^{\circ}\text{F}$; $<0^{\circ}\text{C}$) must be used to help maintain the microbiological integrity of potentially hazardous non-shelf stable or perishable ingredients. One or more monitoring systems should be used to verify adequate temperature control of these ingredients during their storage.

5. Refrigerated storage time-temperature limits should be placed on all potentially hazardous and perishable ingredients. Reuse of ingredients, and rework of product should be monitored and appropriate criteria established to help minimize microbiological safety problems from refrigerated foods.

Product Development

1. In addition to ingredient evaluation of HACCP principles, evaluation to assure control of critical points in processing should occur as early as possible in product development (2, 13). CCP evaluation should include, but not be limited to, raw material and ingredient handling, time/temperature adequacy, sanitation requirements, prevention of cross contamination, and food handling and employee hygiene. The evaluation should identify the proper controls, procedures, and monitoring systems to be used at each critical control point.

2. During the product development phase for refrigerated products, pathogen inoculation studies should be conducted to evaluate product safety and to verify the efficacy of the applied process. Incubation of inoculated samples should be done at the appropriate abuse temperatures (e.g., within a range of 50°F to 85°F; 10-30°C). Consideration of the worst case scenario should be used in choosing the abuse temperature. This testing is essential to demonstrate the effectiveness of the barriers to prevent pathogen multiplication, thus maintaining product safety.
3. A process authority, knowledgeable in the heating, cooling and refrigeration procedures, should be consulted to establish the adequacy of the process.

Processing

1. A HACCP analysis of the plant processing system should be used to evaluate CCP's (2, 13). Such analysis, using flow diagrams, should identify critical points in processing where an uncontrolled process could allow a microbiological hazard to exist or develop. Proper controls and monitoring systems should be specified for each CCP. Analysis should include, but not be limited to, ingredient storage and handling, time/temperature adequacy, fabrication, packaging integrity, and finished product storage and distribution.
2. Thermal processing equipment must be adequate to enable the proper and thorough heating/cooling of food, when such processes are necessary.
3. When perishable foods or ingredients which can support pathogen growth must be heated and held during processing, they must be maintained at 140°F (60°C) or above during the holding period (6).
4. Cross contamination of processed product from in-process or raw product must be minimized through proper sanitation of all product contact surfaces including portable equipment (i.e. pans, trays, etc.) and proper handling practices by individuals (6). Raw ingredients must be maintained and handled separately from in-process or finished product at all times.
5. Refrigeration systems should maintain in-process refrigerated foods at 40°F (4°C) or below as appropriate for the food.
6. Cooling systems should reduce the internal temperature of hot foods, including hot-filled items, from 140°F (60°C) to less than 45°F (7.2°C) within 4 hours. Refrigerated foods should be chilled to 45°F (7.2°C) or less prior to casing and brought to 40°F (4°C) or less within 24 hours after casing.
7. Portable equipment (i.e., pans, trays, troughs) used in the processing of refrigerated foods must be such that the specified heating, cooling and refrigeration requirements can be attained and maintained (6).
8. Systems should be in place to verify the continued use and effectiveness of barriers and other critical control points. Records must be kept and immediately audited; corrective action must be taken when necessary.
9. Monitoring devices, properly calibrated, (e.g., thermometers, temperature recorders) and/or monitoring systems

(e.g., microbiological) to verify the continued adequacy of the process should be used. Records shall be kept and audited. Corrective action should be taken when necessary.

10. An incubation program should be established using prescribed temperatures to monitor the microbiological shelf life of the food product.

11. Good manufacturing practices in the area of plant sanitation are critical. Plant sanitation guidelines should be provided and strictly adhered to for each manufacturing facility.

Packaging

1. HACCP analysis should be done to identify potential CCP's associated with packaging.
2. Specifications (structural, chemical and microbiological) of packaging materials and the final package itself should be defined and monitored.
3. Package integrity should be adequate to exclude contamination by microorganisms during storage, distribution and sale.
4. Tamper evident packaging should be used where possible.
5. Each package should be prominently labeled "Keep Refrigerated" or "Keep Under Refrigeration".
6. Date coding to specify product shelf-life should be used on each package.

Storage and Distribution

1. Storage temperature of finished refrigerated foods should be uniformly maintained at 40°F or lower. Distribution practices from the processor to the retailer should enable maintenance of product temperature at 40°F (4°C) or lower.
2. Time/temperature recorders should be used to indicate the temperature history of the food during storage and distribution.

Records

Records are an integral part of a good manufacturing program for refrigerated foods. While record keeping is recommended for some areas and required for others, its importance for assuring the production of safe food products cannot be overstated. This section summarizes the record keeping noted throughout this document.

1. Ingredients
 - Supplier certificates documenting compliance with processor's specifications
 - Processor audit records verifying supplier compliance
 - Storage temperature records of temperature sensitive ingredients.
 - Storage time records of limited shelf-life ingredients
2. Product Development
 - Sufficient data and records to establish the efficacy of barriers in maintaining product safety
 - Sufficient data and records establishing the shelf life of the product
 - Documentation of the adequacy of the processing pro-

cedures from a knowledgeable process authority

3. Processing
 - Records from all monitored Critical Control Points
 - System records verifying the continued effectiveness of the barrier
 - Records verifying the continued adequacy of the process
4. Packaging
 - Records indicating compliance with specifications of packaging materials
5. Storage and Distribution
 - Temperature records indicating proper storage

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N.M.C.

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Use These Treatment Procedures

Teat canal keratin acts as a primary defense against mastitis by forming a physical barrier against bacteria. The teat sphincter muscle functions by maintaining tight closure of the canal and limiting bacteria to the teat orifice. Manipulation of these tissues, such as manual insertion, may jeopardize the antibacterial properties of the teat canal.

When teat ends are disinfected prior to intramammary infusion many bacteria are killed, but some lodged in the microscopic crevices around the orifice survive. When a treatment syringe cannula is fully inserted through the orifice, surviving bacteria may be carried into the teat cistern where a few resistant ones can multiply.

Teat-and disinfection has no effect on bacteria that colonize teat canal keratin. Full insertion of the treatment syringe cannula may push bits of keratin with colonized bacteria into the teat cistern, where again, a few resistant ones could multiply and infect milk-producing tissues. In addition, the syringe cannula may be up to eight times the diameter of the teat canal, causing temporary dilation of the sphincter muscle and providing an open passageway for bacteria.

Studies have shown that partial insertion of the treatment syringe cannula only 1/8 inch into the teat canal avoids damage to teat and tissue and reduces new infections by 50 percent.

It is recommended that the following procedure be used when administering intramammary infusion products:

1. Completely milk out the udder.
2. Vigorously scrub teat orifices with alcohol pledgets, starting with teats furthest from the milker.
3. Insert the syringe cannula no more than 1/8 inch (3 millimeters) into the teat canal, starting with the teats closest to you.
4. Slowly infuse antibiotic preparation into the quarter.
5. Dip teats in an approved postmilking teat antiseptic.

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Rapid Methods and Automation in the Microbiological Examination of Foods

by

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The Applied Laboratory Methods Committee of the International Association of Milk, Food and Environmental Sanitarians, Inc. suggested the author to prepare this paper as a part of the committee's activities. (Chair of the committee: Lawrence A. Roth)

In the past 15 years, much interest has developed in the field of rapid methods and automation in microbiology on an international scale. A series of international symposia were held in the following places and years: Stockholm, (1973), Cambridge, UK, (1976), Washington, D.C. (1981), Berlin, (1984) and Florence, Italy (1987). Proceeding of four of these symposia were published by the following authors: Heden and Illeni (30, 31), Johnson and Newsom (33), Tilton (48), and Habermehl (29). An excellent review of rapid methods for foodborne microorganisms and their toxins was prepared by Pierson and Stern (44).

An international workshop focusing on practical application of rapid methods was initiated by the senior author as Kansas State University in 1981. In July 1987, the seventh workshop was held in Manhattan, Kansas. The theme of these symposia and workshops was the detection, isolation, identification, and characterization of microorganisms in clinical, food, environmental, and industrial specimens.

The approaches can be summarized as follows:

1. Miniaturization of Conventional Procedures and Development of Diagnostic Kits.

The senior author developed a series of methods to reduce the volume of reagents and media (from 5-10 ml to

ca. 0.2 ml) for bacteriological testing in microtiter plates. The basic components of the miniaturized system are a microtiter plate for test cultures, a multiple inoculation device, and containers to house solids media (large petri dish) and liquid media (another series of microtiter wells). The general procedure involves placing liquid cultures to be studied into sterile wells of a microtiter plate to form a "master plate". Each microtiter plate can hold up to 96 different cultures or 48 duplicate cultures or less. The cultures are then transferred by a sterile multipoint inoculator to solid or liquid media. Each transfer represents 96 separate inoculations in the conventional method. After incubation at appropriate temperature the growth of cultures in solid and liquid media are then recorded and data analyzed. Considerable savings of time, effort, materials, labor and space occur using these miniaturized procedures. The miniaturized concept was utilized for the characterization of thousands of bacterial isolates from meats (17, 21, 22, 35, 36) and for the study of food yeasts (38, 39, 40) and conceivably can be extended to the field of mycology as well. Miniaturized methods can also be used to study the affect of various dyes on bacterial growth (23, 24) and the production of catalase (25).

Another area of development in miniaturization was in viable cell count procedures. Fung and colleagues (14, 18, 19, 20) utilized miniaturized concepts to develop viable cell procedures and most probable number (MPN) tests. This involved using microtiter loops (0.025 ml) to dilute liquid samples in microtiter wells and then aseptically transfer small volumes (0.025 ml) of diluted samples onto agar surfaces to form spots. The agar plates were then incubated and colonies counted after growth. One regular petri dish can house four spots of growth. Another concept was to dilute sample of liquid food in a three-well series in nutrient broth in the microtiter plate to form a miniaturized 3-tube MPN. These tests were developed for efficient operation of the viable cell count and the standard MPN count.

On the commercial side, many diagnostic kits to identify microorganisms have been developed and marketed. Currently, API, Enterotube, R/B, Minitek, Spectrum 10, MicroID, and IDS are available. Detailed descriptions of

these tests are given by Cox et al. (5, 6) and Fung and Cox (13). The conclusion is that these diagnostic kits provide ca. 90 to 99% accuracy compared with conventional methods. Their usefulness in clinical and food microbiological laboratories will continue to be important. A detailed study on comparative analysis of diagnostic kits and selection criteria for miniaturized systems was made by Fung et al. (15) and Cox et al. (4). The general conclusions are that these miniaturized systems are accurate, efficient, labor saving, space saving, and cheaper than the conventional procedure for diagnostic microbiology in clinical, industrial, environmental and food samples.

2. Modifications of Viable Cell Count Procedures.

The viable cell count is still the standard for counting live microorganisms in our food supply. The method is time consuming in both terms of operation and collection of data. Several methods have been explored to improve the efficiency of operation. The Spiral Plating method was developed to spread a liquid sample on the surface of agar. The principle is to deposit a thin film of liquid sample in a spiral fashion at a decreasing rate on a rotating plate. The system is being used in the U.S.A. for a variety of foods (46). One of the disadvantages of this system is the clogging of the dispensing tube during the operation by meat or other solid particles. Konuma and Kurata (34) modified the stomacher bag by placing a filter in the bag to prevent solid particles from coming into the spiral plating system. The system saves considerable amounts of time in operation and uses much less laboratory materials since no dilution bottles are involved and only one agar plate is required for each sample instead of many in the conventional method. The method is accurate for food such as milk, meat and other liquified samples and is listed as an alternate method for the examination of foods in the *Standard methods for the Examination of Dairy Products* (1).

The Isogrid method allows the sample to be filtered through a hydrophobic grid for ease in counting colonies after growth of the organisms. Food samples such as meat are weighed, blended, and enzyme-treated before passage through a membrane filter containing hydrophobic grids. The filter is then placed on agar containing suitable nutrients for growth of the bacteria, yeast, or mold. The hydrophobic grids prevent colonies from growing further than the square grid; thus, all colonies have a square shape rather than the familiar round shape on ordinary agar plates. This facilitates counting of the colonies both manually and electronically. It has 1,600 chambers and utilizes the MPN concept in estimating viable cell counts of foods. This system has been successfully used for viable cell count in a variety of food products (9, 10). Lin, et al. (40) developed in a trypan blue agar for use in conjunction with the Isogrid system.

Petrifilm SM System and Redigel are two new modifications of the standard plate agar method. The Petrifilm SM system uses a dry rehydratable film with nutrients

imbedded in it. Liquid samples are added directly to the dry medium. The plates are then incubated at the desired temperature and time before counting. This method has been successfully used to make aerobic plate counts in milk and freshly ground beef (27, 47). The Redigel System consists of a tube containing sterile nutrient in liquid form. A sample (e.g., 1 ml of slurry of food) is placed on this medium. After mixing, the sample is poured into a special petri dish previously coated with a gelating material. When the liquid comes in contact with the gelating material, it forms a complex that swells to resemble the conventional agar. After appropriate incubation time and temperatures, colonies can be counted. Both systems are prepackaged and no sterilization step is needed. These systems are ideal for on-site testing. Data from the author's laboratory (16) indicated a 0.99 correlation coefficient comparing Petrifilm SM with the conventional viable cell count method for seafood analysis of mesophiles. A method called DEFT (Direct Epifluorescent Filter Technique) was developed to directly count the microbial cells in a sample. Cells are first concentrated on a filter and stained with acridine orange and then enumerated under ultraviolet microscopy. Pettipher and colleagues studied this technique extensively and concluded that the method was comparable to the viable cell method for milk samples (42, 43).

3. Development of Alternative Approaches for the estimation of Microbial Populations.

This section describes some new approaches and instruments for the indirect estimation of microbial populations. All these methods need the development of standard curves correlating some parameters (e.g. ATP level, detection time of electrical impedance or conductance, generation of heat, radioactive CO_2 , etc.) with viable cell counts of a series of samples. In general, the more viable cells in the sample, the shorter the detection time. A scattergram is then plotted and used for further comparison of unknown samples. Theoretically these methods can detect as low as one viable cell if the incubation period is long enough (days or weeks). On the practical side, usually the lower limit is 10^4 /ml. When a sample has 10^{6-7} organisms/ml the detection time can usually be achieved in about 4-6 hours.

All living things produce ATP. In the presence of a firefly enzyme system (luciferia luciferase) and ATP, light will be produced: This is the basis of the bioluminescence method. Littel et al. (37) indicated that the ATP procedure was able to predict bacterial levels within 0.5 \log_{10} of the actual count for beef and chicken samples. Minimum sensitivity is 5×10^4 colony forming units/g of meat sample. In the evaluation of fish samples Ward et al., (50) also found a positive correlation between ATP and the conventional method.

Electrical impedance measurements rely on the fact that as the bacteria grow they change the electrical impedance of the liquid around them. By measuring the changes in

electrical impedance, the number of bacteria present in the liquid can be estimated. The impedance or conductance methods have been used to estimate numbers of bacteria in milk and meats (8) and fish (26). When low levels of radioactivity are introduced into the carbon atom of glucose or other sugars, a radiometric method based on the fact that many bacteria generate carbon dioxide during metabolism of carbohydrates can be used. As the bacteria grow in the medium, they metabolize and release radioactive CO₂ into the head space of the container. An instrument (Bactec) is then used to measure the radioactivity of the head space gas. The amount of radioactivity detected is proportional to the number of bacteria present in the food sample. This method has been used to detect bacteria in meat products, as well as food pathogens (37, 45).

Microcalorimetry depends on heat generated by bacterial growth in foods. Instruments have been designed to detect small temperature changes in food systems. The assumption is that a large population of bacteria will generate more heat in the growth medium than a smaller number of bacteria. Studies on microcalorimetric measurements of ground meat by Gram and Sogaard (28) indicated that an instrument called the bioactivity monitor was a promising analytical tool for estimation of bacteria levels in the range of 10⁵ to 10⁸ colony forming units/g in less than 24 hours.

The Limulus Amoebocyte Lysate Method is a sensitive method for measuring endotoxin or lipopolysaccharides of gram negative cell walls and has been used to estimate the quality of ground beef by Jay (32). The principle involves a reaction of the endotoxin material with a lysate of the amoebocytes of *Limulus*. A gel is formed in one hour in the presence of endotoxins. Recently, an instrument called the Catalasometer has been introduced to detect catalase in foods. The principle is based on the flotation time of a paper disc containing catalase in a tube containing H₂O₂. A biochemical reaction between catalase and H₂O₂ generates molecular oxygen, which causes the paper disc to float. In the presence of a high level of catalase (indicating a high level of catalase positive microorganisms), the flotation time will be shorter (measured in seconds). Conversely, the flotation time will be long (100s or 1000s) in the presence of a low catalase concentration. Since most commercial foods are cold stored under aerobic conditions, the spoilage organisms are mainly catalase positive psychrotrophs. Wang and Fung (49), in a study with refrigerated chicken concluded that good correlation exists between flotation time and the surface bacterial count. A major problem of this system is the interference of non-bacterial catalase. In the above mentioned study the non-bacterial catalase was minimized by acidifying the sample prior to analysis. Although more research and development are needed for the catalasometer to be successful, the speed of the test warrants continued investigation.

4. Identification of Microbes by Sophisticated Instruments and Procedures.

The Auto Microbic System (AMS) is an automated instrument for the identification of enterics, yeast, *Bacillus*, and other organisms. The instrument was first developed for clinical specimens. Recently, Bailey et al (2) were successful in utilizing the AMS to identify *Enterobacteriaceae* from foods. The system depends on growth of target organisms in specially-designed media housed in small plastic cards. The cards are then inserted into the incubation chamber which allows as many as 240 isolates to be simultaneously analyzed. Each hour the instrument scans the wells of the cards and sends information to the computer which then matches the data base and identifies the unknown isolates in the cards. Following sample preparation the system is almost entirely automated and computerized and provides hard printed copies for recordkeeping.

Concepts and applications of several miniaturized kits, immunoassays and DNA hybridization for recognition and identification of food-borne bacteria are the subject of a companion paper to this present article written by Cox et al. (3). DNA Probe (Gene-Trak) is a new and sensitive method to detect *Salmonella*. Recent data by Fitts (11) and Flowers (12) stated that the method was as sensitive or more sensitive than the conventional method for *Salmonella* detection and required less time. The enzyme immunoassay screening procedure (EIA) method, recently commercialized by Organon Teknika, utilizes two monoclonal antibodies specific for *Salmonella* detection. In a comparative study involving 1,289 samples, Eckner et al., (7) found that there was no significant difference between the conventional method and EIA method on all foods with the exception of cake mix and raw shrimp. The EIA was significantly better for detecting *Salmonella* in cake mix, whereas the culture method was more productive for shrimp. A new system motility agar was recently introduced. The One-Two Test (BioControl) allows *Salmonella* to grow and then encourages only *Salmonella* to move through a motility agar column. At the end of the column, antibodies against *Salmonella* are diffused downwards and will form a fairly stable, visible band when *Salmonella* is present in the agar.

