ISSN:0273-2866
Box 701
Ames, Iowa 50010

May, 1986
Vol. 6, No. 5
Pages 181-228
$6.00

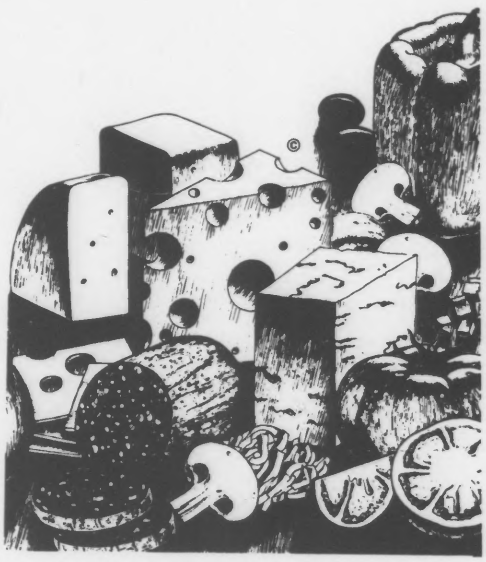
Dairy and Food Sanitation®

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

FDA's Dairy Program Initiatives

The Bacterial Quality of Vacuum Packaged Fresh Fish

Assuring Food Quality



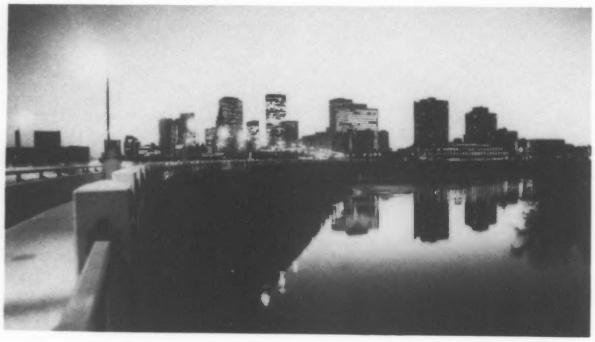
Processed Meat Products and Safety Issues

DRINC Products Undergo Consumer Testing

Should You Participate in the Dairy Herd Buyout?

73rd IAMFES Annual Meeting
August 3-7, 1986
Minneapolis, Minnesota
Registration Forms in this Issue

Minneapolis in 86
Don't Miss It



August
3-7, 1986

IAMFES
73rd Annual
Meeting

Networking

Friends

Education

Don't
Miss
It!

Awards

International Association of Milk, Food & Environmental Sanitarians, Inc.

1986
MEMBERSHIP APPLICATION

All memberships on calendar year basis, Memberships include a subscription to *Dairy and Food Sanitation* or both journals.

BEST BUY Check one:
☐ Membership with BOTH journals $50
(Dairy and Food Sanitation & Journal of Food Protection)
☐ Membership with *Dairy and Food Sanitation* $28

FOREIGN AND CANADA
Add $7 for each Journal ordered for postage

* Student Membership $14 for DFS - $25 for both – please include student verification

1986
SUBSCRIPTION APPLICATION
for agencies, associations, and institutions

All subscriptions on a calendar year basis

BEST BUY
☐ BOTH Journals $110
☐ *Dairy and Food Sanitation* $60
☐ *Journal of Food Protection* $80

FOREIGN AND CANADA
Add $7 for each Journal ordered for postage

1986
PUBLICATION ORDER FORM

3-A Sanitary Standards

( ) Complete set 3-A Dairy Stds ..... ea $30. + $3 postage
( ) Complete set 3-A Dairy & Egg Stds ..... ea $45. + $3 postage
( ) 3-A Egg Stds ..... ea $25. + $3 postage

Five-Year Service on 3-A Sanitary Standards

( ) 3-A Dairy Stds ..... Five years $22.
( ) 3-A Egg Stds ..... Five years $12.
( ) 3-A Dairy & Egg Stds ..... Five years $28.

☐ Procedures to Investigate Waterborne Illness ..... ea $2.25

☐ Procedures to Investigate Foodborne Illness ..... ea $2.00

☐ Procedures to Investigate Arthropod-borne and Rodent-borne Illness ..... ea $2.50

Multiple copies available at reduced price.

Please fill out completely

Name _____ Company Name _____

Address _____

City _____ State/Province _____ Country _____ Zip _____

Phone with area code _____
Job Title _____

☐ Payment enclosed
☐ Mastercard/Visa (circle appropriate card)
Card # _____
Expiration Date _____
☐ Bill me (payment due upon receipt)
☐ Please check here if you would like information on joining your state/province association.

U.S. FUNDS

MAIL ENTIRE FORM TODAY TO:

IAMFES-Dept. B
P.O. Box 701
Ames, IA 50010

Please circle No. 360 on your Reader Service Page

For faster service use your charge card & call 800-525-5223 or 515-232-6699 ask for Sandy

IAMFES Sustaining Members

Alfa-Laval, Inc.
Agri-Group
11100 North Congress Avenue
Kansas City, MO 64153

Alpha Chemical Services, Inc.
P.O. Box 431
Stoughton, MA 02072

Anderson Chemical Co.
Box 1041
Litchfield, MN 55355

Angenics, Inc.
100 Inman St.
Cambridge, MA 02139

Associated Milk Producers, Inc.
830 N. Meacham Rd.
Schaumburg, IL 60195

Babson Bros. Co.
2100 S. York Road
Oak Brook, Illinois 60521

Bio-Lab, Inc.
PO Box 1489
Decatur, GA 30031

Borden, Inc.
Dairy & Services Div.
16855 Northchase
Houston, TX 77060

CLN Industries, Inc.
700 Billings, Suite F
Denver, CO 80011

Dairymen, Inc.
10140 Linn Station Road
Louisville, KY 40223

Darigold
635 Elliott Ave. W.
Seattle, WA 98109

Dean Foods
1126 Kilburn Ave.
Rockford, IL 61101

Difco Laboratories
P.O. Box 1058-A
Detroit, MI 48232

Diversey/Wyandotte
1532 Biddle Ave.
Wyandotte, MI 48192

Eastern Crown, Inc.
P.O. Box 216
Vernon, N.Y. 13476

FRM Chem, Inc.
P.O. Box 207
Washington, MO 63090

GAF
1361 Alps Road
Wayne, NJ 07470

Gerber Products Co.
445 State St.
Fremont, MI 49412

Gist-Brocades USA
P.O. Box 241068
Charlotte, NC 28224

H. B. Fuller Co.
Monarch Chemicals Div.
3900 Jackson St. NE
Minneapolis, MN 55421

IBA Inc.
27 Providence Rd.
Millbury, MA 01527

Kendall Co.
One Federal St.
Boston, MA 02101

Klenzade Division
Economics Laboratory, Inc.
3050 Metro Drive
Suite 208
Bloomington, MN 55420