There are other ideas and systems using protein profiles for microbial fingerprinting (AMBIS System) or cell composition (fatty acid analysis) as a way to identify bacteria (Hewlett-Packard System). All the above methods are designed to replace the conventional procedures. In developing these methods, conventional techniques were used for direct comparison which can present a problem when the newer methods are more sensitive than the conventional procedures.

The field of rapid methods and automation in microbiology is in an exciting phase. It will continue to flourish since applied microbiologists will no doubt continue to seek more sensitive, efficient, and inexpensive methods to detect, enumerate, and identify microbes to ensure the health of consumers and safety of the food supply.

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Listeria and U.S. Dairy Products: The Issues in Perspective

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Intense microbiological surveillance of U.S. dairy products has occurred during the past two years under directives issued from the Food and Drug Administration's (FDA) Dairy Safety Initiatives Program (1). Results of this surveillance have revealed the presence of the bacterial pathogen *Listeria monocytogenes* in products such as ice cream, ice cream novelties and specialty cheeses. These findings have elevated consumer fear regarding potential health risks associated with the consumption of dairy products. Although additional surveillance efforts and product recalls continue to occur, in only one instance have the products involved in recalls actually been linked to the onset of illness in humans; this having occurred during the Jalisco cheese incident (2). In fact, the number of confirmed outbreaks of listeriosis linked to the consumption of dairy products remains at two (2,3). Much speculation and misinformation has accompanied the publicity surrounding these incidents. This article will review and correct the misinformation which has not only been disseminated to the public, but also that which appears in the scientific literature. This article will specifically focus on information concerning the purported heat resistance of this organism, and attempt to put the issue of *Listeria* contamination of dairy products into perspective.

L. monocytogenes is a gram positive, nonspore-forming, psychrotrophic, rod-shaped bacterium which is very widely distributed within the environment. There is no doubt that this organism has been present in our environment, and in our food supply, for some time. Reports of organisms resembling *Listeria* appear in the scientific

literature beginning as early as 1896, but not until 1926 was a complete description of the organisms we now recognize as *L. monocytogenes* published (4). *L. monocytogenes* can cause illness in a variety of animals, including humans. Symptoms associated with listeriosis may range from milk flu-like symptoms to more severe symptoms which include meningitis, and stillbirth or spontaneous abortion of fetuses. A high mortality rate, approaching 20-25%, is associated with this illness. Susceptibility to acquiring listeriosis varies within the human population, but the overall risk is quite low. Rate of infection is estimated to be 7 cases per 1,000,000 persons and only individuals in certain high risk groups are likely to acquire listeriosis (2). High risk individuals include immunocompromised hosts such as patients undergoing chemotherapy for cancer treatment, individuals receiving corticosteroids to prevent organ transplant rejection, and pregnant females. Normal healthy humans who possess no underlying illnesses appear to be relatively resistant to acquiring listeric infection.

The role of *L. monocytogenes* is a foodborne pathogen is newly recognized. Sporadic outbreaks of listeric infection due to food consumption have been reported to the scientific literature. Potel (4) described a major outbreak of listeriosis which occurred in Halle and Bremen, Germany, and was linked to raw milk consumption. The first well documented outbreak of listeriosis due to consumption of processed food was reported by Schlech, et al. (5). Commercially prepared cole slaw was incriminated as the infective vehicle in this outbreak.

Between January and June of 1985, a major outbreak of human listeriosis was conclusively linked with the consumption of Mexican-style cheese. Most of the individuals involved in this outbreak were pregnant Hispanic women. The epidemic serotype of *L. monocytogenes* was isolated from numerous samples of queso fresco and cotija cheese produced by Jalisco Products, Inc. (2). Investigations of the processing plant which produced the incrimi-

nated cheese revealed unsanitary conditions, suggesting a possible role for post-pasteurization contamination in this incident. Additional evidence has indicated that not all of the milk used to make the cheese had been pasteurized.

A second outbreak of listeriosis, which occurred during July and August, 1983, was epidemiologically linked to the consumption of whole or 2% pasteurized milk by 49 individuals in the Boston, Massachusetts area (3). It is this latter outbreak which has been the subject of much controversy within the dairy industry. First, unlike the Jalisco investigation, at no time during investigation of the New England listeriosis outbreak was the epidemic serotype of *Listeria* isolated from either pasteurized milk or from the raw milk which supplied the milk processing plant. Secondly, it was hypothesized during investigation of this outbreak that *Listeria* may have actually survived the pasteurization process because of its location within bovine leukocytes. In this state, it was hypothesized, *Listeria* may have been heat shielded and thus able to survive the pasteurization process. It should be noted that the processing conditions employed at the dairy involved in the outbreak were 170°F (76.7°C) for 19.5 sec, clearly above the legal minimum HTST pasteurization requirements. Publication of the results of this investigation in the prestigious New England Journal of Medicine not only raised public concern over the efficacy of current pasteurization requirements, but created a crisis for the dairy industry and federal regulatory officials responsible for protection of public health.

Conflicting results have appeared historically in the scientific literature concerning the heat resistance of *L. monocytogenes*. These conflicting results can be explained by either procedural differences in methods used to measure thermal resistance, or by actual misquotation and misinterpretation of published results. For instance, Potel (6) published a manuscript, in German, entitled "Die morphologie, kultur und tierpathogenitat des *Corynebacterium infantisepticum*" (now known to be *Listeria monocytogenes*). Numerous authors interpret this work to indicate that "this organism survived heating at 80°C (176.1°F) for 5 min." In reality, the manuscript dealt with a determination of whether this organism produced spores. The exact translation of this manuscript is "spores were not detected. Sudden death of bacteria occurred upon heating at 80°C."

Bearns and Girard (7) published a manuscript entitled "The effect of pasteurization on *Listeria monocytogenes*." These authors (who incidentally misquote the work of Potel to indicate that *L. monocytogenes* may survive 5 min at 80°C) reported that *L. monocytogenes* could survive pasteurization when populations of the organism exceeded 5×10^4 /ml. However, the methodology used in this study involved heating the organism in test tubes which were only partially submerged in a water bath. Test tube methodology is generally accepted as being inaccurate for measurement of bacterial heat resistance. A more accurate method involves placing a bacterial suspension in sealed glass tubes, which can be completely immersed in

a water bath or other heating menstruum. Donnelly, et al. (8) compared test tube methodology in side by side experiments with sealed tube methodology for measurement of heat resistance of *Listeria*, and dramatically different results were obtained. These results can best be expressed in terms of D-values, or the time necessary (at a given temperature) for 1 log cycle of the bacterial population to be inactivated. $D_{62.7C}$ (145°F) estimates of approximately 1.0 min are calculated for *L. monocytogenes* using sealed tube methodology, versus the $D_{61.7C}$ (143°F) value of 10.9 min originally calculated by Bearns and Girard. Assuming the $D_{61.7C}$ estimates of 1.0 min are correct, holding pasteurization should take *Listeria* through approximately 30 log cycles of inactivation, or a population of 1×10^{30} *Listeria* would be necessary for survival at current minimum legal holding pasteurization requirements (145°F (62.7°C) for 30 min). The maximum population level to which *Listeria* can grow in milk under ideal conditions is approximately 10^9 /ml.

Conflicting results continue to appear in the present day scientific literature concerning the heat resistance of *L. monocytogenes*. Estimates of heat resistance as determined by the FDA using slug flow heat exchanger methods or sealed tube methodology indicate that the D_{161F} value for *L. monocytogenes* can range from 0.9-5.0 sec, depending on the strain of organism used, whether the organism is intracellular or freely suspended, or whether sterile whole milk or raw milk is used as the suspending menstruum (9, 10). Recently, work from the University of Wisconsin conducted by Doyle, et al. (11) has shown that *L. monocytogenes* can be detected in milk following pasteurization at 72.2°C (162°F) for 16.4 sec. However, a number of factors associated with this study make it improbable that *Listeria* would survive pasteurization under actual conditions of commercial milk processing. First, Doyle, et al. were using milk from artificially infected cows who were shedding abnormally high levels of *Listeria* into milk. In all 12 pasteurization trials conducted by Doyle, et al., the Standard Plate Count (SPC) for study milk exceeded the 1.0×10^5 standard for grade A raw milk from individual cows. Secondly, it is known that *Listeria* is shed at extremely low levels in cows milk. Lovett, et al. (12) have estimated the level of *Listeria* in raw bulk tank milk to be less than 1 organism per ml. Thus, in order for *Listeria* to cause a problem in commercial practice, levels of the organism in bulk tank raw milk would need to approach 10^3 /ml, and would also need to exist in an intracellular state to potentially survive pasteurization. Bovine neutrophils, the predominant phagocytic cell population in cows milk, have a half life of approximately 6-8 hours. These cells fail to remain intact during 48 hours of storage at 4°C. Thus, any *Listeria* originally shed in an intracellular state into cows milk would be freed to an extracellular state upon degeneration of neutrophils during prolonged storage. It should be noted that Doyle, et al. examined the thermal resistance of *Listeria* when heated at 76.4-77.8 (169.5-172°F) for 15.4 sec. No surviving *Listeria* were found when subjected to

this process. The milk processed in the New England listeriosis outbreak was treated at 76.7°C (170°F) for 19.5 sec. Assuming an intracellular D_{161c} value of 5.0 sec, and a Z_D of 8.0°C (the worst case scenario calculated to date for *L. monocytogenes*) (10), at 76.7°C, *Listeria* through approximately 1.2 sec. This process would take *Listeria* through approximately 16 log cycles of inactivation, or a population of 10^{16} *Listeria* per milliliter of milk would be necessary for survival to occur at this temperature.

Recently, a series of publications have been presented by the Spanish authors Fernandez-Garayzabal, et al., who have studied the incidence of *Listeria* in both raw and heat processed milk from Spanish dairies. In one publication, it was indicated that *L. monocytogenes* was isolated from 21.4% of pasteurized milk samples which had been processed at a Spanish dairy at the maximum treatment permitted under Spanish law- 78°C (172.4°F) for 15 sec (13). *L. grayii* was isolated from 89.2% of analyzed specimens. Again, assuming an intracellular D_{161c} of 5 min, and a Z of 8°C, at 78°C (172.4°F) *L. monocytogenes* would have a D -value of 0.8 sec. Fifteen seconds of heat treatment at 78°C would take the organism through approximately 19 log cycles of inactivation. Thus, a population of 10^{19} organisms would be necessary in order for survival of *Listeria* to occur. In both the New England listeriosis outbreak, as well as contamination of milk processed at Spanish dairies, it is likely that factors other than inadequate heat treatment were responsible for the alleged *Listeria* contamination.

While debate over the efficacy of current pasteurization standards is likely to continue, the presence of *Listeria* in processed dairy products cannot be ignored. Results generated from the FDA Dairy Safety Initiatives Program offer important insight into probable reasons for product contamination. First, in all instances of product contamination to date, faulty pasteurization has not been implicated as the cause of product contamination. More importantly, in most instances of product contamination, an environmental source located within a processing plant has been linked with product contamination. These findings clearly argue for the role of post-pasteurization contamination of dairy products as the cause for the appearance of *Listeria*, and not inadequacies in pasteurization process. Increased focus on elimination of sources of post-pasteurization contamination within processing environments will keep our products free of contamination, and restore consumer faith in the unequivocal safety of U.S. dairy products.

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The Utilization of Buttermilk in The Production of Yoghurt Cheese "Labneh"

by

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Introduction

The Yoghurt cheese "Labneh" has been characterized as the product obtained by removing some water, lactose and salts from ordinary yoghurt. This concentrated yoghurt is usually consumed, in some countries of the Middle East, as a part of a main meal. The effect of using different types of milk such as cow's, buffalo's, sheep's, full-cream spray dried milk, recombined and hydrolyzed milk on the characteristics of concentrated yoghurt "Labneh" was studied (Tamime, 1978; Tamime and Robinson, 1978; Rosenthal et al, 1980; Abd-El-Salam and Alamy, 1982).

Buttermilk occurs as a dairy by-product from either sweet or sour cream where the butter is manufactured by conventional churning method.

In Egypt, a large amount of buttermilk is produced as a by-product and the most of this material is usually disposed as a waste. As the composition of buttermilk is similar to that of skim milk (Gonc, 1977; Muller, 1981; Mahran et al, 1987), it means that the unused quantities of this by-product cause disposal problems besides the loss of valuable milk nutrients.

The current work has been conducted to investigate the possibility of utilization of buttermilk in the production of concentrated yoghurt "Labneh". Moreover, the quality of the end product, as affected by the addition of milk solids to buttermilk, prior processing, was assessed during storage at $8 \pm 1^\circ\text{C}$.

Materials and Methods

Manufacture of Labneh:

Fresh buttermilk (10% TS) was obtained from butter-making trials carried out, using unripened buffaloes' cream, at the Dairy Laboratory, National Research Center (treatment I). Skim milk powder was used for the fortification of the total solids of buttermilk up to 18% (treatment II).

The buttermilk and fortified buttermilk were heated to

90°C for 20 min., cooled to 40°C and then inoculated with yoghurt starter (*Streptococcus Thermophilus* and *Lactobacillus bulgaricus* 1:1) at 2% (v/v) level. The pure cultures of starter were obtained from Cairo MIRCEN, Faculty of Agriculture, Ain Shams University. The inoculated milk was stirred and dispensed into 1L plastic containers and incubated at $40 \pm 1^\circ\text{C}$ for 3-3.5 hours when it curdled. Then the cultured buttermilk and fortified buttermilk were cooled overnight, mixed thoroughly with 1% (w/w) of dry fine salt (sodium chloride) and put into cloth bags that were hung in the refrigerated room to allow for whey drainage during a 12 hour period. The Labneh was filled into 125 g plastic containers and kept in a refrigerator at $8 \pm 1^\circ\text{C}$. Five replicates of each treatment were manufactured and analyzed for chemical and organoleptic properties.

Chemical analysis:

Fresh samples of Labneh as well as samples stored for 15, 30 and 45 days were withdrawn and immediately analyzed for total solids, fat, total nitrogen, nitrogen-non-protein, soluble nitrogen and titratable acidity (Ling, 1963); lactose (Barnett and Abd-El-Tawab, 1957); acetaldehyde (Lees and Jago, 1969) and diacetyl (Westerfeld, 1945). The pH values were measured using Kinck-Digital pH meter Model 646.

Sensory evaluation:

Ten trained panelists evaluated the buttermilk Labneh samples, on the same day of the chemical analysis, for flavour (45 points), body and texture (30 points), appearance and colour (10 points), acidity (10 points) and container and closure (10 points).

Statistical analysis:

Data obtained for chemical analysis were statistically analyzed according to Snedecor and Cochran (1967).

Results and Discussion

Data presented in Table 1 indicate that the addition of skim milk powder to buttermilk, prior manufacture, in-

creased the total solids, lactose, total nitrogen, nitrogen-non-protein and soluble nitrogen in the produced Labneh. This increase was in the level of 71%, 99%, 134%, 32% and 30%, respectively. While the fat content decreased (10%) as a result to fortify the buttermilk solids using solids-not-fat, i.e., skim milk powder. During storage, a slight increase was observed in total solids content of Labneh of both treatments that could be attributed to some evaporation that had occurred during the storage period (Ibrahim, 1984). In general, the total solids estimated for Labneh made from either buttermilk (21.01 - 22.32%) or fortified buttermilk (35.97 - 38.32%) are in agreement with those reported by other investigators (Taimé, 1977 and 1978; Tamime and Robinson, 1978; El-Samragy et al, 1987). Recently, Tamime and Robinson (1985) mentioned that, in Poland, pre-concentrated milk, e.g. 30 - 40% total solids, was used to manufacture a product called "Super Yoghurt", and also a high concentration of solids (31.94%) was achieved in a yoghurt-type product using the cloth bag method, and in this instance ordinary yoghurt made from whole milk fortified with skim milk powder. Moreover, the procedure for the manufacture of "Chanklich" is somewhat similar to that "Labneh Anbaris", and it differs only in the addition of herbs and/or spices to the highly concentrated yoghurt, i.e. 30 - 40% total solids.

A similar decrease in fat content, of both treatments, were noticed during storage period (Table 1). This decrease might be due to a slight fat hydrolysis (El-Shibiny et al, 1979; Alm, 1982; El-Samragy, 1987).

Lactose content of Labneh manufactured from buttermilk as well as fortified buttermilk showed a gradual decrease until the end of storage period (Table 1), which was probably due to lactose being converted to lactic acid, acetaldehyde and acetoin (Viani and Horman, 1976). Similar results have been recorded for the behaviour of fat and lactose content of Labneh, produced using different starter cultures, during cold storage (El-Samragy et al, 1987).

In regard to changes in milk protein of Labneh during storage, a gradual increase was observed in total nitrogen, nitrogen-non-protein and soluble nitrogen towards the end of storage period (Table 1). The increase in the total nitrogen could be explained by the production of volatile substances that evaporated during storage, while the increase in the nitrogen-non-protein may be due to breakdown of protein (Alm, 1982). These results coincide with those reported by Rosenthal et al (1980) who found that the total nitrogen of Labneh ranged from 2.77 to 5.96%, while the soluble nitrogen varied from 0.26 to 0.56%.

The titratable acidity of fortified buttermilk Labneh was 2-folds higher than that determined for buttermilk Labneh in fresh samples (Table 2). This may be due to the high content of total solids from using skim milk powder to rise the milk solids of buttermilk before processing. During storage, the acidity of both treatments gradually increased until the end of storage period. The pH values decreased as titratable acidity increased, showing the commonly

known relationship between the two. These findings are in accordance with those reported by other researchers (Tamime and Robinson, 1978; Rosenthal et al, 1980; El-Samragy et al, 1987).

Acetaldehyde and diacetyl have been recognized as being the most important flavour components of those compounds that are produced during the fermentation process when a fermented dairy product being manufactured (Botazzi and Dellaglio, 1967). The addition of skim milk powder to buttermilk decreased the acetaldehyde content, while caused the opposite for the diacetyl content of fortified buttermilk Labneh compared with that made from only buttermilk. However, the acetaldehyde content of both treatments showed a gradual decrease towards the end of storage period. Diacetyl content increased until the 15 days of storage and then demonstrated a decrease until the end of the storage period. This decline in acetaldehyde as well as diacetyl during cold storage of Labneh is probably due to the activity of lactic acid bacteria in reducing these compounds (Bills and Day, 1966; Bills et al, 1972; Hamden et al, 1972; Hogarty and Frank, 1982).

Statistical analysis supported the concept that enrichment of the total solids of buttermilk using skim milk powder prior the manufacture of Labneh, as well as storage at $8 \pm 1^\circ\text{C}$, significantly affected ($P < 0.01$) total solids, fat, lactose, total nitrogen, nitrogen-non-protein, soluble nitrogen, titratable acidity, pH, acetaldehyde and diacetyl content of this fermented dairy product.

The results of sensory evaluation indicated that the Labneh processed from fortified buttermilk gained higher score points than that made from buttermilk, either fresh or stored (Table 3). The acceptability of both treatments gradually decreased during storage, which could be referred to the development of acidity and degradation of protein as storage period advanced. This observation was evident in buttermilk Labneh (treatment I), that had a lower score points after 15 days and was refused after 30 days of storage.

The present work has shown that, it could utilize the buttermaking by-product "Buttermilk", in the production of fermented dairy product "Labneh". Also, supporting the total solids of buttermilk using skim milk powder improved the properties of produced Labneh and increased its acceptability until 45 days when stored at $8 \pm 1^\circ\text{C}$.

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Table 1: Composition of buttermilk and fortified buttermilk Labneh during storage at $8 \pm 1^\circ\text{C}$.

Storage period (days)	Treatment	Total solids	Fat	Lactose	Total nitrogen (%)	N-non-protein	Soluble nitrogen
Fresh	I	21.01	4.1	3.52	1.36	0.130	0.176
	II	35.97	3.7	7.00	3.18	0.171	0.228
15	I	21.64	3.6	2.74	1.44	0.151	0.202
	II	36.74	3.6	6.08	3.59	0.197	0.259
30	I*	22.32	3.3	2.26	1.56	0.219	0.249
	II	37.49	3.4	5.14	3.83	0.222	0.302
45	II	38.32	3.0	3.38	3.83	0.263	0.339

I: Buttermilk (10% TS).

II: Fortified buttermilk (18% TS).

I*: Samples were not judged after 30 days.

Table 2: Changes in titratable acidity, pH, acetaldehyde and diacetyl of buttermilk and fortified buttermilk Labneh during storage at $8 \pm 1^\circ\text{C}$.

Storage period (days)	Treatment	Titratable acidity (%)	pH	Acetaldehyde		Diacetyl
				μmole/100g		
Fresh	I	3.5	4.1	220	145	
	II	7.0	3.7	188	230	
15	I	2.7	3.6	211	211	
	II	6.1	3.6	179	251	
30	I*	2.3	3.3	193	158	
	II	5.1	3.4	166	232	
45	II	3.4	3.0	105	133	

I: Buttermilk (10% TS).

II: Fortified buttermilk (18% TS).

I*: Samples were not judged after 30 days.

Table 3: Sensory evaluation of buttermilk and fortified buttermilk Labneh during storage at $8 \pm 1^\circ\text{C}$.

Storage period (days)	Treatment	Fresh									
		I		II		15		30		45	
		(45)	40	45	30	42	30	40	35		
		(30)	28	30	25	28	20	28	25		
		(10)	10	10	8	10	6	10	8		
		(10)	8	10	6	8	5	6	6		
		(5)	5	5	5	5	5	5	5		
		(100)	91	100	74	93	66	89	79		

I: Buttermilk (10% TS).

II: Fortified buttermilk (18% TS).

I*: Samples were not judged after 30 days.

BOTTLED WATERS

The Beverage of the Future

by David Slater

(Communications specialist at the National Restaurant Association, Reprinted from *Restaurants USA/January 1988*)

Bottled waters are the fastest growing segment of the beverage industry. Some beverage analysts believe the waters' impact on the U.S. marketplace has only begun. With health consciousness and alcohol awareness now among the trends that are driving the industry, consumers are ready to switch from other beverages to waters. Restaurateurs can tap into this growing potential.

Until Perrier's American advertising blitz began to open eyes and whet thirsts in 1975, the United States was considered an undeveloped market for bottled water. But when the floodgates opened, it was like a dam bursting. Today, bottled water is the country's fastest growing beverage, and sales increases in the double digits are expected to continue through 1990.

The water is spilling over into restaurants, too. Bottled waters show the most spectacular growth among all tableservice restaurant beverages. Since 1980, the number of restaurant patrons ordering the beverage has grown more than four times, and the volume of consumption has jumped by almost 500 percent. Operators are pouring premium noncarbonated waters at the table as a point of distinction in their restaurants. And health-conscious customers are quaffing bottles of sparkling waters in lieu of soft drinks and alcoholic beverages.

Although the total volume of bottled waters consumed in restaurants represents a small percentage of the beverages consumed by diners, beverage industry experts agree that restaurants have just scratched the surface with regard to water sales. The impressive growth figures that have already surfaced are leading restaurateurs in all

segments to take the plunge into profitable waters.

Untapped possibilities

In 1986 Americans consumed an average of 4.4 gallons of nonsparkling, or still, water and 0.6 gallons of sparkling water. The total of 5 gallons per person was an enormous leap from just 1.5 gallons in 1976. Per-capita consumption is expected to double by 1993.

Drinking prodigious amounts of bottled water may be a novelty for Americans, but it is nothing new to Europeans. The French and Belgians consume more than 14 gallons per head each year, and, in most European countries, a bottle of water at the table is considered almost as necessary as a knife and fork.

The expanding American bottled water market can be divided horizontally into domestics and imports and vertically into sparkling and still waters. The number of brands is mind-boggling. According to the International Bottled Water Association, the Alexandria, Virginia-based trade association for the bottled water industry, there are approximately 450 American bottling plants, which produce more than 600 different brand labels. Many of these brands are regional in origin and distribution.

There are currently more than 50 brands of imported waters, most of which are in the naturally carbonated mineral water category. Few of them are distributed nationally. Perrier, with 1986 sales of \$108 million, controls 72 percent of the imported market, but its share is dropping.

Although distinctions among types of water can sometimes be confusing, water enthusiasts believe there to be a

correct water for each occasion. In general, bottled still water is most often purchased as an alternative to tap water. Home, office and institutional delivery of bulk water, often in large containers for water coolers and general consumption accounts for a large share of non-sparkling sales.

On the other hand, naturally carbonated mineral water, such as Perrier, generally is purchased as an alternative beverage, taking the place of cocktails or soft drinks. A fast growing portion of this segment includes waters flavored with fruit essences or fruit juices.

Customer acceptance

Many restaurateurs have already learned that profits can also flow out of the natural springs that serve as the sources for these beverages. Not every restaurant moves more than 200 cases of bottled water a month, as New York City's well-known Windows on the World regularly does, but a perusal of distributor's customer lists makes it easy to locate operations that go through more than 50 cases each month - without any promotions or staff training.

At Valentino (170 seats), an upscale Italian restaurant in Los Angeles, customers drink up to three cases of bottled water each day. One of the keys, says assistant manager Nessim Cayem, is the variety of waters Valentino offers. The selection includes three still waters, Fonte Vella, Fiuggi and Evian, and two sparkling brands, Perrier and San Pellegrino.

In addition to serving small, 8 to 10-ounce individual bottles, Valentino makes tableside presentations of Evian, San Pellegrino and Fonte Vella in large

bottles. The large bottles are served in an iced wine bucket, and, says Cayem, some customers ask the waiter to "just keep our glasses filled." At \$2.25 for a small bottle and \$5.50 for a large bottle, the restaurant gets a high return on its bottled waters.

An image-builder

Many hotel restaurants, and also some independent operators, such as association director Michael Hurst of Ft. Lauderdale's 15th Street Fisheries, choose to pour complimentary glasses of still water at the table to add, as Hurst says, "a little touch of class." "It's a point of distinction" that is clearly appreciated by the restaurant's customers, says Hurst, who teaches restaurant marketing at a nearby college. He changes the brand of water he uses every few months, depending on the best deal he can get from his distributors.

Other restaurants and hotels have also discovered the sparkling benefits of bottled waters. At Cricket's (105 seats) in the Tremont Hotel in Chicago, associate food and beverage manager Francis Johnson finds that bottled water "afford a luxury that goes hand-in-hand with a luxury hotel." At Johnson's suggestion, the Tremont also recently began a well-received amenity program that includes complimentary bottled water in the rooms of VIPs.

Also boosting water's image as a luxury item is the Water Bar, which was opened last year at the IXI:Z men's clothing store in Beverly Hills, California. The bar, which was opened as a service to the store's customers, offers 110 varieties of bottled waters, ranging in price from \$1 to \$5. According to "bartender" Duane Bolden, "the popularity - and media attention - has been consistent since the week we opened."

The catalyst: health consciousness

The reasons behind the bottled water boom can provide operators with clues to marketing the fashionable product. The bottled water industry is in the enviable position of serving two growing markets. First, there is the drinking water market - people who are concerned about the quality of municipal

water supplies. These fears about water supplies vary from region to region, but, according to Michael Bellas, president of the Beverage Marketing Corporation, they are growing rather than diminishing.

The second, overlapping market that has fueled the explosion of bottled water in the last decade is the health-conscious market - consumers who are drinking bottled waters an alternative to soft drinks and alcoholic beverages. Refreshing, calorie-free mineral water, with no additives or preservatives, found an instant audience with running enthusiasts in the late 1970s. And as we move into the next decade, experts predict that bottled water is already becoming less a luxury item and more a staple in American refrigerators.

Bob Levin, a Miami, Florida-based distributor for Mountain Valley water, has believed for years that bottled water is "the beverage of the future." A decade ago, Levin formed a group called "Les Amis de L'Eau" ("The Friends of Water") and held two water tastings in Miami. The second tasting, in March 1978, was attended by more than 400 water lovers from throughout the United States and several foreign countries. Six foreign and domestic waters were rated for flavor, color and aftertaste.

"Fans of water are just like fans of wine or food," says Levin, who believes there is still a lot of room for expansion of water sales in American restaurants. "Restaurants are missing the boat if they don't have a few varieties on their menu," he adds.

Restaurants - a natural market

Bottled water's sales potential in restaurants is demonstrated by the eagerness with which distributors market their waters. According to John H. Bergmann, who is introducing Eau Canada Sparcal to the Northeast American market, restaurants play an important role in the success of a bottled water. "Our restaurant sales, we hope, will probably be comparable to those of the other imports - 25 percent or less of total volume. But restaurants also are especially important in that they give the thrust to the market," he says.

One of Sparcal's selling points in restaurants, says Bergmann, will be the company's distinctive bottle, which, with its tapered, triangular shape, "will not be out of place in a champagne bucket." Its crystal-clear glass suggests a pure, clean product with nothing to hide, he adds, in what seems to be a challenge to Perrier, the best-seller in the ubiquitous green bottles.

One of the country's fastest growing waters, San Pellegrino, got its initial foothold in America by gearing its marketing to Italian restaurants. "The beginning of our marketing programs is to go through restaurants," says Mark Goldstein, vice president of San Pellegrino USA. Italy's best-known mineral water, San Pellegrino is now reaching out to nonethnic restaurants in the United States. "Overall, we doubled our sales in the past year, and we're ahead of that pace at restaurants," says Goldstein.

Perhaps it is because Americans are so unsophisticated in their knowledge of good water that bottled water companies see fit to emphasize the beauty of their bottles and, even more commonly, the legends and histories associated with their waters. Perrier points out that their water was bottled by decree from Napoleon in 1963 "for the good of France." San Pellegrino boasts that Leonardo da Vinci visited its source in the Italian Alps to "take the waters." The admirers of Mountain Valley, an American still water from Hot Springs, Arkansas, included Elvis Presley, Joe Louis and even Secretariat, the racehorse. And Aussie Blue, a flavored Australian water which will soon reach our shores, is linking its water to the myth of the Australian "Blue Kangaroo."

Marketing

Operators agree that even without promotion, bottled water sales can become significant. As the American per-capita consumption increases from a projected 6.2 gallons in 1987 to nearly 12 gallons in 1996, restaurants should anticipate a continued strong demand from an increasingly sophisticated bottled water market.

With profit margins similar to those of beer and wine, savvy operators are al-

(Con't. on p. 310)

Brush, Floss and Eat Your Cheese

Consumption of cheese and other dairy foods may offer protection against cavities. This was the consensus of a panel of 15 internationally-known dental researchers.

The expert panel convened recently in Orlando, Florida, for the conference "Dairy Foods and Dental Health," coordinated by National Dairy Council and funded by the National Dairy Promotion and Research Board.

Chaired by Juan M. Navia, Ph.D., University of Alabama, the conference participants reviewed scientific evidence about dairy foods and dental health and discussed the relationship of specific dairy foods to cavities. "The protective effect of cheese (against cavities) is well established," summarized William H. Bowen, B.D.S. Ph.D., of the University of Rochester Medical Center in New York.

Several aged cheese help prevent tooth decay, the group said, and may protect teeth against cavity formation if eaten before or after "sugars." The term "sugars" is defined to include not only table sugar, but also the sugars which are added to or found naturally in many foods. Cheese reduces the amount of acids caused by sugar in the mouth. These acids lead ultimately to cavity formation in the tooth enamel.

"Cheese works on all aspects of protection," explained John D.B. Featherstone, Ph.D., of the Eastman Dental Center in Rochester, New York. "It helps decrease acid production and provides calcium, phosphates, protein and fat which all help to protect the tooth against acids."

The panel agreed on a number of specific findings relating to the role of dairy foods in the prevention of cavities, including:

- Cheese such as aged Cheddar, Monterey Jack and Swiss can protect against acid production caused by sugars in the diet.

- Cheddar cheese consumed immediately after a sugar-containing food can help to protect against tooth decay.

- Cheddar, Swiss or Monterey Jack cheese eaten one-half hour before a sugar-containing food can reduce plaque acid production.

- Components of milk and cheese which may afford some protection against dental cavities include milk proteins, fat, calcium and phosphorus.

In addition to Cheddar, Swiss and Monterey Jack, at least nine other cheeses including Mozzarella, Muenster, Edam and Gouda have been identified as helpful in prevention of cavity formation, according to research conducted by Mark E. Jensen, D.D.S., Ph.D., University of Iowa.

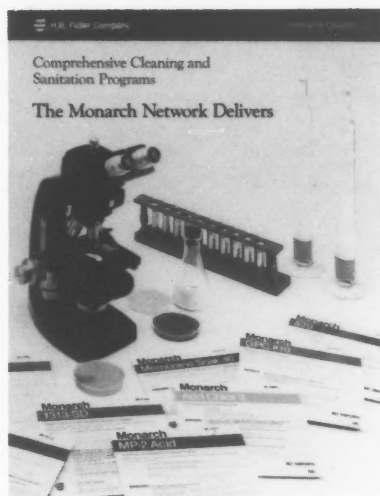
The knowledge that eating cheese can help prevent tooth decay and even repair the early cavity-forming process has important implications to the public as well as to the dairy industry and dental profession. Choosing cheese as a snack may not only help prevent cavities, but

it also supplies important nutrients such as calcium, protein, riboflavin and magnesium.

The panel made recommendations for further research in areas that could lead to practical advice for consumers regarding dental health, such as the effects of nutrition and diet, including dairy foods such as milk and cheese, on periodontal or gum diseases; and the impact of food and nutrition on dental health of the elderly.

National Dairy Council conducts nutrition education and nutrition research programs as part of United Dairy Industry Association (UDIA). UDIA and its member organizations and affiliated Dairy Council units invest \$110 million annually in a unified promotion program for the dairy industry.

For more information contact Lisa Coe at 312-696-1020.



Monarch Publishers Comprehensive Cleaning and Sanitation Programs Brochure

A new brochure describing the advantages of using quality products and services to implement a customized sanitation program has been published by the Monarch Division of H.G. Fuller Company.

For a copy of the Monarch® Comprehensive Cleaning and Sanitation Programs brochure, contact: Marketing Manager, Monarch Division, H.B. Fuller Company, 3900 Jackson St. NE, Minneapolis, MN 55421.

H.B. Fuller Company is a Fortune 500 company with more than 10,000 specialty chemical products including adhesives, sealants, coatings, paints, specialty waves and sanitation chemicals. Founded in St. Paul, Minnesota, in 1887, the company has 53 plants and technical service centers in 30 U.S. cities and operations in 28 countries around the world.



Eriez Magnetics Literature Kit Describes Free Trial Offer for the Food Industry

A literature kit from Eriez Magnetics describes the company's Free Trial Offer for the food industry. The literature describes step-by-step procedures for obtaining Permanent Magnets and Rare Earth Magnetic Separators on a trial basis.

In-stock Permanent Magnetic Plates, Grates and Pipeline Traps are available to use in the applicants processing lines free for 30 days' trial. Select sizes of SuperStrength Rare Earth (RE) Magnetic Tubes, Grates and Traps are also available free of charge for 30 days. Complete details are described in the literature.

For a free literature kit describing the FREE TRIAL OFFER ON PERMANENT MAGNETS IN STOCK and FREE TRIAL OFFER ON RARE EARTH MAGNETIC SEPARATORS, write: Eriez Magnetics, Separation Division, Asbury Road at Airport, Erie, PA 16514. Or call Toll Free: 1-800-345-4946 to have an Eriez Representative contact you. In PA, 1-800-345-0093.

AOAC to Offer New Short Course on Sampling

The AOAC (Association of Official Analytical Chemists) is introducing its new two-day short course, "Field and Laboratory Sampling of Food, Drugs, and Agricultural Commodities," November 30 and December 1, 1988 in Arlington, Virginia. In this course on sampling principles, their applications and administration, enrollees will learn how to improve

the sampling process and thereby reduce the sampling error impact on the analytical scheme. Whether taken for basic knowledge or as a refresher course, the course will provide invaluable information to those involved in sampling quality assurance, sampling planning, field operations, regulatory affairs, manufacturing, laboratory management, sample analysis, as well as anyone wanting to know the what, how and why of sampling food, drugs, and agricultural commodities.