Maryland & Virginia Milk Producers Assn., Inc.
P.O. Box 9154 Rosslyn Station
Arlington, Virginia 22209

Mid America Dairymen, Inc.
P.O. Box 1837 SSS
800 W. Tampa
Springfield, MO 65805

Naige Co.
P.O. Box 365
Rochester, NY 14602

Nasco International
901 Janesville Ave.
Fort Atkinson, Wisconsin 53538

National Mastitis Council
1840 Wilson Blvd.
Arlington, VA 22201

National Milk Producers Federation
1840 Wilson Blvd.
Arlington, VA 22201

National Sanitation Foundation
P.O. Box 1468
Ann Arbor, MI 48106

Norton Co.
P.O. Box 350
Akron, Ohio 44309

Oxoid USA, Inc.
9017 Red Branch Rd.
Columbia, MD 21045

Penicillin Assays, Inc.
36 Franklin St.
Malden, MA 02148

The Pillsbury Company
311 Second St., S.E.
Minneapolis, MN 55414

Rexham Machinery Group
5501 N. Washington Blvd.
Sarasota, FL 34243

Selberling Associates, Inc.
11415 Main St.
Roscoe, IL 61073

SmithKline Animal Health Products
P.O. Box 2650
West Chester, PA 19380

3M/Medical-Surgical Div.
225-5S-01
3M Center
St. Paul, MN 55144-1000

Universal Milking Machine Div.
Universal Coops, Inc.
Dairy Equipment Dept.
P.O. Box 460
Minneapolis, MN 55440

Walker Stainless Equipment Co.
601 State St.
New Lisbon, WI 53950

Dairy and Food Sanitation (ISSN:0273-2866) is published monthly by the International Association of Milk, Food and Environmental Sanitarians, Inc., executive offices at PO Box 701, 502 E. Lincoln Way, Ames, IA 50010. Printed by Heuss Printing, Inc., 911 Second St., Ames, IA 50010. **Second-class postage paid at Ames, IA. Postmaster: Send address changes to IAMFES, 502 E. Lincoln Way, Ames, IA 50010-0701.**

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

"Instructions to Contributors" can be obtained from the editor.

Orders for Reprints: All orders should be sent to IAMFES, Inc., PO Box 701, Ames, IA 50010-0701. Note: Single copies of reprints are not available from this address; address reprint requests to principal author.

Business Matters: Correspondence regarding business matters should be addressed to Kathy R. Hathaway, IAMFES, PO Box 701, Ames, IA 50010-0701.

Subscription Rates: $60.00 per volume, one volume per year, January through December. Single copies $6.00 each. No cancellations accepted.

Sustaining Membership: A sustaining membership in IAMFES is available to companies at a rate of $300 per year, which includes $100 credit toward an ad in the "annual meeting issue" of the Journal, the July issue. For more information, contact IAMFES, PO Box 701, Ames, IA 50010-0701, 515-232-6699.

Membership Dues: Membership in the Association is available to individuals only. Direct dues are $28.00 per year and include a subscription to **Dairy and Food Sanitation.** Direct dues and both journals are $50.00. Affiliate and International Membership include both journals for $50, plus affiliate dues. Student membership is $14.00 per year, with verification of student status, and includes Dairy and Food Sanitation. No cancellations accepted.

Claims: Notice of failure to receive copies must be reported within 30 days domestic, 90 days foreign. All correspondence regarding changes of address and dues must be sent to IAMFES, Inc., PO Box 701, Ames, IA 50010-0701, 515-232-6699.

Dairy and Food Sanitation

CONTENTS Vol. 6 No. 5 May, 1986

Dairy and Food Sanitation, Vol. 6, No. 5, Pages 184-185 (May 1986)

FDA's Dairy Program Initiatives

Jerome J. Kozak, M.P.H.

Chief, Milk Safety Branch
United States Food and Drug Administration
200 C. Street, S.W.
Washington, DC 20204

As a result of outbreaks associated with pasteurized milk and milk products over the last several years, the Food and Drug Administration has decided that an increased level of effort is necessary for the nation's dairy industry. The following information summarizes FDA's Dairy Program Initiatives.

During April and June, 1985, there were two major illness outbreaks associated with pasteurized fluid milk and a soft Mexican style cheese, in Illinois and California respectively, which received much public attention. This is to provide background information regarding the State and federal findings from the investigation of these outbreaks. This will also announce a dairy initiative to be undertaken by FDA in cooperation with the National Conference of Interstate Milk Shipments (NCIMS) to affirm that conditions that likely contributed to these outbreaks do not exist in other dairies.

The association of illness outbreaks with dairy products did not begin with the April outbreak in Illinois. Over the past few years, pasteurized fluid milk and milk products have been demonstrated to contain pathogenic microorganisms and to have caused small outbreaks of human illness. The most significant outbreaks have been Yersiniosis in Tennessee, Arkansas, and Mississippi in July, 1982; Listeriosis in Massachusetts in July/August, 1983 and in California in May/June, 1985; and Salmonellosis in Illinois in March/April, 1985. In the past few months, additional problems have been encountered with Staphylococcal enterotoxin in chocolate milk in Kentucky and contamination of milk with cleaning solutions in Florida and California. These incidents seem to be occurring with greater frequency and involving larger numbers of affected people. There have also been deaths associated with some of these outbreaks.

FDA has the responsibility under the Food, Drug and Cosmetic Act (FD&C Act) and the Public Health Service Act in assuring the public that the nation's milk supply is uniformly safe and wholesome. FDA fulfills its responsibilities with respect to Grade A dairy plants through a signed Memorandum of Understanding with the National Conference on Interstate Milk Shipments comprised of all fifty States. Under this program, responsibilities for assuring the wholesomeness of Grade A milk products are shared cooperatively between the States and FDA. Responsibilities for non-Grade A dairy products, including cheese, are undertaken separately by FDA and the States under the regulatory provisions of the FD&C Act and State statutes.

FDA has decided that an increased level of surveillance is appropriate for the nation's dairy industry in order to provide assurance that there are no generic public health control weaknesses in the industry and that further disease outbreaks are unlikely. The primary purpose of the increased surveillance effort will be to better identify whether there are any other unrecognized dairy plant processing problems. Special emphasis will be placed on the probable contributing factors identified in the previous disease investigations.