The course program will cover the following subjects:

- The Reality of Sampling
- Developing the Sampling Program
- Sampling Concepts and Statistical Approaches
- Sampling Equipment and Sampling Safety
- Documenting Sampling Collections
- Sample Preservation, Preparation, and Transport
- Principles of Sampling (Sample Collection and Sampling Schedules)

- Laboratory Sampling and Sample Preparation for Analysis

- Legal Considerations and Consensus Standards
- Sampling Project Discussions

Frederick M. Garfield, former Assistant Administrator of the U.S. Drug Enforcement Administration, AOAC's Scientific Coordinator, developed with short course. Mr. Garfield also developed and authored the popular AOAC Quality Assurance for Analytical Laboratories Short Course and the AOAC manual, *Quality Assurance Principles for Analytical Laboratories*.

All lecture outlines were reviewed and evaluated by a committee of recognized experts on the subject: W. Horwitz, F.D. McClure, and W. Schwemer, U.S. Food and Drug Administration; A. Tiedemann, Consolidated Laboratory Services Division of the Virginia Department of General Services; J.B. Bourke, New York State Agricultural Experiment Station; J.J. Karr, Pennwalt Technical Center; J.E. McNeal, U.S. Department of Agriculture; and E. Elkins, National Food Processors Association.

Instructors will be selected from persons who have had extensive experience in sampling and sampling statistics.

This is not a completely new venture for the AOAC. The Association designed and presented a two-day sampling short course, under contract, for Agriculture Canada in March 1986, and a symposium in Scottsdale, Arizona in September, 1986 at the AOAC 100th Annual International Meeting and Exposition. Both programs were well received.

Registration is \$475.00 for members and \$525.00 for non-members.

Registration for the course is now open. Course size is limited and on a "first come" basis. To register, first verify space availability by calling or writing AOAC Education Department, 1111 N. 19th St., Suite 210, Arlington, VA 22209, 703-522-3032; then, to reserve your space, send your name and address and payment to cover applicable registration fee.

BISSC Announces Officers for 1988

At its board of Directors meeting on March 5, 1988, held at the Downtown Marriott Hotel, Chicago, Illinois, the Baking Industry Sanitation Standards Committee (BISSC) re-elected the following officers for 1988:

Chairman	William E. Pieper Chicago, Illinois
Vice Chairman	J. Allen Baird Mrs. Baird's Bakeries Fort Worth, Texas
Secretary-Treasurer	Bonnie Sweetman Chicago, Illinois

Inquiries regarding BISSC should be directed to Bonnie Sweetman at the BISSC headquarters office, 111 East Wacker Drive, Suite 600, Chicago, Illinois 60601. (312)644-6610.

New Technical Brochure Describes Dixon's Rulon® 641 Bearing Material for the Food, Drug & Dairy Industries

A new technical brochure is now available from Dixon Industries Corporation describing RULON® 641, a new self-lubricated bearing material for applications in the food, drug and dairy industries.

RULON® 641 is comprised solely of FDA-cleared materials making it a sensible alternative to bronze, carbon and brass bearings which can pose health hazards.

The proprietary bearing material offers excellent wear resistance and frictional properties as well as load carrying capacity at temperatures up to 550°. Also, RULON® 641 is chemically inert and, therefore, resists equipment washdown chemicals and process environments.

RULON® 641 is Dixon's latest addition to the very successfully RULON® line of high-performance bearing materials. It is available in various stock sizes of extruded and hand-molded rod and tube. RULON® 641 also can be custom-fabricated for specific applications.

For a copy of the brochure, contact Ed Relle, senior product manager, Dixon Industries, 386 Metacom Ave., Bristol, RI 02809. (401)253-2000.

Lawrence Practical Dairy Science Correspondence Course

Funke Dairy Supplies, Inc., Cincinnati, OH has been appointed exclusive sales agent for the 'Lawrence Practical Dairy Science Correspondence Course'. C.E. Lawrence, author of the course, reports that dairy and ice cream companies in the United States and throughout the world are using this course to further educate their key personnel. W.F. Funke, President of Funke Dairy Supplies, Inc., said that his organization would actively work with dairy companies throughout the United States in their effort to inform the dairy industry of this program.

For more information contact Funke Dairy Supplies Inc., P.O. Box 30097, Cincinnati, OH 45230, 513-272-3100.

Consumer Concern About Food Additives

With terms like "maltodextrin," "monocalcium phosphate" and "sodium bisulfite," food labels can read like a chemistry test.

"Although consumers have cultivated a taste for an all sorts of convenience foods that require additives, they also wonder about the long-term health effects of the chemicals listed on the labels," says Dr. Dymple Cooksey, a nutritionist with Texas A&M University's Agricultural Experiment Service.

Are shoppers' concerns well-founded?

"Food additives are hardly new," she explains.

"They've been with us for thousands of years, probably starting with the discovery that salted meat lasted longer."

Cooksey says the most commonly used additives are "natural" substances, such as sugar, salt and corn syrup. Along with baking soda, pepper and few others, these substances make up about 98% by weight of all additives used in the country.

The man-made chemicals added to foods are closely scrutinized and strictly regulated by the Food and Drug Administration. Their use is permitted in foods only levels that ensure a large margin of safety between levels of human exposure and the highest level at which no harm of any sort is evident in test animals, the nutritionist says.

She notes that additives maintain and improve food quality by preserving foods and adding nutrients. The flavor enhancers, flavings, colors and sweeteners make food more appealing. Emulsifiers (mixers), stabilizers, thickeners, texturizers and acidity control agents act as processing aids in the manufacturing process.

But the nutritionist concedes that some chemical additives are still a source of consumer concern.

"The most controversial additives are artificial dyes, such as Red No. 3 which is found in maraschino cherries, pistachio nuts, gelatin desserts and other foods," says Cooksey.

"Yellow No. 5 also causes allergic reactions in an extremely small segment of the population. It's the only dye that must be listed by name on food labels. Others can be listed as artificial coloring."

She notes that many food manufacturers are aware of consumers' worries and have substituted natural dyes such as annatto, carotene, caramel or fruit juice.

"People have been eating foods with natural and artificial additives for thousands of years. In terms of health, the composition of our diets is probably more significant than the substances added to foods," she maintains.

"A diet that's low in fat the contains adequate fiber, vitamins and minerals is the best. If you're still concerned about additives, eat a variety of foods to limit your exposure to any one additive, should it turn out to have longterm risk," advises the nutritionist.

For more information, contact: Dymple Cooksey, (409)845-1735.

Expert Warns About Risk of AIDS in Heterosexuals

Americans cannot afford to wait for definitive information about the risk of heterosexuals spread of the AIDS virus. So states an editorial by Dr. J.D. Robinson in the January/February issue of ACSH NEWS & VIEWS, a publication of the American Council on Science and Health (ACSH), and independent scientific organization.

"Some people argue that heterosexuals' risk of AIDS must be small, because few heterosexually acquired cases have been detected in the general U.S. population. This argument is faulty," Dr. Robinson said.

"Because AIDS has a long incubation period, we shouldn't expect to detect a large number of such cases at this time. They probably won't show up for several more years, if they show up at all."

"Unfortunately, we cannot wait for definitive answers," he warned. "By the time we have them, the genie could really be out of the urn. The reality is that behavioral and policy decisions must be made with fragmentary epidemiological information."

The current assumption that heterosexuals are at minimal risk is dangerous, Dr. Robinson contends. The proponents of this view have dismissed the distribution of the AIDS virus in other parts of the world and ignored science's general understanding of infections and epidemics, he argues.

"There are many agendas held by advocates of one or another of the predictions about the future spread of AIDS," Dr. Robinson said. "These should not distract us from the risk of understanding."

"It will not be easy to steer a safe course of rational thought past the shoals of people who feel nothing should be done about the suffering unless everyone feels threatened. Nor can we easily navigate past the reefs of those who wish to stigmatize AIDS victims."

"The consequences of error on this subject are so vast that the burden of proof should rest on those who minimize the risk," he concluded.

The American Council on Science and Health in an independent nonprofit consumer education organization promoting scientifically balanced evaluations of food, chemicals, the environment and health.

Copies of ACSH NEWS & VIEWS can be obtained from ACSH, 47 Maple St., Summit, NJ 07901.

16th Edition of Standards Method for the Examination of Dairy Products

Request for Consensus Reviewers of the 16th edition of Standard Methods for the Examination of Dairy Products. The American Public Health Association is now preparing the 16th edition of standard methods for the examination of dairy products as was practiced with the 15th edition. The APHA would like to develop a roster of persons from the dairy science field who are willing to serve as consensus reviewers for the chapter manuscripts before they are submitted for publication. The purpose of this is to assure that the methods that are included are realistic and up-to-date.

If you would like to serve as a consensus reviewer will you please send your name and address to: Howard L. Bodily, Ph.D., Consultant, APHA, P.O. Box 69, Midway, UT 84049. Please submit your name and address before August 31, 1988.

Chlorine Safety Booklet

A new booklet entitled "Chlorine. For Safety's Sake," has just been published and is now available free of charge from Jones Chemicals, Inc. The booklet features a 21-point checklist of key chlorine safety procedures, covering everything from chlorine container valve replacement and inspection to emergency equipment and free safety training seminars offered by Jones. Those involved with municipal chlorine purchasing will find the booklet helpful in reviewing recommended safety procedures to be followed by suppliers. For your free copy, write or call Jones Chemicals, Inc., 100 Sunny Sol Blvd., Caledonia, NY 14423 (716) 768-6281.

Team Uses Passive Dosimetry To Monitor Water Pollutants

Passive dosimetry, developed in industrial hygiene to monitor concentrations of airborne pollutants in the work place, is being applied by ESE researchers to the problem of monitoring organic pollutants in surface and ground waters.

In a passive monitor, contaminants diffuse from the ambient air or water along parallel tubes that lead to an adsorbent such as activated carbon or Tenax. After sampling, the adsorbent is extracted using a solvent or desorbed thermally, then analyzed to give the mass of each organic contaminant of concern. From the contaminant mass measured, pollutant concentration can be calculated using Fick's law of diffusion.

Passive dosimetry determines the average pollutant concentration over the time of sampling. The mass of contaminant collected is proportional to the exposure time and pollutant concentration, so that very low concentrations can be detected if the exposure time is long enough.

The samplers used in this study are relatively small, about the size of a hockey puck. They are much less expensive, more rugged and less prone to vandalism than the pumps and timers presently used in the field and should therefore function much better.

In the work conducted thus far, prototype passive dosimeters have been "exposed" for up to seven weeks in water tanks that contained 1 pm of xylene, 10 pm of xylene or 0.054 ppm of atrazine, a pesticide. Concentrations in these tanks measured by the prototype dosimeters were 1.3, 10.4 and 0.069 ppm, reasonably close to the actual values.

The prototype used in these tests had diffusion channels one cm long, drilled through a block of acrylic plastic. A second generation dosimeter has since been designed with diffusion channels taken from a nucleopore filter and only 10 micrometer long. Because collected mass is inversely proportional to channel length, the new dosimeter currently being evaluated should have detection limits orders of magnitude lower than the first prototype.

The first field application of this device will be to measure contamination of groundwater below a leaking underground storage tank. For this application, passive dosimeters can be lowered into wells drilled at locations around the tank, then periodically withdrawn and analyzed to determine the extent to which the subsurface water has become contaminated by leaking gasoline or heating oil.

Let's Talk About UHT Milk

Milk processed at ultra-high temperatures is an important food product in Europe and underdeveloped countries because it doesn't need refrigeration until it's opened. But U.S. consumers don't much like its flavor and high cost.

With UHT, the milk is quickly heated to a high temperature (275-300 F degrees), and held at that temperature for one to four seconds. Then, it is rapidly cooled to room temperature in about 10 to 15 seconds.

UHT milk is aseptically processed and packaged in a container that prevents entry of microorganisms. The milk remains sterile without refrigeration. However, once you open the carton, UHT spoils the same as other milk.

High temperature treatments for short times, as in UHT, cause less loss of color, flavor, and nutrients than conventional pasteurization at lower temperatures and longer times. Also, UHT milk loses fewer vitamins.

UHT milk tastes different than pasteurized milk, says Carolyn Dedolph, a UW-Madison student who regularly drank UHT milk while in Tunisia, North Africa. Because refrigeration is rare in Tunisia, Dedolph drank UHT milk from cardboard cartons. Dedolph says, "UHT milk is hard to drink when you're used to fresh milk, so we used it to make lots of puddings and soups. It was very thick and sweet and kind of burnt tasting."

According to Robert Bradley, professor of food science at the UW-Madison, "The flavor is between evaporated and whole milk, and it tastes cooked."

Some people have heard that drinking UHT milk for a long time will cause your body to reject regularly processed milk because proteins are changed. Bradley said, "That is incorrect. It's absolutely not true." There are no risks involved when drinking UHT milk.

Europeans consume much more UHT milk than we do in the United States. Bradley says half of all milk consumed in Europe is UHT milk. Germany is reported to be the largest consumer. Bradley says UHT milk sells well in Europe because refrigeration is not as common as in the United States. In England most UHT milk is flavored.

UHT milk's high cost is another block to its use in this country. It is about three times more expensive than regular white milk. Bradley used an example where UHT milk sold in Sparta, WI, cost \$4.09 per gallon, while white fluid milk was \$1.45 per gallon. For UHT milk to be profitable in the United States, refrigeration costs would have to increase four to five times the present cost, Bradley figures. This will probably never happen, he adds.

Underdeveloped countries rely heavily on UHT milk for nutrients, especially calcium. "There are not many dairy cows, and what cows they do have don't produce well," Dedolph says. "It is nutritionally important, especially for children who don't have anything else," she adds. Bradley points out that UHT processing "allows you to store more milk at no cost of refrigeration." Therefore milk can get to places that otherwise couldn't have milk.

UHT milk is well-suited for people in single-person households who need to store milk for a longer period of time, or people who need to purchase milk in bulk. Although UHT milk has not caught on here in the United States, its popularity in Europe and underdeveloped countries is growing. In these countries UHT milk is an important product for both nutrition and good health.

For more information, contact: Brenda Rumier, (608)264-0692.

Letter to the Editor

Dear Editor:

The article "Use of Remote Communications to Transmit Product Quality Information From Polymer-Based, Time-Temperature Indicators", published in *Dairy and Food Sanitation*, Vol. 8, No. 4, p. 174-176 (April 1988) was missing Table I. Please print the table in the next possible issue.

Sincerely,
Dr. R. R. Zall
Cornell University
Ithaca, NY

TABLE 1. Indicator Reflectance and Remaining Shelf Life¹ for Frozen Orange Juice Concentrate.

Days	% Reflectance	Remaining Shelf Life (wks)
0	91.00	52
7	86.07	47
8	87.78	47
39	76.66	39
53	70.57	36

¹Determined by % reflectance values based on a shelf life of 52 weeks at -17.8°C (0°F).

Distribution Scheme

Day 0-7: Orange juice stored at processing plant.
Day 7-8: Orange juice in-transit to storage facility.
Day 8-53: Orange juice in storage at military facility.

Bottle Waters . . . con't. from p. 304

ready promoting bottled waters as aggressively as they have traditionally pushed alcoholic counterparts. Water tastings and "water of the mouth" efforts are two of the promotions that have been borrowed with success from the wine and beer industry.

Operators can place themselves on the forefront of the bottled water movement by offering a menu of waters that complement each other as well as the restaurant's food. Different mineral and carbonation levels make certain waters more attractive to individuals and more appropriate to certain situations. For example, Perrier's heavy carbonation makes it an excellent aperitif. The lighter sparkle of San Pellegrino goes well with food, and still waters, such as Evian or Mountain Valley, serve as refreshing table waters.

Restaurateurs who leave it to their

customers to discover the differences among the many waters may be doing a disservice to the tasters as well as to themselves. A well-trained staff that can suggest appropriate waters, or a special water menu that lists the merits of each beverage, can be an effective sales tool.

Operators with a large water list will also find it easy to couple ethnic waters with ethnic foods. Badoit, Perrier and Evian can be served with French specialties. Fonte Vella, from the Geron province of Spain, can be paired with Spanish foods. And German meals can be complemented by the sparkling carbonation of Apollinaris or Gerolsteiner Sprudel.

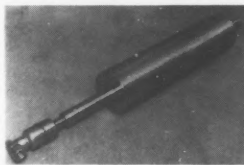
Although carbonated waters generally are considered "more sociable" by the American public, bottled still waters, too, should find more of a place in

restaurants over the next few years. According to John Bergmann of the Mineral Water Company of Canada, "The American consumer has been taught to prefer the carbonated water. But there is definitely a need for a still water, too, that can serve as a refreshing, pure table water." When still water is used as table water, Bergmann adds, the beverage should be served chilled and not with ice cubes made from tap water.

The rising per-capita consumption figures for both still and carbonated water seem to suggest that the public is ready to investigate the subtle benefits of bottled water. As the trends in dining out continue to shift toward items that are light, natural and nutritious, bottled water may become as obvious as accompaniment to a fine meal as good bread or wine.

New Product News

The products included herein are not necessarily endorsed by Dairy and Food Sanitation.



New Pulley for Conveyor Belts

The Dynaloc Corporation announces a self-centering pulley for conveyor belts. It keeps the edges of the belt from fraying due to poor tracking of the belt.

These pulleys are available in stainless steel or any end configuration the customer will have.

Bacteria counts are held to a minimum and eliminates contamination due to frayed belts. The continuous washing by the ports in the pulley provide the cleaning and as the helixes spread outward it removes particle contamination also.

For more information, contact René A. Conrad, Dynaloc Corporation, 1670 S. Amphlett Blvd, PO Box 6130, San Mateo, CA 94403. (415)574-2900.

Please circle No. 283
on your Reader Service Card

Name Change for BBL Microbiology Systems

Becton Dickinson and Company, a Fortune 500 Corporation headquartered in Franklin Lakes, NJ, recently announced the name change of BBL Microbiology Systems, Cockeysville, MD, to Becton Dickinson Microbiology Systems. A division of Becton Dickinson since 1955, Becton Dickinson Microbiology Systems has been marketing products for the microbiology laboratory for over 50 years.

While the division name change reinforces and capitalizes on the strong Becton Dickinson identify, the established BBL trademark will continue to be used in conjunction with product Brand names.

Founded in 1935 as Baltimore Biological Laboratory, Becton Dickinson Microbiology Systems has grown from a modest manufacturing plant producing dehydrated culture media to a manufacturer of over 4,000 different products. The world's largest manufacturer of prepared media, the company also produces and markets differentiation and susceptibility testing products, anaerobic systems and products, reagents, coagulation equipment and supplies, and rapid diagnostic test kits. It also continues to manufacture a broad line of dehydrated culture media for both clinical and industrial applications.

Direct any inquiries to: Dorothy Steltzer, Advertising Media Specialist, BBL Microbiology Systems, PO Box 243, Cockeysville, MD 21030. (301)771-0100, Ext 2304.

Please circle No. 284
on your Reader Service Card

High Temperature Gas Chromatograph Maximum Temperature 520°C

Antek Instruments now offers a High Temperature version of its Model 3000 Gas Chromatograph. This new development allows for the operation of columns, detectors, and injectors up to 520°C, and permits full utilization of newly available High Temperature Capillary GC Columns. The high temperature technology provides for the separation and quantitation of high molecular weight compounds or for samples which are relatively non-volatile, and require temperatures in excess of 370°C to volatilize in a thin film capillary column.

Typical applications include simulated distillation of petroleum fractions containing C₁₀₀₊, triglyceride separations, and analysis of oligomer and low molecular weight polymers.

The Model 3000 Gas Chromatograph features microprocessor control for easy operation, highly sensitive detector options, and modular electronics. Flexible design provides for operation of multiple columns/detectors simultaneously, and allows the user to choose exactly the system needed for specific applications.

For further information, contact: Antek Instruments, Inc., 6005 North Freeway, Houston, TX 77076. (713)691-2265.

Please circle No. 241
on your Reader Service Card

Oxygen Analyzer Features Failsafe Design, Monitors for O₂ Deficiency in Breathable Atmospheres

Teledyne's Model 335 Oxygen Monitor quickly and accurately measures the oxygen concentration in such applications as control rooms, closed atmospheres, critical breathing circuits and other situations that require the failsafe continuous monitoring of ambient air. This AC-powered instrument is provided with a power-fail backup consisting of two NiCad battery packs maintained on a "trickle" charge. Primary power interruption and subsequent battery operation is signalled by illumination of the LO AC panel light.

Range of the Model 335 is 0-25% O₂ with a full-scale accuracy of ±2%. Operating temperature range is +32 to +122 degrees F.

For more information, contact: Teledyne, Analytical Instruments, 16830 Chestnut St., PO Box 1580, City of Industry, CA 91749-1580. (213)283-7181.

Please circle No. 242
on your Reader Service Card

Pressel & Company, Inc., Introduces Compact High Efficiency Commercial Heating and Hot Water System

A Denver-based manufacturing company introduces Enerlogix™, a revolutionary high efficiency heating and hot water system designed to substantially reduce building and operating costs. Pressel & Company, Inc., a publicly held corporation, develops and manufactures a line of energy efficient systems.

Enerlogix offers substantial cost savings over even the newest technologies. This computer-controlled energy management system eliminates the need for a staff boiler engineer. Plus the fuel/air mixture is precisely adjusted second by second to achieve optimum combustion in any climate or altitude for maximum fuel-cost savings.

Substantially smaller than conventional equipment and locomotive type boilers, the Enerlogix System is 57"H x 33"L x 27"W and weighs only 275 pounds. Because of the system's compact size, it saves space shipping costs. It can be installed during the final stages of construction and won't tie up capital for months before lease income is generated. The unit can also be air freighted for less than rail or trucking costs for locomotive boilers.

Enerlogix is available in four computerized-controlled models with power modulation ranges from 35,000 to 600,000 BTU's per hour.

For more product and dealer information contact Pressel & Company, Inc. at 6900 E. Belleview, Ste. 210, Englewood, CO 80111 or call (303)721-7000.

Please circle No. 243
on your Reader Service Card

Tubular Aseptic Processing System

Tubular aseptic processing system features helical configuration of either two tube or three tube, or combinations thereof, in various diameter tubes, which each module being individually tailored to specific process parameters.

Operating on the indirect heating principle, each module has its own specific heating, regenerating or cooling duties, and all tubes are constructed in Type 316ss throughout. Operating pressures can reach as high as 3500 psig, and temperatures over 350°F, with flow rates in excess of 20,000 liters/hour. Units have steplessly variable capacity and turn-down ratios, and are cleaned and maintained.

For more information, contact Stork Food Machinery, Inc., Suite T-19, 3525 West Peterson Ave., Chicago, IL 60659. (312)583-1455.

Please circle No. 244
on your Reader Service Card



PTX-Pentronix, Inc. Introduces Electronic Moisture Balance

•PTX-Pentronix introduces an Electronic Moisture Balance - a highly accurate balance that combines a heater unit with an electronic top loading balance. It is used for rapid measurement of water content using the dry-and-weigh method.

Benefits Include:

- Highly Accurate Weighing - measuring conditions can be adjusted accurately within a wide range.
- Uniform Heating - plate type ceramic heaters emit infrared rays from the entire surface for even heating.
- Longer Heater Life - ceramic heater is more dependable than conventional heaters.
- Unattended Operation - automatic shut down - by detection of dry-end point or pre-set timer - and automatic water content display, allow for decreased operator involvement.

Applications:

- Ceramic, chemical and other industrial materials - including clays, cements, iron ores, pulps, pigments, fibers, chemicals, rubber reagents, adhesives, and desiccating agents.
- Foods and food materials - such as flour, proteins, dairy products, sugars, seasonings, cakes, salts, marine products and feedstuff.
- Pharmaceutical materials - including cosmetic.
- Industrial wastes such as soils, sands and sludge.
- Any materials that do not decompose or evaporate before being dried.

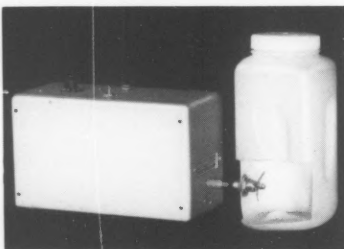
The Moisture Balance is very effectively used for quality control and material testing in factories, as well as research in laboratories.

Optional Accessories:

- EP 40-20 Printer
- RS 232 Serial Output Buffer - attaches to computer for permanent data storage.

For more information please contact: Fred Wheeler, PTX-Pentronix, Inc., 1737 Cicotte, Lincoln Park, MI 48146. (313)388-3100.

**Please circle No. 245
on your Reader Service Card**



New Dairy Program Consistently Kills Major Mastitis-Causing Bacteria

•To better control mastitis, it has been recommended that dairymen use a teat dip and udder wash having the same chemical ingredient.

The Nolvasan® Dairy Program recently introduced by Fort Dodge Laboratories, enable dairymen to use compatible products on dairy cows for two of the most effective steps in the control of mastitis: the washing and dipping of tender udders and teats.

Nolvasan Teat Dip, for post-milking sanitation, has proven through years of extensive field testing to kill bacteria causing bovine mastitis. Nolvasan Udder Wash, recently developed to complement Nolvasan Teat Dip, is the pre-milking sanitizer which aids in the reduction of bacteria from the udder an teats.

Both Nolvasan products contain chlorhexidine acetate formulated with special surface-active substances to kill the major organisms known to cause mastitis, including *Streptococcus agalactiae*, *Staphylococcus aureus* and *Escherichia coli*. The Association of Official Analytical Chemists' Sanitizing Solution Test confirmed that Nolvasan Udder Wash killed 99.99% of the bacteria of the mastitis causing bacteria within 30 seconds.

Although both products are very effective against bacteria, they are also very gentle to teat and udder tissue. Nolvasan has a low tissue toxicity which means minimal cracking, scaling and chapping. Repeated application will not damage or irritate tissues.

Nolvasan adheres to the surface of the udder and teat, where it can remain active in the presence of milk, dirt, fecal matter or other organic materials better than many other antimicrobial agents.

Nolvasan Udder Wash is available in pints (one ounce makes four gallons) and pump gallons (one stroke yields one gallon). Nolvasan Teat Dip is available in pints (makes one gallon and 1/2 gallons (yields five gallons).

For more information, contact your veterinarian for the free Nolvasan Dairy Program brochure or contact Dr. Wm. E. Ryan, Director of Communications, 800 5th Street NW, Fort Dodge, IA 50501. (515) 955-4600.

**Please circle No. 246
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Blendo Flask

•The Blendo Flask is a new product for microbiological analyses that allows blending and incubation to be performed in the same container and diminishes the potential for cross-contamination. A propeller mounted through the container wall is fitted to a detachable motor for blending. The Flask is nontoxic to microorganisms, fully autoclavable, and reusable. It is available in three sizes to accommodate samples from 25 to 375g.

For more information, contact Summit Laboratory Supply 845 E. Johnson St., Madison, WI 53703. (608)256-1260.

**Please circle No. 247
on your Reader Service Card**

New PII Clean Room Increases Protection

•Plastofilm Industries, Inc. located in Wheaton, Illinois, has recently installed a clean room facility that houses three thermoforming lines.

In order to provide the highest standard of cleanliness and control, Plastofilm Industries, Inc., has completed the construction of a new clean room by installing walls of 8" thick cinder blocks, chemically cleaned to remove all residues and contaminants. They were then treated with block filler and finished with two coats of polyamid epoxy paint for a smooth, high gloss finish.

The new high efficiency filtration system HVAC Trane roof top unit, which serves only the clean room, filters and changes the total air every two minutes. Special exhaust systems are situated over the thermoforming units to insure a fume and particle free environment.

Bright, glareproof lighting fixtures provide lighting sufficient to permit detailed inspection of parts prior to packaging.

All materials used on the forming machines are either less steel, chrome, nickel plated or epoxy painted to eliminate any rust or corrosion.

For further information, contact: Rich Partlow, Sales Manager, Plastofilm Industries, Inc., 935 W. Union, Wheaton, IL 60187. (312)668-2838.

**Please circle No. 248
on your Reader Service Card**

Poultry Processors Can Meet Consumers Convenience Needs, Increase Profitability, With Dual-Ovenable Trays

•Poultry processors can provide consumers with an attractive, convenient package for pre-cooked poultry, while increasing per pound profitability, with a new, dual-ovenable poultry tray line from Sonoco Products Company.

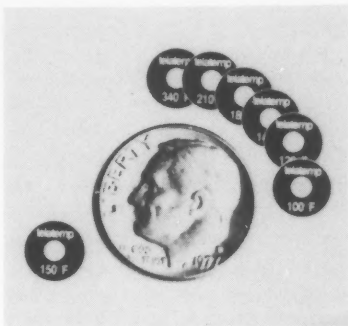
The Oven Easy® tray line provides processors with a package which meets consumers desire for convenient, ovenable-packaged foods. The durable CPET trays are designed to allow consumers to cook and serve precooked frozen or refrigerated poultry products, such as cornish hens and roasters, in the same container. The package can go directly from the freezer or refrigerator to either a microwave or conventional oven and withstand temperatures from -40°F up to 420°F. The thermoformed trays are also stain-resistant and reusable.

Poultry processors can increase profits with the Oven Easy trays since precooked poultry commands a higher per pound price than fresh.

The trays are available in three sizes to accommodate large and medium roasters and cornish hens. In addition, the trays can be manufactured with the processor's logo.

For more information, contact Brad Ross, Product Manager, Sonoco Products Co., Hartsville, SC 29550. (803)383-7000.

**Please circle No. 249
on your Reader Service Card**



FREE SAMPLE - New Microminiature Hot Spot™ Temperature Recorder for Frozen Food Quality Control

*Telatemp is offering a free sample of the world's smallest self-contained thermometer for frozen foods, the new 1% accuracy microminiature 5mm diameter Hot Spot™ self-adhesive temperature recorder. Each recorder contains a sealed heat sensitive indicator which turns permanently and irreversibly from silver to black in less than one second at its rated temperature, which is printed at the indicator window. Available in 10° increments over a temperature range of 100°F to 350°F. Nominal thickness is 0.01".

The Telatemp Hot Spot was designed for to measure small and low mass components anywhere in a process, for design evaluation of electronics under load, and for heat dissipation and energy studies anywhere in the plant where other temperature devices prove impractical. It is ideal as a temperature warranty "tattletale" for small heat-sensitive products in transit and in use. The exposed Hot Spot may be removed for inclusion in test and quality assurance reports. Delivery from stock. Economically priced at \$.95 each for package of 20.

For a free sample and literature contact Telatemp Corp., PO Box 5160, Fullerton, CA 92635. (800)321-5160, in CA (714)879-0160.

Please circle No. 250
on your Reader Service Card



Sanitary Pressure Control System for Food, Dairy and Beverage Industries

*Designed specifically for the food, dairy and beverage industries, Dynisco's 800 series sanitary transducer and model uPC650 pressure

controller combine to provide processors with a complete sanitary pressure control system.

The 800 series sanitary transducers have been certified by 3A to meet the most stringent requirements of the food and dairy industry. These units feature an accuracy of $\pm 0.5\%$ of full scale output, including linearity, hysteresis and repeatability. Wetted surfaces are of 316 stainless steel, with a self-draining pressure sensing diaphragm free of pits, voids and imperfections. The diaphragm can be clean-in-place (CIP) or subjected to full assembly sterilization with saturated steam or water temperatures of up to 250°F (121°C).

These sanitary transducers convert process pressure into a proportional electrical signal and send the input directly to the model uPC659 pressure controllers, which provides clear digital display of pressure, setpoint and deviation. This highly accurate microprocessor-based pressure controller features fully adjustable PID control, with 0-20/4-20 mA control outputs, an accuracy of $\pm 0.2\%$ and three programmable alarms. Its RS232C, RS422 and RS485 serial communications capability allow direct interface with data loggers and computers.

For more information contact Dynisco, Inc., 10 Oceana Way, Norwood, MA 02062. (617)769-6600.

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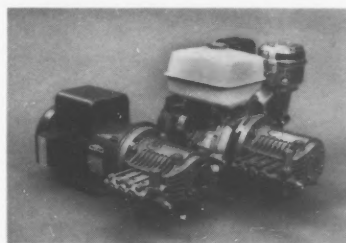
Space-Age Coatings Protect Aluminum and Aluminum Alloys Against Wear, Corrosion, Friction, Sticking, Galling

*TUFRAM® space-age "synergistic" coatings that make aluminum surfaces as hard as steel have been announced by General Magnaplate Corp., Linden, NJ. By combing the hardness of aluminum oxide ceramic and the protection of a fluorocarbon topcoat in a multi-step proprietary process, they impart previously unattainable levels of hardness, corrosion resistance and permanent lubricity to products and parts of aluminum and aluminum alloys. Tabor abrasion tests have shown that the metal "coating", originally developed to protect parts for use in outer space vehicles, has greater abrasion resistance than hard chrome plate or case-hardened steel.

In addition, the TUFRAM process impregnates into the surface of aluminum, providing an unusual degree of permanent lubricity. Coated parts and equipment exhibit longer wear life, and require less maintenance. Treating mating parts which operate by sliding or rotating motion greatly reduces the possibility of galling. Some TUFRAM coatings are USDA approved.

Additional technical data and information in available from General Magnaplate Corporation, 1331 Route 1, Linden, NJ 07036.

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Revolutionary New Super Flow Plunger Pumps

*Cat Pumps announces the expansion of the tremendously successful SUPER FLOW Plunger Pump line. These unique SUPER FLOW pumps eliminate the need for gearboxes, yet provide exceptional performance at direct drive speeds. With the addition of the new "4SF" models, the SUPER FLOW direct drive performance has expanded to 4.5 GPM up to 2500 PSI providing powerful cleaning capabilities from an ultra-compact unit. This revolutionary design is sure to change the shape of the pressure cleaning industry.

Special features common on all SUPER FLOW pump models are:

- Each unit includes a regulatory unloader mounted on the pump to assure pump protection and permit system pressure regulation.
- The patented SUPER FLOW Uniflow design means continuous fluid flow forward through the pump which reduces cavitation risk and delivers exceptional packing life.
- The SUPER FLOW pump also features a unique spring loaded inlet valve and flow throughout solid ceramic plunger providing excellent suction capabilities up to 3600 RPM.
- The SUPER FLOW pump is a low energy consumer — the 1.5 HP unit draws less than 15 amps full load — and a low water consumer — which will hold down operating costs.

For more information contact Cat Pumps Corporation, 1681 94th Lane N.E., Minneapolis, MN 55434. (612)780-5440.

Please circle No. 253
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Heat-seal wheels on medical/surgical product packaging machines are treated with a Magnaplate TUFRAM® coating to extend wear life and prevent excess material from adhering to equipment.

Suspected Nosocomial Influenza Cases in an Intensive Care Unit

Georgia: During November 1987, CDC received reports of three patients and one nurse with suspected influenza infection in a 15-bed medical-surgical intensive unit (MSICU). The index case occurred in a 71-year-old female with diabetes mellitus who was admitted to the MSICU on October 19 and subsequently required mechanical ventilation. Influenza A was identified by fluorescent antibody (FA) staining of tissue culture cells inoculated with an endotracheal aspirate collected on November 11. The patients died on November 14, and influenza virus was identified in lung tissue collected postmortem. The second patient, an intubated 60-year-old woman with chronic obstructive lung disease, had been hospitalized since October 26. Influenza A was identified by FA staining of cell culture inoculation of a lung biopsy specimen obtained on November 23. The same procedure was used to identify influenza A in an endotracheal aspirate specimen collected on November 26 from an intubated 76-year-old man who had been hospitalized since September 28. Further investigation revealed that a nurse who had cared for all three patients was absent from work during the last week of November because of an influenza-like illness. Neither the three patients nor the nurse had received the 1987-88 influenza vaccine. Isolates were not available for confirmation and subtype identification. MMWR 1/15/88.

International Outbreak of Type E Botulism Associated With Ungutted, Salted Whitefish

On November 2, 1987, a 39-year-old Russian immigrant and his 9-year-old son were admitted to a suburban New York hospital with symptoms indicative of botulism. The father's stool specimen contained type E botulinum toxin. On October 23, the father had purchased a whole, ungutted, salted, air-dried whitefish known as either ribyetz or kapchunka from a delicatessen in Queens, New York City. He and his son had eaten the fish on October 30 and 31. On November 3, 1987, CDC received a report the Ministry of Health, Jerusalem, Israel, of five additional cases suspected to be botulism; one case was fatal. The patients had eaten ribyetz purchased in a grocery in Brighton Beach, Brooklyn, New York City, on October 17 and taken to Israel. The fish as well as a serum sample from one surviving patient subsequently yielded type E botulinum toxin.

The implicated fish was distributed in the New York City area by Gold Star Smoked Fish Inc., a firm in Brooklyn. On November 3, the New York City area by Gold Star Smoked Fish Inc., a firm in Brooklyn. On November 3, the New York City Department of Health issued an embargo on the sale and distribution of ribyetz or kapchunka and removed the implicated product from the shelves of stores selling Gold Star products. The public was alerted through news released, and acute care hospitals in New York City and surrounding areas were notified. No additional cases have been identified in New York. However, one additional laboratory-confirmed case of botulism has been reported in Israel. On November 13, the patient 17-year-old female, had eaten whitefish that had been purchased on October 18 at the same delicatessen in Queens associated with the original patients.