Probable Contributing Factors:

A. Grade A Dairy Products

In reviewing and evaluating the circumstances surrounding the problems with Grade A dairy products, the actual pasteurization process and effectiveness of pasteurization has not been demonstrated to have caused a problem. Instead, the following factors have been found to have been the most probable contributing factors:

1. Post-Pasteurization Contamination

Major changes have been made in the dairy industry regarding the handling of milk after pasteurization and before packaging. There has been a proliferation of pipelines connecting raw and pasteurized storage and holding tanks in the dairy plants. These connecting lines present easy by-passes around the pasteurizer thus permitting post-pasteurization contamination in the event of equipment failure or operator error. The existing equipment controls and operating procedures need to be closely examined to ensure that any potential opportunities are completely eliminated. This should include a comprehen-

These initiatives were previously distributed to State Health Officers, State Agriculture Directors and State Dairy Officials.

sive review and evaluation of critical control points and possible routes of contamination in post-pasteurization blending operations.

2. *Plant Systems Reviews*

In many cases, up-to-date diagrams of all operations within the plant are not available. In addition, it is unclear whether all modifications to existing systems and renovations are being submitted to the State or local regulatory agency for evaluation as to their effect on the entire plant system. It is also unclear whether adequate plan review is being provided to assure that the design of plants incorporates no "cross connections" between pasteurized product equipment and raw product equipment and piping, whether direct or indirect through a portion of the CIP return system, and whether there is adequate protection against product contamination from cleaning and/or sanitizing solutions.

3. *Equipment Review and Evaluation*

In many instances, State inspections and ratings and FDA check ratings have been conducted at a time when the plant is operating. Although this is desirable for evaluating certain parts of the system, this may have inhibited the proper breakdown of equipment and comprehensive inspection of the plant. There is a need to conduct State regulatory plant inspections, State ratings, and FDA check ratings on days or a portion of a day when the plant is not operating, as well as during operating times.

4. *Education and Training of Dairy Industry Personnel*

The lack of awareness of dairy plant employees concerning the public health consequences of improper pasteurization or post-pasteurization contamination has sometimes contributed to conditions leading to dairy plant processing problems. Increased education of dairy plant personnel in the public health aspects of dairy products would be beneficial in reducing the level of human error throughout the industry.

B. Non-Grade A Dairy Products

FDA's inspection of soft cheese manufacturers associated with illness outbreaks or with contaminated products found by FDA has revealed similar problems with respect to potential bypasses around the pasteurizer, post-pasteurization blending, and the lack of education and training. In addition, important contributing factors not found during inspections of Grade A products were found in non-Grade A plants. These include defects in the pasteurization process, widespread presence of pathogenic organisms on environmental surfaces in the process and storage areas, and discrepancies in plant records and pasteurization charts.

Special Initiatives:

In an effort to strengthen the current program and to specifically address the factors of concern as revealed in FDA inspections, special initiatives have been developed under both the framework of the cooperative NCIMS program and FDA's regulatory program.

Under these initiatives, FDA requests that each state:

1. Conduct a statewide meeting(s) with industry to discuss disease problems encountered with Grade A and non-Grade A dairy products, the major areas of concern as previously discussed in this memorandum, and to describe the dairy program initiatives to be undertaken. (As further background information a copy of the report titled "Final Task Force Report - Salmonellosis Outbreak, Hillfarm Dairy, Melrose Park, Illinois" dated September 13, 1985 can be obtained from Jerry Kozak, Chief, Milk Safety Branch, FDA, 200 C Street, SW, Washington, DC 20204.)

2. Intensify their present surveillance efforts in dairy processing plants and conduct comprehensive inspections and ratings to identify any previously unrecognized critical non-conformities and to take appropriate State corrective action.

Nationally, FDA will:

1. Conduct intensified check ratings in every IMS pasteurization plant within the next few years. The expanded check rating will specifically provide for the following:

- scheduling so that a portion of the check rating time is spent during "down" times or days to allow for a more thorough review and breakdown of equipment;
- more thorough review of records, such as HTST charts, CIP charts, sampling data and product sources;
- more comprehensive evaluation of the piping flow and delineation of pasteurized and raw product lines and CIP lines;
- more thorough evaluation of plants for cross connections between raw, pasteurized and CIP lines;
- intensified evaluation of critical control points and monitoring devices for post-pasteurization contamination opportunities;
- more thorough review of cleaning and sanitizing procedures; and
- more comprehensive evaluation of pasteurizing equipment.

2. Conduct intensified inspections under the FD&C Act in non-Grade A dairy processing firms over the next few years.

3. Incorporate within FDA check ratings and inspections a microbiological surveillance program designed to detect pathogenic contamination of finished products.

4. Intensify and upgrade present training and standardization of federal and state milk specialists, rating officers, and sanitarians.

5. Tabulate and analyze results of the FDA check ratings and inspections and prepare national reports on the status of NCIMS pasteurization plants and non-Grade A processing plants.

FDA has met with representatives of the National Conference on Interstate Milk Shipments, who are supporting the need and nature of the initiatives. The Agency will continue to work closely with the states, the Conference and the dairy industry to monitor the effectiveness of these efforts.

Dairy and Food Sanitation, Vol. 6, No. 5, Pages 186-193 (May 1986)

Processed Meat Products and Safety Issues

Curtis L. Kastner* and Donald H. Kropf

Department of Animal Sciences & Industry
Kansas State University
Manhattan, KS 66506

The application of meat processing practices had its beginning in antiquity. The application of meat processing techniques certainly contributed to the dietary emphasis of early cultures. The accidental discovery of beneficial practices such as salting, drying, and cooking enhanced the flavor of meat, but more importantly made it possible to store this nutritious commodity. Even though early applications of meat processing techniques were crude by current standards, we still capitalize on those positive experiences. The continued use of processed meats throughout history testifies to the utility of these products *(1)*.

Because of the diligent efforts of many who have sought to improve the food supply, we have a good understanding of meat processing technology and how meat is affected by current processing practices. Nonetheless, there is still much to be learned about the science and technology of processed meat and the effect the product has on the well-being of consumers. Questions have been raised about the safety of many food products, including processed meats. The objective of this publication is to summarize the information about the factors that may influence the safety of processed meat products.

Why Process Meat?

Early meat processing techniques effectively preserved the meat supply when compared to those products that were not salted, smoked, and/or cooked. Today we still realize this benefit from processed meats. However, processing methods also provide a variety of flavors which compliment the total meat product mix. Processed meats are convenient and easy to prepare, lend themselves to portion control, generally have little waste, and frequently are precooked by the processor or are processed in such a way that cooking is not required before consumption. For the consumer, processed meat products also save on labor and energy while allowing the realization of the nutritional contribution of meat *(1, 2)*.