Editorial note: Ribyetz, or kapchunka, is an ethnic food consumed in this country primarily by Russian immigrants. It has been implicated as a vehicle for botulism twice in recent years. In 1981, a California man became ill and, in 1985, two Russian immigrants died in New York City after eating the fish. Type E botulism is typically associated with foods of marine origin. The mechanism of contamination of the ribyetz has not been established. However, *Clostridium botulinum* spores can be found in the intestinal contents of fish, and the fact that the fish were uneviscerated may have been important.

The whitefish implicated in this outbreak was produced by one firm and distributed only in New York City. In addition to halting the distribution of the fish officials in New York City and New York State are developing regulations that would in effect prohibit the production and sale of such uneviscerated whitefish. Although refrigeration is recommended, some consumers may be storing the fish unrefrigerated before eating it uncooked. Persons who purchased ribyetz in New York City in October should dispose of any remaining fish in such a way as to make it inaccessible to others.

Public health personnel should be aware of the potential problem, especially for people in ethnic groups known to eat this product. Guidance in treating botulism and testing serum and stool samples for botulinum toxin can be obtained through state or city health departments. Requests for testing specimens of ribyetz can be made through the district offices of the Food and Drug Administration (FDA) or the FDA Division of Emergency and Epidemiological Operations, Rockville, Maryland 20857; telephone number (301)443-1240.

MMWR 12/18/87

Lyme Disease - Connecticut

From 1984 through 1986, CDC received an average of 1,500 reports of Lyme disease annually, making it the most tick-borne disease reported to CDC. The disease takes its name from Lyme, Connecticut, where the full spectrum of illness was first described in 1975. To further study the incidence of disease among its residents, Connecticut conducted a laboratory-based program of surveillance for Lyme disease from July 1, 1984 to March 1, 1986.

Indirect immunofluorescence antibody (IFA) and enzyme-linked immunosorbent assays (ELISA) were used to detect antibodies to *Borrelia burgdorferi*, the spirochete that causes the disease. Serologic testing was offered to Connecticut physicians without cost for all residents with suspected Lyme disease if the serum was accompanied by a case report form. Resident who, in 1984 or 1985, had onset of erythema migrans and/or neurologic, cardiac, or arthritic manifestations characteristics of Lyme disease and a positive serologic test (IFA >1:128 or Elisa >1:160 with a polyvalent conjugate) were included in the study.

Thirty-seven percent of the 3,098 patients reported met the criteria for inclusion in the study (460 in 1984 and 689 in 1985). In 1985, the first complete year of reporting, 66% of the patients studied had onset of symptoms from June through August. Twenty-four percent more patients had onset of symptoms from July through December 1985, than from July through December 1984 (492 compared with 397). Serologic testing was equally available during these time periods.

The incidence of Lyme disease for all Connecticut residents in 1985 was 22/100,000. Town-specific incidences ranged from zero to 1,156/100,000. Towns with the highest incidences were in southern Connecticut, east of the Connecticut River.

Fifty-one percent of patients with Lyme disease were male, and all but one of the 372 patients with known race reported in 1984 were white. Racial information was not gathered in 1985. Age-specific incidence was tabulated by 5-year age groups for patients reported in 1985. The incidence ranged from 11/100,000 for persons aged 20 to 24 years, to 39,100,000 for those aged 5 to 9 years.

Overall, 83% of the patients studied had erythema migrans; 24% had arthritis; 8% had neurologic manifestation; and 2% had cardiac involvement. For those with arthritis, affected joints were the knee (89%), hip (9%), ankle (7%), and elbow (2%). In 1985, persons under 20 years of age were 1.6 times more likely to have arthritis than persons over 20 (7/100,000 compared with 4/100,000), while both groups were equally likely to develop erythema migrans (13/100,000). Seventy-nine percent of patients with arthritis did not report antecedent erythema migrans. Sixty-one percent of patients with erythema migrans reported a tick bite within 30 days of illness.

Sera received before July 1, 1985 (1,447 samples)

were tested by IFA; sera received later (1,579 samples) were tested by ELISA; and 72 patients were reported without a request for serologic testing. For those with erythema migrans, the overall sensitivity of serology was 30% of IFA and 24% by ELISA. When the serum sample had been obtained 21 days or more after onset of symptoms, the sensitivity of the IFA increased to 45% and that of the ELISA, to 32%.

Editorial Note: This study demonstrates the impact of Lyme disease in an endemic area. A comparison of the results with those of a 1977 study reveals an increase of 163% in the incidence of Lyme disease in the eight towns reporting cases in 1977 and shows that, by the mid-1980s, the disease had spread inland from the coastal areas.

Serologic testing for Lyme disease has increased considerably in Connecticut. To trace these changes in testing, the state health department recently compared the annual number of immunoglobulin or IgG-specific serologic tests for Lyme disease ordered by Connecticut physicians from January 1984 through August 1987. The number and results of these tests varied by year as follows: 2,492 in 1984 (30% positivity), 3,770 in 1985 (20% positivity), 5,175 in 1986 (24% positivity), and 6,420 through August of 1987 (14% positivity). This increase may reflect an actual increase in the incidence of Lyme disease or in the recognition of the disease by physicians. It may also reflect the increased availability of the laboratory test or its overuse, especially during the early stage of the disease, when the test is likely to be negative.

The diagnosis of early Lyme disease remains primarily clinical, and physicians should be aware of the limitations of current tests. Sensitivities of the IFA and the ELISA are relatively low during stage one, and the antibody response can be curtailed or aborted by early treatment with antibiotics. In contrast, some research laboratories have reported sensitivities >95% for tests of patients, with stage two or three Lyme disease. Test specifications approaching 100% have also been reported, however, considerable variability may occur among laboratories because the tests are not standardized and are difficult to perform. The sensitivities and lack of standardization of the tests preclude their use alone for routine disease reporting and reinforce the need to develop a reliable and practical case definition surveillance that is not dependent on serologic test results.

Lyme disease is a problem of increasing national and international concern with merits continual and improved surveillance. Clinical studies to further define complications of the disease and to evaluate treatment regimens are needed. Public health education can help alert people to the symptoms of Lyme disease and to the importance of avoiding tick bites. The development of other effective primary preventive measures, particularly vector control, is essential.

MMWR 1/5/88.

Synopsis of Papers for the 75th Annual Meeting

Abstracts of papers to be presented at the 75th Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians, Inc. to be held in Tampa, Fl., July 31-August 4, 1988.

Evaluation and Control of Microbiological Contamination of Conveyor Lubricants, Katalin Rossmoore, Diversey Wyandotte Corporation, 1532 Biddle Avenue, Wyandotte, Michigan 48192.

The biosusceptibility of conveyor lubricants due to environmental contamination with dairy and beverage products and airborne organisms was evaluated in two dairy sites and in the laboratory. Microorganisms included common gram negative and gram positive bacteria as well as species of yeasts and filamentous fungi. The concerns for the lubricant as a vehicle and growth medium for selected dairy product pathogens was evaluated using a strain of *Listeria monocytogenes*. The need for a fast acting, compatible, safe biocide was established. Glutaraldehyde was added to selected lubricant formulations and was found to reduce bacterium levels by >99.99%, and fungal levels by >99.9% in 30 minutes. These results suggest the Glutaraldehyde would successfully control contamination during average residence time (30 minutes) of once through conveyor lubricants during actual operation in the food/beverage and dairy industry.

Growth of *Listeria monocytogenes* at 10°C in milk preincubated with selected pseudomonads, Douglas L. Marshall and Ronald H. Schmidt, Food Science and Human Nutrition Department, University of Florida, Gainesville, Florida 32611.

Sterile whole milk, skim milk and 10% reconstituted nonfat dry milk (NDM) were preincubated for 3 days at 10°C with selected pseudomonads (*P. fragi*, and *P. fluorescens* strains P26, T25, and B52), followed by inoculation with *Listeria monocytogenes* and further incubation at 10°C. Growth curves of *L. monocytogenes* were constructed for each treatment combination and generation times were statistically compared for differences. Results indicated that *L. monocytogenes* did not affect the growth or survival of the *Pseudomonas* spp. However, growth rates of *L. monocytogenes* were significantly ($P < 0.05$) enhanced in milk systems preincubated with pseudomonads. Doubling times of *L. monocytogenes* were reduced by up to 3 h when grown in preincubated milks. The three strains of *P. fluorescens* showed more stimulation of growth of *L. monocytogenes* compared to *P. fragi* in preincubated whole or skim milk but not in preincubated NDM. Milk composition had little effect on the growth of either genera when incubated alone. This study demonstrates that *L. monocytogenes* can grow in the presence of *Pseudomonas* spp. Furthermore, data suggest that the presence of the pseudomonads may enhance the growth of *L. monocytogenes* in milk.

Lethality of Modified Atmospheres to *Campylobacter jejuni* In Turkey Roll, F.A. Draughon*, R. Phebus and B. Lee, Uni-

versity of Tennessee, Department of Food Technology and Science, PO Box 1071, Knoxville, Tennessee 37901-1071.

Campylobacter jejuni, a cause of acute bacterial gastroenteritis, is frequently found in poultry. The objectives of this study were to evaluate survival of *C. jejuni* in turkey roll held under modified atmosphere storage and to determine an optimal culture medium and diluent for recovery of *C. jejuni*. Lethality and variation in recovery rates from various diluents is a major problem in working with *C. jejuni*. Seven diluents were compared as to their ability to maintain viable *C. jejuni* by diluting pure cultures and plating onto *Campylobacter* blood-free agar and Brucella Blood Agar. Cary-Blair diluent (0.1% agar) consistently produced the highest counts of *C. jejuni*, followed by reinforced clostridial medium and fluid thioglycollate USP. The preferred plating medium was blood free *Campylobacter* agar. Of the modified atmospheres evaluated (100% air; 100% nitrogen; 85% nitrogen:10% carbon dioxide:5% oxygen; 40% nitrogen:60% carbon dioxide; and 20% nitrogen:80% carbon dioxide), the 80% nitrogen:20% carbon dioxide atmosphere was most inhibitory to *C. jejuni* and also reduced both aerobic and microaerophilic spoilage microflora in turkey roll stored at 4°C.

Use of Field Computers for State Food Service, Regulatory Food Service Inspections, and Dairy Farm Inspections, Richard W. Peterson, U.S. Public Health Service, Food and Drug Administration, Denver, Colorado.

A field hand-held computer was used in early 1987, to conduct food service program evaluations in Colorado and Wyoming, and a concurrent retail food store evaluation in Wyoming. It is now being successfully used for regulatory food service inspections.

The unit is used as an integral part of the inspection. A note pad, standard inspection report, and pen/pencil is not used.

The inspection information stored in the hand-held computer is transferred electronically to the office computer data base, becoming part of a total ADP system.

The evaluation data was analyzed by a datatrieve software program developed in the FDA Denver office.

Advantages of using a field computer for environmental health inspections:

1. It is relatively easy for a computer illiterate person to use.
2. There is tendency to enter all violations observed directly into the unit as seen, rather than taking notes and transferring to an inspection report.
3. The drudgery of hand written reports is eliminated, since the unit provides legible printed reports in the field.
4. Easy analysis of status of any particular environmental health program/personnel by program administrators, and outside evaluators.

Affiliate Newsletter

Ohio Association of Milk, Food & Environmental Sanitarians Spring Meeting

Forty-five individuals representing state and local regulatory agencies, industry and academia attended the annual Spring meeting held at the Queensgate Holiday Inn, Cincinnati, Ohio. Although the rain was heavy it did not dampen the excellent program as evident by the many questions and comments.

In reference to IAMFES, the Annual Meeting Dates and location were announced along with information about the Lending Library. Members of OAMFES were encouraged to join IAMFES. OAMFES has 100 members as of this date.

The fall meeting is scheduled for October 6, 1988 in Columbus, Ohio. For more information contact Donald L. Barrett, 614-222-6195.

Affiliate Calendar

1988

September 26-28, INDIANA ENVIRONMENTAL HEALTH ASSOCIATION, INC., annual fall meeting will be held at the Hilton in Fort Wayne, IN. The contact person is Rosemarie Hansell, Marion Co. Health Dept., 222 East Ohio St., Indianapolis, IN 46204, (317) 633-9682.

September 27-29, NEW YORK STATE ASSOCIATION OF MILK AND FOOD SANITARIANS annual meeting will be held at Sheraton Inn-Binghamton at Sarbro Square, One Sarbro Square, Binghamton, NY. For more information, contact: Paul Dersam, 27 Sullivan Rd, Alden, NY 14004, (716)937-3432.

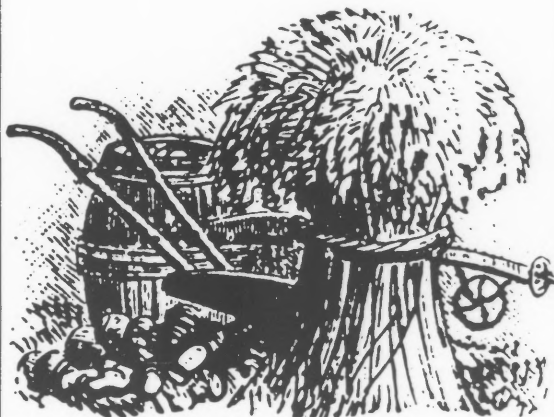
September 29-30, SOUTH DAKOTA STATE DAIRY ASSOCIATION will hold its annual convention at the Holiday Inn, Brookings, SD. For additional information, contact: Shirley W. Seas, Dairy Science Dept., SD State University, Brookings, SD 57007, (605)688-5480.

October 6, OHIO ASSOCIATION OF MILK, FOOD & ENVIRONMENTAL SANITARIANS FALL MEETING, will be held in Columbus, OH. For more information contact D. L. Barrett (614) 222-6195.

October 18-19, CALIFORNIA ASSOCIATION OF DAIRY AND MILK SANITARIANS CONFERENCE, to be held at the Concord Hilton Hotel, Concord, CA. For more information, contact: Jack Coppes, Executive Secretary, PO Box 9234, Whittier, CA 90608, (213) 699-4313.

November 1-3, NORTH DAKOTA ENVIRONMENTAL HEALTH ASSOCIATION ANNUAL FALL CONFERENCE, to be held at the Holiday Inn, Minot, ND. For more information contact Peri Dura (701) 224-2382.

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IAMFES

Special Events Program

TAMPA BY THE BAY TOUR

August 1, Monday

9:30 a.m. - 3:30 p.m.

A guided bus tour of historical Tampa, FL. Visit the University of Tampa campus including the lovely H. B. Plant Museum which was once the lavish Tampa Bay Hotel built in 1890. Shop at Hyde Park in the restored area, drive along Bayshore Blvd. where some of Tampa's finest old mansions are located. Lunch at the Colanade Restaurant over-looking the water. Browse the marketplace at Harbour Island and finally visit Ybor City, Tampa's famous Latin quarter. Here you visit historic Ybor Square located in a cigar factory built in 1886. There will be ample time for shopping in the quaint shops and you will view cigars being handrolled. Cost: Adults \$25.00; Children (12 and under) \$12.50.

A DAY OF ADVENTURE AT BUSCH GARDENS

August 3, Wednesday

9:30 a.m. - 4:30 p.m.

Spend the day at Busch Gardens, The Dark Continent. Visit the fourth largest zoo in the United States, the amusement park, nature shows, and all Busch Gardens has to offer. Including Lunch at the park. Cost: Adults \$25.00; Children (2 and under) \$4.00.

DISNEY WORLD PACKAGES

August 4 & 5, Thursday and Friday

For those interested, 2 or 3 day post-meeting Disney World packages will be arranged by Around the Town Travel Agency, Tampa, FL. Typical packages will include transportation, park admission, and lodging at special rates. Arrangements must be confirmed no later than June 30, 1988.

SOCIAL EVENTS THROUGHOUT THE MEETING

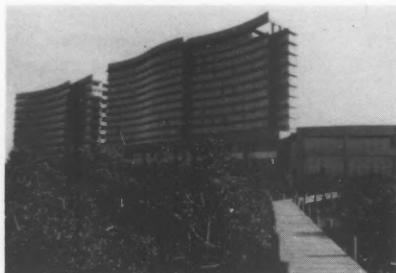
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July 31 - August 4, 1988
Hyatt Regency Westshore
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The Florida Association of Milk, Food and Environmental Sanitarians (FAMFES) will be hosting the 75th IAMFES Meeting, July 31 - August 4, 1988. They cordially invite you to participate in the educational sessions as well as in social functions and special events with old or new colleagues and friends, view the table top exhibits, and enjoy Florida hospitality at the Hyatt Regency Westshore, uniquely located in a 35 acre nature preserve on beautiful Tampa Bay.

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Book Review

Development in Food Flavours, by: G.G. Birch and M.G. Lindley

Developments in Food Flavours is the result of an industry-university symposium held at the University of Reading, England, March 1986. Organized by the National College of Food Technology, the symposium brought together leading world experts in the field of food flavor technology to review and discuss new developments in flavor science. Symposium proceedings were edited by G.G. Birch and M.G. Lindley and published by Elsevier Applied Science.

Initial chapters define flavor and provide background information on the interrelationships between the sense of smell and taste. One chapter is devoted to a relatively new branch of flavor science, umami (the taste of monosodium glutamate and associated compounds). A description of the taste mechanisms of umami is presented. A limited discussion on the flavor of dairy products is provided in chapter 10.

Developments in Food Flavours not only provides a wealth of technical information for the active researcher, but also provides the non-researcher with an awareness of the magnitude of the flavor industry. Synthetic flavorings represent one of the largest classes of food additives. More than 3,000 chemical additives are now used as flavor agents. Public fears concerning the health aspects of food additives has resulted in increased flavor research activities in recent years. While the number of flavor additives may be large the quantity used in foods is extremely small, which diminishes the toxicity aspects.

Individuals involved in food research will find this text to be an excellent review of current flavor technologies. Those involved in process control in the food industry would also find it useful. For field sanitarians and other public health professionals *Developments in Food Flavours* would not make a wise investment due to its focus on a highly limited and technical aspect of the food industry.

Homer C. Emery, R.S., Ph.D.

1865 Bullene Drive
Frederick, MD 21701

Food, Health, and the Consumer T.R. Gromley, G. Downey, and D. O'Beirne

This text was one of three cooperative studies carried out as part of the Commission of the European Communities (CEC) forecasting and assessment in science and technology (FAST) program. The purpose of the publication is to provide information on public policy and technological change affecting the European agriculture and food industry.