What are Processed Meats?

Even though the term processing may mean any manipulation or treatment of meat, we have chosen to define the scope of processed meats as indicated below.

Commercially processed meats in the U.S. normally involve beef, pork, lamb, chicken, turkey or fish. However, any animal that is normally used for human consumption can be manufactured into processed meat products, but must meet the inspection requirements of regulatory agencies before it can be sold commercially. Processed meats may exist as whole pieces (i.e. hams) or be subdivided (ground, chunked, flaked, chopped, etc.) and then restructured to yield a finished product such as a finely ground sausage (i.e. bologna), coarsely ground sausage (i.e. salami), restructured roast beef or restructured bacon-like beef or pork products. Whether whole or restructured, the meat may be subjected to smoking and/or heating to achieve precooking, fermentation and drying. Ingredients such as sweeteners, water, nitrate and/or nitrite, phosphates, erythorbate or ascorbic acid, and a variety of seasonings may be added. Variety meats such as liver and heart add excellent nutritional qualities. Non-meat extenders like soy protein and non-fat dry milk powder also may be incorporated to improve texture and moisture and fat binding properties. Mechanically separated (deboned) meat may also be included in these products. Even though many of these ingredients and processes preserve the product, that may not be their only function. Processes such as chilling, freezing, canning, drying, and irradiation may also be used to facilitate preservation. Casings made from cellulose, collagen, cloth and plastic, and natural casings, such as hog intestines, may be used to contain and shape meat during processing. Cans and laminated retort pouches provide excellent packages during processing and marketing. Many processed meat products are vacuum packaged in flexible films after processing to improve their shelf life without subjecting the product to the texture-deteriorating, high temperatures necessary to can or retort "shelf-stable" products *(1)*.

The ingredients and processes mentioned above are not all inclusive and not all are applied to all products; consequently, the vast number of combinations of ingredients and processes result in a great variety of processed meat products. Most of the ingredients and processes serve more than one useful function. They may enhance palatability and appearance, facilitate processing and marketing, and contribute to preservation thus promoting the safety of the product. Because some processes and ingredients have caused safety concerns, the meat industry, regulatory agencies, and consumers have been placed in the position of making risk-benefit decisions. Users of the following information should realize that continuous research efforts certainly will add to our knowledge about the safety of processed meats and may provide the basis for new recommendations in the future. *(3).*

Ingredients Used in Processed Meat

Processed meats are manufactured from carcasses and ingredients that have been inspected and approved by the Food Safety and Inspection Service, Meat and Poultry Inspection Division of the United States Department of Agriculture (USDA) or state inspection programs that have been approved by USDA as meeting Federal standards. Imported products are allowed to enter the domestic market only if the exporting country's overall inspection program meets USDA standards, and if the particular plant in that country is certified by USDA. Plants are reviewed periodically by USDA personnel to insure that standards are maintained. When the product reaches this country, USDA personnel reinspect it. The USDA program includes inspection of not only raw materials, but the total meat processing operation. Effectiveness of the program for both domestic and imported products is reflected by an excellent public health record *(2, 3).*

Even with the best inspection and handling procedures, one should expect fresh meat, like other foods, to be contaminated with some microorganisms. This contamination normally will be confined to the surface of meat unless the surface has been penetrated. For example, if processed meats are injected with a curing solution, boned, or subdivided during processing, the surface is penetrated and the interior of the product may also become contaminated. Consequently, processed meats should be handled as a perishable commodity even though their normal shelf life is somewhat longer than non-processed meats. Processed meats frequently are cooked during processing, destroying many of the microorganisms found on meat. However, one should not consider those products shelf-stable for an indefinite time period or consider them stable at room temperature. Recontamination of the cooked product must be minimized because potentially pathogenic microorganisms may flourish in the absence of the normal microbial flora on fresh meat. Even though processed meats are normally more shelf-stable than non-processed products, they should be handled carefully to insure their safety *(4).*

Only high quality raw materials that have met the inspection requirements and are properly handled during processing should be utilized. Processing should not be expected to correct deficiencies in raw materials.

Salt. An estimated 14 percent of the total dietary sodium comes from red meat, poultry, and fish. The major source of sodium in meat is processed products derived from those species. If no salt is added, these products are relatively low in sodium (usually less than 100 milligrams per serving of red meat) *(5).*

Salt (sodium chloride) is added to virtually all processed meats. Without its addition the typical characteristics of these products would be difficult or impossible to attain. The salt level in most processed meats is 2 to 3 percent; a few products, such as country cured hams, have levels over 4 percent *(1).* Historically, added salt levels were higher to be more effective in preserving the product in times of less refrigeration. However, in today's processed meats salt still contributes to preservation as it acts synergistically with other ingredients and processes to delay microbial growth and spoilage. Even though research has shown that the salt levels used in processing some products could be reduced up to 25 percent without affecting the functional properties of the product, this practice should be carefully evaluated for its effect on preservation and microbiological safety.

Besides contributing to preservation, salt is used to extract proteins from meat which bind the meat particles together. Thus, a boneless ham resembles an intact piece of meat, a product like bologna does not break apart upon slicing, and pieces of meat can be restructured into products that resemble intact roasts, steaks, and chops. Additionally, salt contributes to the characteristic flavor of cured meats. Extensive substitution of other salts (i.e. potassium chloride) for sodium chloride is not widely practiced by industry because of adverse effects on product flavor *(5).*

Per capita consumption of sodium chloride from all food sources is estimated to average 10 to 12 grams per day. Because high sodium intake has been associated with the development of hypertension in some individuals (10 to 20 percent of the population), moderation in salt intake for the entire population is advocated by some. The Food and Nutrition Board of the National Academy of Sciences has recommended that sodium chloride intake be reduced to 3 to 8 grams per person per day. Of the 10 to 12 grams of sodium chloride consumed daily, approximately 30 percent comes from discretionary use (salt shaker), 30 percent is naturally present in unprocessed foods, and 40 percent is added during processing. To achieve the proposed goal of 3 to 8 grams of sodium chloride per day, the consumer must add less discretionary salt or consume less processed food, or both, and/or the food processors must add less salt during processing *(5, 6).*

A prudent, balanced diet of a non-hypertensive individual can include

processed meat (Table 1). Individuals on mild sodium restriction (3,000 milligrams sodium per day) or moderate sodium restriction (2,000 milligrams sodium per day) possibly may include processed meats in the diet, but they should be selective. Most agree that consumption of processed meats is incompatable with therapeutic, low sodium diets *(3, 5)*.

Nitrate/Nitrite. Historically these ingredients were added inadvertently to processed meats as contaminants of unpurified salt. Currently, sodium nitrite usually is added to processed meats; sodium nitrate is still allowed to be added to a few products that require an extensive curing period. The amounts of these curing ingredients that can be added are specified by product and closely regulated by USDA. Original regulations specified that nitrate and nitrite, either singularly or in combination, could not exceed 200 parts per million (ppm) in the finished product. More recent regulations have significantly reduced the allowable ingoing levels to 50 to 156 ppm. Additionally, processors voluntarily have sought to further reduce residual nitrite levels in the finished product. However, concern has been voiced that nitrite levels not be lowered beyond the effective, protective level required to control microbial growth.

Nitrate, when used, is converted to nitrite through microbial action. Nitrite is then reduced to nitric oxide, which reacts with meat pigments to form the cured color of processed meats and contributes to the flavor of the product. These curing agents reduce the incidence and severity of rancidity and warmed-over flavors in reheated products. Additionally and most importantly, they inhibit the growth of many food spoilage organisms and potentially pathogenic microorganisms, including the outgrowth of spores of *Clostridium botulinum*, the organism causing potentially fatal botulism food poisoning. Considering the broad spectrum of the effects of nitrate and nitrite, no single chemical has been identified that can replace them.

Nitrite can react with nitrogen-containing compounds to form compounds called nitrosamines which, at certain levels, have been shown to produce cancer in test animals. The high-temperature cooking of bacon, and especially its overcooking, can result in the formation of small amounts of nitrosamines. USDA regulations require that sodium ascorbate (a form of vitamin C) be added at 550 ppm along with the nitrite (120 ppm and more recently down to 100 ppm with other protective measures) to bacon. Ascorbate is a blocking agent that effectively reduces the formation of nitrosamines during cooking. Only under unusual conditions will nitrosamines form in other processed meats containing nitrite.

Cancer in humans has not been shown to be due to exposure to nitrosamines. Animals fed large quantities of nitrite-cured meats have not shown an increase in tumors or cancer. Even so, it would be prudent to minimize our exposure to nitrosamines, nitrate, and nitrite. Certain occupations (i.e. tire factory worker) and activities (i.e. smoking) expose individuals to nitrosamine levels far in excess of what one would obtain from a "normal" daily consumption of crisply fried bacon.

Nitrite also may react with compounds to produce nitrosamines in the body. Estimates indicate that natural body processes alone expose man to 100 to 1300 times more nitrosamine than the daily consumption of nitrite cured products *(3)*. The level of nitrite ingested from cured

TABLE 1. *Sodium content of selected processed meats.*

Item	Portion		Sodium	
	Size	Weight, grams	Milligrams in portion	Milligrams per 100 grams
Beef bologna	one slice	23 grams	230	1,000
Corned beef loaf, jellied	two slices	57 grams	558	1,032
Lebanon bologna, beef	one slice	23 grams	359	1,560
Pork bacon (cooked)	two slices	14 grams	274	1,957
Pork ham	---	85 grams	1,114	1,311
Pork bologna	one slice	23 grams	272	1,183
Pork bratwurst	one link	85 grams	473	557
Ham, chopped, canned	one slice	21 grams	287	1,367
Ham and cheese loaf or roll	two slices	57 grams	762	1,337
Polish sausage, pork	---	28 grams	248	885
Pork sausage, fresh cooked	1 patty	27 grams	349	1,292
Salami, dry or hard, pork	1 slice	10 grams	226	2,260
Chicken frankfurter	one frankfurter	45 grams	617	1,371
Turkey bologna	one slice	28 grams	498	1,779
Turkey ham, thigh meat	2 slices	57 grams	565	991
Pepperoni, pork, beef	1 sausage	6 grams	122	2,033
Salami, cooked, beef and pork	1 slice	23 grams	245	1,065
Vienna sausage, canned, beef and pork	1 sausage	16 grams	152	950

Adapted from: Composition of foods, sausages and luncheon meats, raw, processed, prepared. Revised 1980. Agriculture handbook No. 8-7. U.S. Dept. of Agric. Science and Education Administration. Washington, D. C. and (6).

meats is well below the level required to induce nitrite toxicity, and the formation of nitrosamines in the body have not been shown to produce cancer in man. Nitrate and nitrite also are produced by natural body processes. Also many foods such as vegetables contain large amounts of nitrate and result in the production of large quantities of nitrite in the saliva, which is continually swallowed. Estimates have shown that an individual's exposure to nitrite due to the average consumption of processed meats constitutes 2 to 3 percent of the total exposure. Based on average consumption rates, one's exposure to nitrite and nitrosamines would remain nearly the same whether or not nitrite-cured processed meats were part of the diet.

Elimination of nitrite to avoid nitrosamines and nitrite toxicity would raise another serious safety concern, botulism. Therefore, reduction in the use of nitrite and nitrate should be evaluated carefully as should new information about the safety of these compounds *(3)*.

Other Additives. Other food grade additives are incorporated into processed meats to improve such factors as the binding of meat particles, yield, color development and stability, processing characteristics, shelf life, and flavor. The decision to allow an additive is based on the best available information on its safety and effectiveness.

Additives such as cereal, soy, and milk products may decrease formulation cost as well as contribute protein to the product. Their use in processed meat is limited to 3.5 percent or less, and their presence is clearly stated on product labels. Incorporation of additives such as phosphates, ascorbic acid (or erythorbate) is regulated by USDA or the Food and Drug Administration (FDA), or both. Only small quantities of these additives are allowed in the finished product. They are also approved for, and are found in, numerous other food products. FDA commissioner and director reports indicate that of all potential food hazards, food additives are the least significant, and there is no evidence of sickness or death due to additives currently used in food from animals *(1, 2)*.

Processing Methods

Mechanically processed meat. Mechanical deboning is an inexpensive method of recovering meat attached to bones. In this process, finely ground meat and bone are forced against a slotted face plate with meat (lean and fat) and some marrow passing through the openings, thus being separated from broken or coarsely ground bone. Another system uses extreme mechanical pressure to force soft tissue (lean and fat) from bone. Because many processed meats are finely subdivided, this product may be used to good advantage. For poultry products there is no limit to the amount of mechanically processed poultry meat that can be added, but for red meats the maximum amount of mechanically processed beef, pork, or lamb meat is limited to 20 percent of the meat portion. The maximum calcium content for mechanically processed red meat is 0.75 percent, which limits the bone content to 3 percent.