In the introduction the authors state that microbiological "food poisoning is the major health hazard in most, if not all, European countries at the present time". Unfortunately, no chapters in the publication are devoted to this critical subject. The major focus has been placed on nutritional and health issues related to consumer attitudes and diet.

A short discussion in chapter three concerning food additives would be of special interest to food sanitarians. The authors recommend "that the use of additives known to cause acute effects be eliminated from foods regularly consumed by children and be prominently labeled or eliminated from other foods". Conclusions and recommendations for future research and study are provided in the following categories: human nutrition thinking, specific nutrients, food and nutrition policy, incentives for dietary change, consumer education, agricultural production, and food processing.

Food, Health and the Consumer would be a useful reference for schools of public health, especially, those with courses in nutrition. With its European focus and the absence of information on foodborne disease it would not be a wise investment for field sanitarians.

Homer C. Emery, R.S., Ph.D.

1865 Bullene Drive
Frederick, MD 21701

Food Microbiology, Fourth Edition William C. Frazier and Dennis C. Westhoff

Food Microbiology First Edition was originally published in 1958 and at that time was designed to be used as a college textbook or as an aid to workers in various food industries. That philosophy is still present in the fourth edition.

This well-written text contains a total of twenty-eight chapters divided into the following six sections:

- Food and microorganisms
- Principles of Food Preparation
- Contamination, Preservation, and Spoilage of Different Kinds of Foods
- Foods and Enzymes Produced by Microorganisms
- Food in Relation to Disease
- Food Sanitation, Control and Inspection

The information contained in the text is very current, enjoyable and easy to read.

If you are in need of a new Food Micro reference, this is one I would recommend. *Food Microbiology* is available through McGraw-Hill Book Company.

Kevin Anderson

Ames, Iowa

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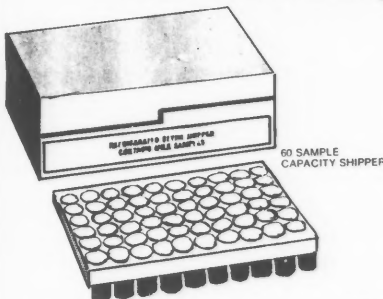
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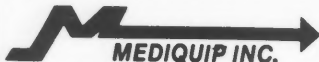
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Effect of Ascorbic and Isoascorbic acids on Survival of *Campylobacter jejuni* in Poultry Meat, B. J. Juven, J. Kanner, H. Weisslowicz and S. Harel, Department of Food Science, Agricultural Research Organization, The Volcani Center, P.O. Box 6, Bet Dagan 50250, Israel

J. Food Prot. 51:436-437

Samples of radiation-sterilized mechanically deboned turkey meat were inoculated with a strain of *Campylobacter jejuni*, stored at 5°C, and viable counts of the test organism determined during a 7-week period. As compared to results obtained with unsupplemented samples, addition of ascorbic acid or sodium isoascorbate (erythorbate) to the meat, at a concentration of 5 mmol/kg, caused an increase in the death rate of *C. jejuni*. Autooxidation of these compounds, during storage of the meat, supports the view that their toxic effect is mainly due to their oxidation products.

Horizontal Spread of Human and Poultry-Derived Strains of *Campylobacter jejuni* among Broiler Chicks Held in Incubators and Shipping Boxes, A. Gavin Clark and Donna H. Bueschgens, Department of Microbiology, University of Toronto, Toronto, Ontario, Canada M5S 1A8

J. Food Prot. 51:438-441

The first chick to hatch and dry in each of a series of incubators was fed a suspension of *Campylobacter jejuni* via a stomach tube and returned to the incubator. Subsequently, all hatched chicks were taken out of the incubators and housed in standard transport boxes for a further 24 h, after which they were killed by carbon dioxide inhalation. The intestinal tracts of all hatched birds were excised, enriched in liquid media and then plated on media selective for *C. jejuni*. *Campylobacter* were cultured from up to 70% of the chicks but this percentage varied with the strain originally fed to the initial chick. The spread of poultry-derived strains was as extensive as that of some human-derived strains, while other human strains showed little tendency to spread amongst chicks. A significant number of hatched, healthy chicks had distended intestinal tracts and showed abnormal gross liver pathology. This symptom was typical of those strains of *C. jejuni* known to be invasive or toxigenic. However, the gross pathology occurred more frequently than did the incidence of viable *C. jejuni* in the intestine of the same chicks, suggesting either that the *C. jejuni* were now mainly unculturable or that some cellular product was responsible for the intestinal pathology. The serotype of each of the strains isolated, was identical to the serotype of the strain initially fed to each banded bird. This laboratory study shows that one infected chick in an incubator potentially can infect other chicks before the birds reached the farm in transport boxes, so accounting for a further source of *C. jejuni* contamination of poultry.

Occurrence of Fecal Coliforms and Enteropathogenic *Escherichia coli* (EEC) in Egyptian Soft Cheese, Ahmed A-H. Ahmed,

S. H. Ahmed and Moustafa K. Moustafa, Department of Food Hygiene, Faculty of Veterinary Medicine, and Department of Bacteriology, Faculty of Medicine, Assiut University, Assiut, Egypt

J. Food Prot. 51:442-444

One-hundred samples of Egyptian soft cheese (Damietta and Kareish) were examined for fecal coliforms and enteropathogenic *Escherichia coli* (EEC). Fecal coliforms and *E. coli* were more than 10³/g in 2% and less than 10/g in 6% of the Damietta cheese samples. Fecal coliforms and *E. coli* existed in 84% of Kareish cheese samples with a level of contamination that ranged from 10 - 10³/g. Fifteen of 46 *E. coli* strains isolated from Damietta and Kareish cheese were serotypes of EEC. They were serotyped as 0125/B15, 025/K11, 0128/B12, 0126/B16 and 0111/B4.

Scanning Electron Microscopic Examination of *Yersinia enterocolitica* Attached to Stainless Steel at Selected Temperatures and pH values, Paula J. Herald and Edmund A. Zotola, University of Minnesota, Department of Food Science and Nutrition, 1334 Eckles Avenue, St. Paul, Minnesota 55108

J. Food Prot. 51:445-448

Attachment of *Yersinia enterocolitica* to stainless steel surfaces at 35, 21, and 10°C was investigated using scanning electron microscopy (SEM). Cells adhered at all three temperatures, but, in general, the greatest number of adhered cells were observed at pH 8 and 21°C. Multi-flagellated cells were noted under these growth conditions. When grown at pH 9.5 and 21°C, fibrils were observed between cells and extending to the stainless steel surface. Fewer cells with flagella were seen at this pH. Adherence may be related to the flagella and any exopolymer surrounding the cells.

Effect of Other Toxigenic Mold Species on Aflatoxin Production by *Aspergillus flavus* in Sterile Broth Shake Culture, Philip B. Mislivec, Mary W. Trucksess and Leonard Stoloff, Divisions of Microbiology and Contaminants Chemistry, Food and Drug Administration, Washington, DC 20204

J. Food Prot. 51:449-451

The effect of *Aspergillus ochraceus*, *A. versicolor*, *Penicillium citrinum*, *P. cyclopium* and *P. urticae* on production of aflatoxin by *A. flavus* when grown together with *A. flavus* in rotary shake culture was investigated. The two aspergilli had no apparent effect on aflatoxin production, whereas all three *Penicillium* species substantially lowered aflatoxin production. The toxins that these penicillia produced when growing in pure culture were not found when the penicillia were grown with *A. flavus*. However, these toxins had no effect on aflatoxin production added to the growth media, nor did the three molds metabolize aflatoxin. When *A. flavus* was grown in both filter- and autoclave-sterilized filtrates of these three species, no aflatoxins were produced, although *A. flavus* grew well. These results suggest that although *A. ochraceus* and *A. versicolor* have no apparent effect on aflatoxin production, *P. citrinum*, *P. cyclopium* and *P. urticae* produce heat-stable, nonfilterable metabolite(s) which inhibit(s) aflatoxin production by actively growing *A. flavus*.

Mycotoxin Formation by *Aspergillus flavus* and *Fusarium graminearum* in Irradiated Maize Grains in the Presence of other Fungi, Raul Cuero, John E. Smith and John Lacey, Department of Bioscience and Biotechnology, Applied Microbiology Division, University of Strathclyde, Glasgow G1 1XW, UK and

Institute of Arable Crops Research, Rothamsted Experimental Station, Harpenden, Herts, UK

J. Food Prot. 51:452-456

Production of aflatoxins B₁ and G₁ and zearalenone by, respectively, *Aspergillus flavus* and *Fusarium graminearum* was measured when they were cultured alone and in pairs with other filamentous fungi in irradiation-sterilized maize seeds, at three water activities (0.98, 0.95 and 0.90 a_w) and two temperatures (25 and 16°C). *A. flavus* was paired with *A. niger*, *A. oryzae*, *Penicillium viridicatum* and *F. graminearum* and *F. graminearum* was paired only with *A. flavus*. Compared to pure culture, aflatoxin production in mixed fungal cultures was decreased at high water activities but was enhanced when water activity was low (0.90 a_w). More aflatoxin was usually produced at 25 than at 16°C. Zearalenone production was markedly decreased at 16°C by the presence of *A. flavus* but was little affected at 25°C. Zearalenone production in pure cultures of *F. graminearum* changed little between 25 and 16°C at any a_w.

Toxicity and Sorbate Sensitivity of Molds Isolated from Surplus Commodity Cheeses, Wei-Yun J. Tsai, Michael B. Liewen and Lloyd B. Bullerman, Department of Food Science and Technology, University of Nebraska, Lincoln, Nebraska 68583-0919

J. Food Prot. 51:457-462

A total of 263 mold isolates were obtained from moldy surplus cheese released from government storage for distribution in the surplus commodity food distribution program in 1984. All of the molds belonged to the genus *Penicillium*, and consisted of four species, *P. roqueforti* (176), *P. cyclopium* (46), *P. viridicatum* (32) and *P. crustosum* (9). About 10% of the isolates were capable of producing known mycotoxins on laboratory media. The mycotoxins detected were patulin, penicillic acid and ochratoxin. Patulin was detected most often followed by penicillic acid and ochratoxin. When tested in chicken embryos, 10.1% of the isolates were toxic (causing 50% mortality or more) when grown on cheese, and 29.7% of the isolates were toxic when grown on rice. There was no correlation between having the ability to produce known mycotoxins and toxicity to chicken embryos. None of the isolates when grown on cheese contained any mutagenic activity in the *Salmonella* mutagenesis (Ames) test. The percentage of isolates showing a high or medium degree of resistance to sorbate were 77, 45, 3.6 and 0 at sorbate concentrations of 0.30, 0.45, 0.60 and 0.90%, respectively. There was no apparent relationship between sorbate resistance and toxigenic properties of the molds.

Production and Characterization of Antibody Against PR Toxin, Ru-Dong Wei and Fun S. Chu, Food Research Institute and Department of Food Microbiology and Toxicology, University of Wisconsin-Madison, Madison, Wisconsin 53706

J. Food Prot. 51:463-466

Antibody against PR toxin was produced after immunizing rabbits with an immunogen prepared by conjugation of PR toxin to bovine serum albumin by a reductive alkylation method. A competitive radioimmunoassay (RIA) was used to determine the antibody specificity. The concentration causing 50% inhibition of binding of ³H-tetrahydro-PR toxin to the antibody by unlabeled PR toxin, tetrahydro-PR toxin, PR imine, eremofortin C (EC), acetyl-EC (Ac-EC), eremofortin D (ED) and eremofortin A (EA) were 7, 10, 5, 15, 50, 500 and 800 ng/assay, respectively; for PR alcohol and eremofortin B (EB), the concentration was greater than 10,000 ng/assay. The practical application of using

this antibody for RIA of PR toxin was tested by spiking cheese with the toxin. PR toxin was then extracted with ethyl acetate, and analyzed by RIA. The overall recovery for 20 samples with 0.1 to 50 ppm of PR toxin was 93%.

Bacteriological Profiles of Human Milk from Individual Donors and Pooled Samples from a Commercial Milk Bank, F. Jane Lin, Harold M. Barnhart, J. Stan Bailey, Nelson A. Cox and Ronald R. Eitenmiller, Food Science and Technology Department and Environmental Health Science, University of Georgia, Athens, Georgia 30602 and USDA - Agricultural Research Service, Richard B. Russell Agricultural Research Center, Athens, Georgia 30613

J. Food Prot. 51:467-470

The bacteriological profiles of human milk samples collected from individual donors under supervised conditions of collection were compared to pooled human milk samples obtained from a commercial human milk bank. Total aerobic counts and total coliform counts of individual donor samples were lower than those of pooled, banked human milk. All of the 200 isolates from ten individual samples were staphylococci with *Staphylococcus epidermidis* predominating (82%). Only 1% of the isolates was identified as *Staphylococcus aureus*. Forty-two percent of the 100 isolates from five pooled samples were staphylococci and all of these staphylococci were coagulase-negative. Three percent of the isolates from the pooled samples were *Streptococcus faecalis*. The remainder (55%) were gram-negative organisms. *S. epidermidis* was the microorganism that was isolated most frequently from either individual (9 of 10) or pooled (3 of 5) samples.

Microbial Decontamination and Weight of Carcass Beef as Affected by Automated Washing Pressure and Length of Time of Spray, J. D. Crouse, M. E. Anderson and H. D. Naumann, U.S. Department of Agriculture, ARS, Clay Center, Nebraska 68933 and Department of Food Science and Nutrition, The University of Missouri, Columbia, Missouri 65211

J. Food Prot. 51:471-474

Carcasses were obtained from 56 heifers that were fed a corn-corn silage diet to determine the effects of automated washing water spray pressures (SP) of 2412 kilopascal (kPa) or 4134 kPa and chain speeds (CS) of 3.9, 5.9 or 7.9 m/min on microflora and weight changes of carcass beef. Carcass beef sides were weighed before washing, 5 min after washing and 20 h after washing and storage at 0°C. *Enterobacteriaceae* and aerobic counts of forequarters and hindquarters were determined before and 20 h after washing. Carcass sides shrank 1.52 kg after 20 h of storage. This shrinkage was similar among all treatment groups. Washing reduced *Enterobacteriaceae* counts 1.57 log₁₀ colony forming units (CFU)/200 cm² and counts of aerobic bacteria 0.87 log₁₀ CFU/200 cm². All combinations of SP and CS were similar in effectiveness of reducing *Enterobacteriaceae* counts. However, the low SP tended (P<0.102) to be more effective in reducing aerobic counts. Forequarters possessed greater (P<0.051) aerobic counts (5.44 vs 5.29 log₁₀ CFU/200 cm²) than hindquarters, but washing eliminated this differential. Automated carcass washing reduced bacterial counts of carcass beef, but within treatments applied, SP and CS had no effect on variation in carcass weight or variation in reduction of microflora. Research indicated that automated carcass washing was a useful procedure for reducing bacterial counts on carcass beef without affecting carcass weights.

Effects of Organic Acids on Thermal Inactivation of *Bacillus stearothermophilus* and *Bacillus coagulans* Spores in Frankfurter Emulsion Slurry, Donald J. Lynch and Norman N. Potter, Department of Food Science, Cornell University, Ithaca, New York 14853

J. Food Prot. 51:475-480

Malic, acetic, citric, lactic and hydrochloric acids were compared for their effects on thermal inactivation of *Bacillus stearothermophilus* and *Bacillus coagulans* spores in a frankfurter emulsion slurry adjusted to specific pH values. For *B. stearothermophilus* at 121°C and pH 5.2 no differences in thermal death rate constants attributable to the acids were noted, but at pH 4.6 a greater inactivation rate was obtained using lactic, citric or acetic acids than malic or hydrochloric acids. For *B. coagulans* at 110 or 105°C and pH 4.5, there was no difference in spore inactivation noted between the five acids, but at these same temperatures and pH 4.2 a faster inactivation rate of this organism was achieved with acetic and lactic acids. Holding the inoculated meat slurry in the acidified state at 4°C for 70 h before heating decreased the thermal resistance of *B. coagulans* spores at pH 4.5.

Acid Production and Proteolytic Activity of *Lactobacillus* Strains Isolated from Dry Sausages, Graciela M. Vignolo, Aida Pesce de Ruiz Holgado and Guillermo Oliver, Centro de Referencia para Lactobacilos (CERELA), Chacabuco 145, 4000 Tucumán, Argentina, and Facultad de Bioquímica, Química y Farmacia, Universidad Nacional de Tucumán

J. Food Prot. 51:481-484

The acid-producing capacity and proteolytic activity of 13 strains of *Lactobacillus plantarum* and 5 strains of *Lactobacillus casei* isolated from dry sausages was determined at different temperatures and at different NaCl concentrations. Most strains exhibited a maximum acid-producing rate at 30°C. According to the acidification rate at this temperature, strains were divided into three rate groups: fast (I), medium (II) and slow (III), with titratable acidity values above 1.7, between 0.7 and 1.4, and below 0.7, respectively. The decrease in pH ranged between 3.1 and 3.95 according to the group to which the strains belonged. The addition of 3% NaCl produced a marked decrease in the rate of acidification for strains in group II, a slight decrease for those in group I and no effect for those in group III. The proteolytic activity of the strains under study reached a maximum at 40°C, with values between 5.2 and 10 mg% tyrosine released. At 30°C, and in the presence of 3% NaCl, the greatest activity (5.4 mg% tyrosine) was observed in *L. plantarum* GV 417 and the lowest (3.4 mg% tyrosine) in *L. plantarum* GV 420. A decrease of approximately 80% in proteolytic activity for all strains was observed in the presence of 5% NaCl.

Comparison of Acridine Orange Staining Using Fluorescence Microscopy with Traditional Methods for Microbiological Examination of Selected Dry Food Products, David Oppong and Birdel H. Snudden, Biology Department, University of Wisconsin - Eau Claire, Eau Claire, Wisconsin 54702

J. Food Prot. 51:485-488

A comparison was made between the acridine orange stain, gram stain and methylene blue stain for direct microscopic counts (DMC) of microorganisms in gravy mixes, spices, cocoa products and baby foods. Bacteria were detected in 96% (45/47) of the samples stained with acridine orange, 64% (30/47) for the gram stain and 66% (31/47) for the methylene blue stain. In most instances, acridine-orange smears showed higher numbers of bacteria than the traditional stains. The staining quality of the acridine orange was better than the conventional stains with bacteria, yeast cells, and mold hyphae fluorescing very differently

from the background. The results indicate that direct staining with acridine orange is better than the traditional methods for estimating bacterial numbers in such foods.