Some contend that these products contain bone fragments and trace elements such as fluoride in amounts that may pose a health hazard. However, when properly processed, bone particle size does not pose a problem. Because of the presence of marrow and small amounts of bone, mechanically processed meat contains additional iron and calcium that is readily absorbed and utilized by the body. Even though fluoride may prevent tooth decay, excessive amounts may cause discoloration of children's teeth. Consequently, use of the mechanically processed product is not permitted in baby, toddler, or junior products. Many foods naturally contain more fluoride than meat products which incorporate mechanically processed meat. In a balanced diet the fluoride content in that product may prove beneficial in preventing tooth decay. Previous labeling laws which required a notation on the label that the product contained a percentage of ground bone due to the incorporation of mechanically processed red meat, have limited the use of this product by many processors. The lack of similar labeling for mechanically processed poultry has encouraged its widespread use in processed poultry products.

The cholesterol content of mechanically processed meat is similar to that of hand boned meat. This product also has an excellent protein quality and content (14 percent or more), and if used in appropriate amounts, it adds to the palatability of processed meats. Mechanical processing makes these benefits available at a very economical cost *(3, 7)*.

Smoking. Like many other meat processing practices, smoking has been practiced since the beginning of recorded history. The highly smoked products of the past have largely given way to milder smoking methods which have reduced, but not eliminated, the effectiveness of smoke as an inhibitor of surface microbial growth. Smoking does not eliminate all microbial growth, but serves as a microbial growth inhibitor and is most effective when used in combination with other preservation techniques. Smoke also protects fat from rancidity, contributes to the characteristic color, and creates unique flavors in processed meats. Smoking also aids in processing, for example, by aiding in the removal of casings from sausages.

There is no evidence that the consumption of smoked meats increases the incidence of cancer. However, wood smoke contains compounds that have been shown to be carcinogens in test animals. The carcinogenic compounds found in wood smoke are removed from liquid smoke, which is produced from condensed wood smoke. Liquid smoke is used widely in industry and not only avoids many of the questionable compounds found in wood smoke, but eliminates virtually all the emissions associated with burning wood or sawdust *(3)*.

Fermentation. Some processed meats have microbial starter culture

added to achieve fermentation to enhance preservation and create a unique "tangy" flavor due to the production of lactic acid. Because of the apparently safe long historical application of this practice, fermented products do not present a serious safety concern. Many other food products including cheese, bread, sauerkraut, and soy sauce are the result of microbial fermentation. Fermentation is known to inhibit the growth of spoilage and pathogenic microorganisms and fermented meats have enjoyed a good safety record. Even so, recent toxicological studies have shown that the fermentation process can produce substances which may aggravate hypertensive conditions in certain individuals. Carefully controlled fermentation processes and starter cultures are being used to minimize toxicological concerns about this process *(8)*.

Cooking. Cooking of foods, including processed meats, may yield varying quantities of toxic compounds and may reduce nutritional value depending on the product characteristics, cooking method, and severity and time of cooking. This should be balanced against the beneficial effects of cooking on food safety, increased nutrient availability, palatability, shelf life, and convenience. Cooking destroys some toxic compounds and nutritional inhibitors, reduces the numbers of spoilage and pathogenic microorganisms, and, if sufficient, destroys parasites. Nonetheless, cooking beyond the point needed to realize the beneficial effects of cooking should be avoided *(10)*. Also, microbial recontamination of cooked products should be avoided as potential pathogens may flourish in the absence of the normal microbial flora on meat. Pre-cooked meat products such as beef roasts are increasingly being prepared for institutional use, especially the fast food industry. The products generally are pre-cooked to a rare state, then are chilled and frequently vacuum packaged. Pre-cooked meat products offer the advantages of closely predictable yield and rapid warming for service.

Cooking time and temperature of roasts, which is critical to microbial safety, is carefully controlled. For example, an internal temperature of 145°F must be reached, or longer times at lower temperatures are required (i.e. holding 8 minutes at 142°F, or 12 minutes at 140°F) to control potential pathogenic microorganisms. Refer to the section on trichinosis for additional information on the use of appropriate cooking to control this parasite found in some pork.

Pre-cooked products should be carefully handled to avoid recontamination and incubation of potential pathogenic and spoilage microorganisms. These problems are most serious with repeated warming and chilling. Canning subjects meat products to sufficient heating to control pathogenic and spoilage microorganisms. The sealed container prevents recontamination and conditions favorable for the growth of microorganisms. Canning is highly effective as long as the processing temperature and time recommendations are carefully followed and "leakers" are avoided. Canning can cause undesirable meat flavors, but these are avoided by incorporating materials such as cereals or vegetables, phosphate, or nitrite into these products. Extreme heating during the canning process may cause high losses of heat labile nutrients and can result in undesirable meat texture.

Development of a flexible retort pouch, as a substitute for cans, results in a reduced package diameter. Therefore the temperature of the center of package contents can be maintained for the minimum necessary time to control microorganisms without overcooking in other areas in the pouch as drastically as for the cylindrical shape of a can.

Irradiation. Subjecting food products to radiation energy, normally in the form of gamma radiation, significantly improves the shelf life and stability of food products. The food product does not come in contact with the radiation source and is subjected only to the emitted radiation energy. This does not render the product radioactive if cobalt or cesium are used as the energy source. Also, if maximum energy levels of electron beam and X-ray sources are restricted they do not result in induced radioactivity. Safety guidelines for preventing induced irradiation of foods have been established.

During irradiation there is only a slight increase in the product temperature; thus, changes in product flavor, odor, color, texture, and nutrient quality may be minimized compared to preservation by heat treatment methods. Irradiation treatment sufficient to produce radiation-sterilized foods will destroy microbiological, viral, and parasitic organisms. Depending on the extent of irradiation, freezing and vacuum packaging prior to irradiation may be required to minimize undesirable changes in the sensory and nutritional characteristics of the product. The nutritional value of properly irradiated foods is at least as high as those preserved by other means such as freezing, canning, and drying.

The Institute of Food Technologists, Expert Panel on Food Safety and Nutrition *(14)* reported that extensive studies have shown that properly applied irradiation does not form toxic compounds in the food products tested. This is supported by animal feed trials and chemical tests. Because of the effective preservation due to irradiation, processed meats could be treated routinely to further enhance their relatively good shelf life characteristics.

Parasites, Molds

Trichinosis. Pork may be infected with the nematode *Trichinella spiralis*, which is the primary parasite of concern in processed meats. U.S. processors do not routinely check pork carcasses for Trichina infestation at slaughter, as many European countries do. The U.S. industry depends on careful control of commercially processed products and public education on proper cooking of fresh pork. In 1966-70, grain-fed U.S. hogs had an infestation inci-

dence of 0.125 percent and garbage-fed hogs a 0.5 percent incidence. In 1980 the U.S. began requiring treatment of garbage before feeding. Cooking procedures for fully cooked processed pork or products containing pork are monitored by USDA, and, if properly applied, are very effective in controlling this parasite. Pork to be used in cured products that is not frozen, salted, or dried under specified conditions to destroy *Trichinella spiralis,* must be fully cooked to at least 137°F during processing to destroy the parasite. Higher internal temperatures are routinely required during processing to insure a margin of safety. Uncooked processed products made from pork subjected to well established freezing, salting, or drying procedures may be safely consumed without cooking. The recommendation for products containing pork is that those that are not fully cooked or otherwise processed according to inspection regulations be cooked to 171°F before consumption. When properly processed, pork products have an excellent safety record *(11, 12).*

Molds. Molds may be found on a variety of food products. Some molds produce mycotoxins which can cause disease in man. Chronic exposure to some mycotoxins has been shown to induce cancer in test animals. Animal feeds also may contain mycotoxin-producing molds. The feeding of test diets containing mycotoxins has resulted in isolation of the toxins from test animal tissues. Thus, mycotoxins could enter processed meats through toxin contaminated tissues.

To minimize exposure to mycotoxins, feeding moldy feeds to animals should be avoided, and mold growth on foods for human consumption generally should be prevented. However, mold growth is cultivated as a part of some processing techniques to alter the flavor and/or appearance of, for example, some fermented products. There appear to be no immediate effects due to consumption of these products *(8).* Proper processing (i.e. cooking) and packaging (i.e. vacuum packaging) techniques reduce the incidene of unwanted mold growth on processed meat products.

Certainly all molds do not produce mycotoxins, and many provide benefits; but without applying specific identification and detection techniques, it is difficult to determine if molds are potential mycotoxin-producers and if mycotoxins are present. Many mycotoxins can survive extensive processing, so unwanted mold growth should be prevented. When unwanted molds are present it may be best to dispose of the product for safety as well as appearance and taste reasons. Even though trimming and/or washing of contaminated products may prove effective and the most economically expedient approach, without testing it is impossible to determine if mycotoxins, had they been present, are then removed *(9).*

Meat, Fat, and Health

Processed meat products, and other foods of animal origin, provide a complete protein source which contains, in favorable quantities, all the essential amino acids. Proteins from plant sources are frequently deficient in one or more of the essential amino acids. Overall, utilization of protein by the body is more efficient when a complete protein is consumed.

Meat, including processed meat products, is an excellent source of readily utilized iron which is more biologically available than iron naturally available from plant sources or that added through fortification. The readily utilized iron in meat also improves the absorption and utilization of iron from other sources.

Strict vegetarians who do not take a vitamin B_{12} supplement or those who do not supplement their diets with animal products consume diets that are deficient in that vitamin.

Balanced diets appear to be the key, recognizing that a mix of animal and plant foods are needed for good nutrition. Nutritional problems arise when one food group or nutrient (i.e. protein, fat, carbohydrate, mineral, or vitamin) is consumed in excess or is completely excluded *(3, 13).* For example, dietary fiber plays an important role in gastrointestinal processes such as elimination and its consumption tends to decrease as food intake from animal sources increases. Diets that include whole-grain products, vegetables, and fruits as well as foods from animal sources including processed meats should not be low in dietary fiber, high quality protein, minerals, and/or vitamins *(3).* The inclusion of animal products in the diet is even more important considering that many women (vegetarian or not) of reproductive age and young children routinely consume insufficient quantities of iron *(3).*

Obesity is the most common nutritional problem in the U.S. population. Consuming calories in excess of caloric needs contributes to excess body fat stores, and can lead to a number of health problems. Even though animal products are a valuable source of a variety of nutrients, their over-consumption can lead to obesity. Regardless of the food source, the consumption of excess quantities is discouraged. Processed meat and other animal products contain fat, protein, and carbohydrates which all contribute to the caloric content of these products. Because of fats caloric density, it receives much dietary scrutiny.

Fat contributes to product juiciness, tenderness, and flavor of processed meats. Additionally, fat reduces the formulation cost of processed meats. The fat content of processed meat products is regulated by USDA. For example, products such as weiners cannot contain more than 30 percent fat, whereas some items such as specialty loaf items may contain greater than 30 percent fat *(1).* However, many processed products contain considerably less fat. The meat industry is responding to consumer demands for leaner products by providing new reduced fat options. As the fat content of processed products is reduced, changes in product appearance and palatability would likely result.

Even though the caloric density of processed meat may not be greater than other foods, it should be con-

sumed in appropriate amounts in a balanced diet to avoid excessive caloric intake.

Some studies have shown the incidence of some forms of cancer to be associated with the consumption of meat and meat products. The association between two factors such as the incidence of colon cancer and meat consumption suggests reasons for the incidence of that cancer in a population, but does not establish cause and effect relationships. For example, fiber consumption tends to be low in those countries where meat consumption is high. Some have speculated that it is the low fiber intake that contributes to the incidence of cancer rather than high meat consumption. However, as with meat, the incidence of colon cancer has not been shown to be caused by low dietary fiber consumption. It is difficult for population studies to take into account all differences between populations, and those factors evaluated may only be associated in some way with the actual cause of cancer *(3, 15)*.

Considering the associative relationship between meat consumption and cancer noted in some studies, some have recommended that meat and meat products be excluded from the diet. However, others have concluded that because of the lack of cause and effect relationships between meat consumption and cancer, the balanced diet approach is reasonable, thus allowing for the realization of the nutritional benefits of meat and meat products while continuing to evaluate those relationships.

Higher fat consumption also has been associated with the incidence of colon cancer. Because of the potential relationship between the level of fat consumption and obesity, obesity may also be associated with the incidence of colon cancer. Recent history has shown total fat consumption from plant and animal sources as well as the incidence of cancer in the U.S. population to be increasing. Recent consumption surveys suggest that 40 to 45 percent of the calories in the U.S. diet are derived from fat. During that same time the proportion of fat from animal sources has decreased while that from plant sources has increased. From 1965 to 1977, the consumption of animal fat declined approximately 13 percent while consumption of plant fat increased 50 percent *(3)*. These associations and fat consumption trends are the basis for the recommendation that no more than 30 percent of the caloric intake should be derived from fat regardless of whether it is of plant or animal origin *(3, 15)*.