Mechanism of Acid Tolerance by a Yeast Isolated from Spoiled Ketchup, Kent M. Sorrells and Barbara Leonard, R & D Microbiology, Beatrice/Hunt-Wesson, Inc., Fullerton, California 92633

J. Food Prot. 51:489-490

A yeast, isolated from spoiled ketchup, grew at a relatively high (0.8%) concentration of acetic acid. The addition of specific metabolic inhibitors in sub-lethal concentrations to acidified Potato Dextrose broth was used to study the mechanism of resistance of the yeast to acid. Growth in non-acidified medium was not affected by most inhibitors and to a limited extent by DNA and RNA inhibitors. Growth in the acidified medium was affected only slightly by the presence of inhibitors of protein (mitochondrial), DNA and RNA synthesis. 2,4-Dinitrophenol and D-cycloserine were the only inhibitors that inhibited growth in acidified media, suggesting acid tolerance involves an energy requiring system as well as cell walls, possibly transport.

Inactivation of Antibiotics by Heating in Foods and other Substrates - A Review, Agricultural Research Service, USDA, Building 201, BARC-East, Beltsville, Maryland 20705

J. Food Prot. 51:491-497

Heat stability of antibiotics in foods to cooking has been determined by a variety of methods. These include heating in such liquid media as milk, water, buffers and meat extracts, and in solids such as buffered meat homogenates and various sausages. Inactivation of incurred residues in tissues and eggs was also studied. Time and temperature of heating were more easily controlled in liquid media, but results in actual meat products are more indicative of actual cooking processes. Ordinary cooking procedures for meat, even to "well-done" cannot be relied on to inactivate even the more heat sensitive compounds such as penicillins and tetracyclines. More severe heating as for canning or prolonged cooking with moist heat might inactivate the more sensitive compounds.

Risk Associated with Vehicles of Foodborne Pathogens and Toxins, Frank L. Bryan, Food Safety Consultation and Training, 2022 Lavista Circle, Tucker, Georgia 30084

J. Food Prot. 51:498-508

A review of foodborne disease surveillance data from the United States for the years 1977 through 1984 was made to ascertain the relative importance of various foods as vehicles; 1,586 incidents were tabulated. Data are given for all outbreaks and for individual diseases. Foods were classified by category, class and item. Seafoods, meats, poultry and salads were the most frequently implicated categories. The most frequently implicated items were roast beef, ham, turkey, chicken and raw clams. Chinese foods, usually fried rice and Mexican-style foods usually ground or shredded meat or pinto beans were also commonly implicated. Of the salads, potato and chicken salads were identified more frequently than other salads. Mahi-mahi was the most common vehicle of scombrototoxin; amberjack/jack was the most common vehicle of ciguatera toxin; roast beef and turkey were the most common vehicles of *C. perfringens* and salmonellae; ham was the most common vehicle of staphylococcal enterotoxin; potato salad was the most common vehicle of shigellae; peppers were the most common vehicle of botulinum toxin; and fried rice was the most common vehicle of *B. cereus* toxins. Relative risk for each food is discussed in references to assessing hazards and setting food safety priorities.

AMENDMENTS TO 3-A SANITARY STANDARDS FOR FITTINGS USED ON MILK AND MILK PRODUCTS EQUIPMENT AND USED ON SANITARY LINES CONDUCTING MILK AND MILK PRODUCTS, NUMBER 08-17 REV.

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D.9

Valves with powered actuators shall have an open space of at least one inch, clear for inspection, between the actuator and the valve.

D.9.1

Powered actuators shall be readily demountable from the valve and stem.

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(Compression Type Valves)

Number 08-19A

The 3-A Sanitary Standards for Fittings Used on Milk and Milk Products and Used on Sanitary Lines Conducting Milk and Milk Products, Number 08-17A rev. are amended as follows:

FABRICATION - POWERED VALVE ACTUATORS

D.13

Valves with powered actuators shall have an open space of at least one inch, clear for inspection, between the actuator and the valve.

D.13.1

Powered actuators shall be readily demountable from the valve and stem.

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PRODUCTS, NUMBER 08-17B REV.**

(Diaphragm Type Valves)

Number 08-19B

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FABRICATION - POWERED VALVE ACTUATORS

D.17

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D.17.1

Powered actuators shall be readily demountable from the valve and stem.

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PRODUCTS, NUMBER 08-17C REV.**

(Boot-Seal Type Valves)

Number 08-19C

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Calendar

1988

June 20, TESTING IN THE FOOD INDUSTRY, will be held at the Omni Royal Orleans, New Orleans, LA. Contact: Robert S. First, Inc., 707 Westchester Av., White Plains, NY 10604, (914) 949-42548.

July 8-15 RAPID METHODS AND AUTOMATION IN MICROBIOLOGY will be held at Kansas State University. The workshop is certified by American Society for Microbiology for Continuing Education Credits. Contact Dr. Daniel Y.C. Fung, Call Hall, Kansas State University, Manhattan, KS 66506, (913) 532-5654.

July 11-13, AMERICAN INSTITUTE OF BAKING IN MANHATTAN has scheduled an updated seminar entitled "'Dietary Fiber" in Manhattan, Kansas. For more information write to the Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502, (800) 633-5137

July 12-14, BASIC PASTEURIZATION COURSE, sponsored by the Texas Association of Milk, Food and Environmental Sanitarians will be held at the Seven Oaks Hotel, 1400 Austin Hwy, San Antonio. For additional information, contact: Janie Park, TAMFES, PO Box 2363, Cedar Park, TX 78641-2363, (512) 458-7281.

July 31-August 4, IAMFES 75th ANNUAL MEETING, to be held at the Hyatt Regency Westshore, Tampa, FL. For more information, contact Kathy R. Hathaway, IAMFES, Inc., PO Box 701, Ames, IA 50010. (800) 525-5223, in Iowa (515) 232-6699.

August 1-5, BIOTECHNOLOGY: MICROBIAL PRINCIPLES AND PROCESSES FOR FUELS, CHEMICALS AND BIOLOGICALS, sponsored by the Massachusetts Institute of Technology, Cambridge, MA. For further information, contact: Director of Summer Session, MIT, Room E19-356, Cambridge, MA 02139.

August 7-12, 1988 ANNUAL MEETING OF THE SOCIETY FOR INDUSTRIAL MICROBIOLOGY, to be held at the Hyatt Regency, Chicago, IL. For more information, contact: Mrs. Ann Kulback, SIM, PO Box 12534, Arlington, VA.

September 7-8, ANNUAL CONFERENCE OF THE NORTH CENTRAL CHEESE INDUSTRIES ASSOCIATION, South Dakota State University, Brookings, SD. For further information, contact: E. A. Zottola, Sec-Treas., NCCIA, PO Box 8113, St. Paul, MN 55108.

September 11-13, NATIONAL DAIRY COUNCIL OF CANADA ANNUAL CONVENTION, to be held at the Winnipeg Convention Centre, Winnipeg, Manitoba. For more information, contact: Pat MacKenzie, 141 Laurier Avenue West, Ottawa, Ontario, Canada K1P-5J3.

September 11-14, SOUTHERN ASSOCIATION OF DAIRY FOOD MANUFACTURERS, INC. 74TH ANNUAL CONVENTION, to be held at the Boca Raton Hotel & Club, Boca Raton, FL. For more information, contact: John E. Johnson, P.O. Box 1050, Raleigh, NC 27605.

September 13-15, SPECIAL PROBLEMS IN MILK PLANTS COURSE, sponsored by the Texas Association of Milk, Food and Environmental Sanitarians. To be held at the Howard Johnson Plaza So., IH 35 at Woodward, Austin. For more information, contact: Janie Park, TAMFES, PO Box 2363, Cedar Park, TX 78641-2363, (512) 458-7281.

September 14-16, AACC - SENSORY EVALUATION OF FOOD, held in St. Paul, Minnesota. For information, contact: AACC Short Course Program, 3340 Pilot Knob Rd, St. Paul, MN 55121, (612) 454-7250.

September 15-16, WISCONSIN LABORATORY ASSOCIATION ANNUAL EDUCATION CONFERENCE, will be held at the Paper Valley Hotel and Conference Center, Appleton, Wisconsin. Contact: Gary Jansen, Pabst Brewing Co., Box 706, Milwaukee, WI 53201, (414) 223-3574.

September 21-22, UNITED DAIRY INDUSTRY ASSOCIATION ANNUAL MEETING, to be held at the Hyatt Regency Minneapolis, Minneapolis, MN. For more information, contact: Edward A. Peterson, 6300 N. River Road, Rosemont, IL 60018.

September 21-22, FIRST ANNUAL MEHA FOOD CONFERENCE, Problems & Solutions, to be held at the Harley Hotel in Lansing, Michigan. For more information, contact: Ike Volkers, Michigan Dept of Public Health, 3500 N. Logan, PO Box 30035, Lansing, MI 48909, (517) 335-8268.

September 21-22, VIRGINIA DAIRY QUALITY CONTROL CONFERENCE, to be held at the Sheraton Red Lion Inn, Blacksburg, Virginia. Sponsored by the Virginia Dairy Products Association. For more information, contact: J. Russell Bishop, Food Science & Technology, Virginia Tech University, Blacksburg, VA 24061, (703) 961-4921.

September 26-28, INDIANA ENVIRONMENTAL HEALTH ASSOCIATION, INC. Annual Fall Meeting to be held at the Hilton Inn in Fort Wayne, IN. For information, contact: Rosemarie Hansell, Marion Co. Health Dept., 222 East Ohio St., Indianapolis, IN 46204, (317) 633-9682.

September 27-29, NEW YORK STATE ASSOCIATION OF MILK AND FOOD SANITARIANS, to hold annual meeting at the Sheraton Inn-Binghamton, Sarbro Square, One Sarbro Square, Binghamton, NY 13901. For more information, contact: Paul Dersam, 27 Sullivan Rd, Alden, NY 14004, (716) 937-3432.

September 29-30, SOUTH DAKOTA STATE DAIRY ASSOCIATION, will hold it's annual convention at the Holiday Inn, Brookings, SD. For more information, contact: Shirley W. Seas, Dairy Science Dept., SD State Univ., Brookings, SD 57007, (605) 688-5480.

October 3-5, CONFERENCE ON LISTERIA MONOCYTOGENES, will be held in Rohnert Park, California. It is sponsored by The Society for Industrial Microbiology. Additional information can be obtained from: Mrs. Ann Kulback, SIM, PO Box 12534, Arlington, VA 22209, (703) 941-5373.

October 8-9, MICROWAVE PROCESS-

ING OF FOOD, sponsored by AACC to be held in San Deigo, CA. Information can be obtained by contacting: AACC Short Course Program, 3340 Pilot Knob Road, St. Paul, MN 55121, (612) 454-7250.

October 9-13, AACC ANNUAL MEETING, to be held at the Hotel InterContinental San Diego, in San Diego, California. For more information, contact: Raymond J. Tarleton, American Assoc. of Cereal Chemists, 3340 Pilot Knob Road, St. Paul, MN 55121, (612) 454-7250.

October 15-19, MILK INDUSTRY FOUNDATION & INTERNATIONAL ICE CREAM ASSOCIATION ANNUAL CONVENTION & SHOW, to be held at Marriott's Orlando World Center, Orlando, FL. For more information, contact: John F. Speer, Jr., 888 16th Street, NW, Washington, DC 20006.

October 18-19, CALIFORNIA ASSOCIATION OF DAIRY AND MILK SANITARIANS CONFERENCE, to be held at the Concord Hilton Hotel, Concord, CA. For more information, contact: Jack Coppes, Executive Secretary, PO Box 9234, Whittier, CA 90608, (213) 699-4313.

October 31-November 2, FOOD PROCESSING WASTE CONFERENCE, will be held at the Pierremont Plaza Hotel, Atlanta, Georgia. The conference is sponsored by the Environment, Health and Safety Division, Georgia Tech Research Institute. Additional information can be obtained from Ed Valentine or Chuck Ross, Georgia Tech Research Institute, Economic Development Laboratory, Environmental, Health, and Safety Division, Atlanta, GA 30332, (404) 894-3412.

November 2-4, GUM CHEMISTRY AND TECHNOLOGY, will be held in Chicago, Illinois. For information contact: AACC Short Course Program, 3340 Pilot Knob Rd., St. Paul, MN 55121, (612) 454-7250.

November 1-3, BASIC PASTEURIZATION COURSE, to be held at the Viscount-Travel Lodge, 1818 Southwest Freeway, Houston will be sponsored by the Texas Association of Milk, Food and Environmental Sanitarians. For more information, contact: Janie Park, TAMFES, PO Box 2363, Cedar Park, TX 78641-2363, (512) 458-7281.

November 1-3, NORTH DAKOTA ENVIRONMENTAL HEALTH ASSOCIATION, annual fall conference to be held in Minot, North Dakota at the Holiday Inn. For more information contact Peri Dura (701) 224-2382.

November 28-December 1, NATIONAL MILK PRODUCERS FEDERATION ANNUAL MEETING, to be held at the Hilton, Anaheim, CA. For more information, contact: James C. Barr, 1840 Wilson Blvd., Arlington, VA 22201.

November 30-December 1, FIELD AND LABORATORY SAMPLING OF FOOD, DRUGS, AND AGRICULTURAL COMMODITIES, to be held in Arlington, VA. Course size is limited and on a "first come" basis. To register, first verify space availability by calling or writing AOAC Education Dept., 1111 N. 19th St., Suite 210, Arlington, VA 22209, (703) 522-3032.

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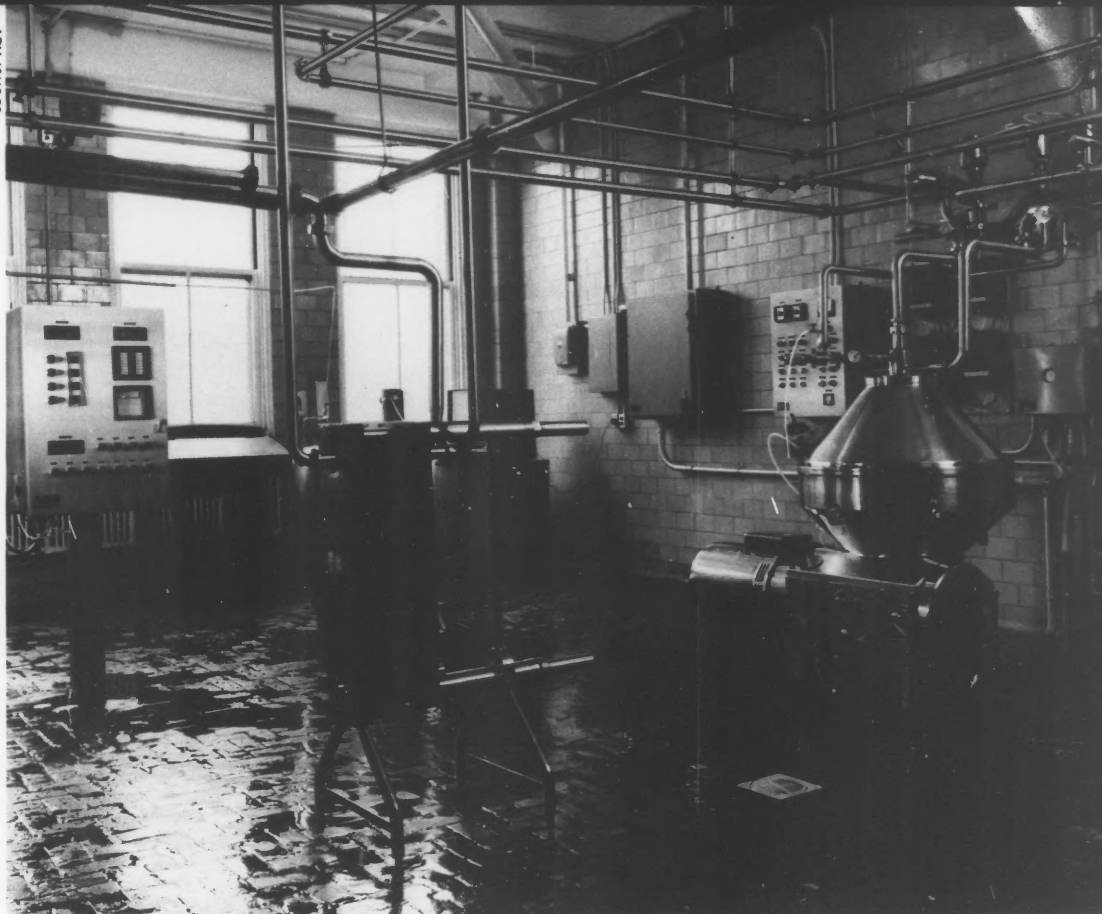
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One Cow, One Cow,
that father bought
for two zuzim,
One Cow, One Cow,

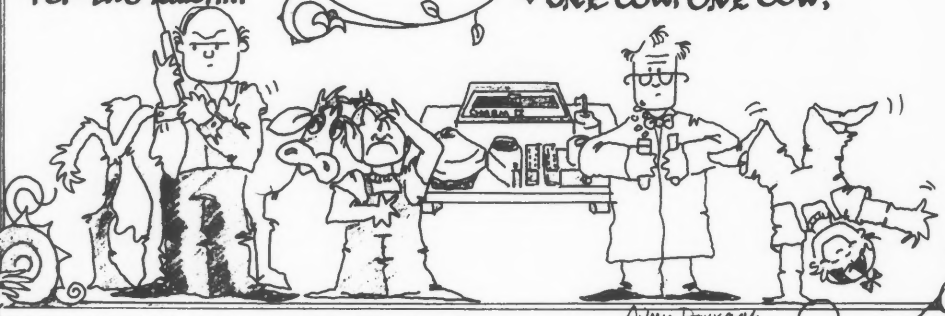
And the bug came
and infected the cow
that father bought
for two zuzim.
ONE COW, ONE COW.

And the tetracycline came
and killed the bug
that infected the cow
that my father bought
for two zuzim.

And the child came
and drank the milk
that contained the tet'
that killed the bug
that infected the cow
that my father bought
for two zuzim.

And the test was needed
to save the child
that drank the milk
that contained the tet'
that killed the bug
that infected the cow
that my father bought
for two zuzim.

And Stanley came
and invented the test
that saved the child
that drank the milk
that contained the tet'
that killed the bug
that infected the cow
that my father bought
for two zuzim.
ONE COW, ONE COW,



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