Atherosclerosis, a major form of heart disease, is characterized by cholesterol containing deposits in the arteries. Blood serum cholesterol levels are generally high among people with atherosclerosis. Some, but not all, populations that consume high levels of saturated fats have a high incidence of atherosclerosis. Because animal fat is relatively saturated and meat contains cholesterol, an association between meat consumption and atherosclerosis has been suggested. This association has led to recommendations that consumption of saturated animal fat be decreased and polyunsaturated fats from plant sources be substituted. Some conclude that normal individuals do not develop atherosclerosis even with consumption of animal products, and singular guidelines for the total population are misleading *(15)*.

Upon review of numerous clinical cases, researchers and physicians have drawn different conclusions relative to the effectiveness of dietary manipulation on the incidence of heart disease. However, most agree that other factors such as smoking, diabetes, obesity, stress, lack of exercise, life-style, and high blood pressure are involved and have an additive effect. Heredity appears to also be a factor as some individuals are more likely to develop atherosclerosis than others, and diet may influence serum cholesterol levels in those individuals. Some individuals appear not to be susceptible regardless of diet *(3)*.

Summary

Considerable information has been accumulated about the technology, nutritional value, and safety of processed meat products. There is still much to be learned, and future research will certainly add to the body of knowledge, particularly about the safety of processed meats. Most authorities agree that scientifically based concerns about processed meats should be evaluated further, and the risks should be balanced against the benefits before ultimately recommending continued inclusion or exclusion from the diet. No food product is absolutely safe or unsafe, and the scientific and health care professions must responsibly use the best information available to make risk-benefit recommendations. Few decisions in the food safety area enjoy total concurrence; therefore, consumers ultimately must make the risk-benefit decision for themselves and in doing so should consult sources that base their information on reliable scientific evidence. Based on current scientific information, many researchers and physicians have concluded that processed meats can safely and advantageously be included in a balanced diet for normal healthy individuals.

References

1. Kramlich, W.E., Pearson, A.M., and Tauber, F.W. 1983. Processed Meats. Pub. AVI Publishing Co., Inc. Wesport, Conn.
2. Kinsman, D.M. 1982. A fresh look at processed meats. Food and Nutrition News. May-June. Pub. National Livestock and Meat Board. Chicago, Ill. Vol. 53, No. 5. p. 1-4.
3. Council for Agricultural Science and Technology. 1980. Food from Animals: Quantity, Quality, and Safety. Pub. CAST. Ames, Iowa. Report No. 82.
4. Kastner, C.L. 1982. Principles and practices of modern meat technology. Journal of Food Protection. Vol. 45, No. 12. p. 1145-1148.
5. Wilson, G.D. Meat products as sources of sodium. Food and Nutrition News. May-June. Pub. National Livestock and Meat Board. Chicago, Ill. Vol. 53; No. 5. p. 5-6.
6. Pearson, A.M. and Wolzak, A.M. 1982. Salt - its use in animal products - a human health dilema. Journal of Animal Science. Vol. 54, No. 6. p. 1263-1278.
7. Field, R.A. 1981. Current status of

mechanically deboned beef and pork. Proceeding of 34th Ann. Reciprocal Meat Conference. Pub. National Livestock and Meat Board. Chicago, Ill. p. 143-146.
8. Buchanan, R.L. 1982. Inherent safety of cheese and meat fermentations: a review of some toxicological considerations. Journal of Food Safety. No. 4. p. 125-137.
9. Bullerman, L.B. 1979. Significance of mycotoxins to food safety and human health. Journal of Food Protection. Vol. 42, No. 1 p. 65-86.
10. Gray, J.I. and Morton, I.D. 1981. Some toxic compounds produced in food by cooking and processing. Journal of Human Nutrition. Vol, 35, No. 1. p. 5-23.
11. Leighty, J.A. 1983. Regulatory action to control *Trichinella spiralis*. Food Technology. March p. 95-97.
12. Kotula, A.W. 1983. Postslaughter control of *Trichinella spiralis*. Food Technology. March issue. p. 91-94.
13. Institute of Food Technologists. 1984. Food Nutrient Interactions. Published by Panel on Food Safety and Nutrition, Institute of Food Technologists. Chicago, Ill.
14. Institute of Food Technologists. 1983. Radiation Preservation of Foods. Published by Panel on Food Safety and Nutrition, Institute of Food Technologists. Chicago, Ill.
15. Franklin, K.R. and Davis, P.N. 1981. Proc. of International Symposium, Meat in Nutrition and Health. Pub. by National Live Stock and Meat Board, Chicago, Ill. p. 109-151.

Dairy and Food Sanitation, Vol. 6, No. 5, Pages 194-197 (May 1986)

The Bacterial Quality of Vacuum Packaged Fresh Fish

C. DEE CLINGMAN and ANA J. HOOPER

Red Lobster
P.O. Box 13330
Orlando, Florida 32859

INTRODUCTION

Seafood quality is of paramount importance to the consumer today. In order to deliver high quality fresh fish at the retail or food service level, maintaining freshness is essential. The extension of shelf life of fresh fish has long presented a challenging situation to the seafood industry. Historically, ice has been and continues to be, the primary tool used to retard bacterial growth on fresh fish.

Recently, the use of modified atmosphere packaging (MAP) is serving as an effective supplement to ice by reducing bacterial numbers as well as suppressing oxidative reactions. By establishing microaerophilic conditions, the growth of strict aerobes is suppressed, and the shelf life of fresh fish can be significantly increased over that of traditional refrigerated storage.

In this study, the bacterial quality of vacuum packaged fish was examined to determine if the shelf life of the vacuum packaged product was appreciably longer than the shelf life obtained under aerobic cold storage.

MATERIALS AND METHODS

Five species of fresh fish were used in this study. Sole, shark, grouper, monk, and trout, which were under five days from the time they were caught, were obtained gutted from various suppliers. The fish were received, packed in ice and upon arrival at the processing plant the products were immediately filleted, skinned and vacuum packaged.

The products were vacuum packaged in pouches through evacuation using a C-4-J Lavovac Vacuum Machine for 30 seconds at 29 inches at mercury. The pouches used were 3 mil impermeable pouches consisting of 2.25 mil EVA copolymer and .75 mil nylon. The oxygen transmission rate at 4°C was 12-5cc/m^2/24 hr.

Seven vacuum packages were prepared for each of the fish species. The packages were stored under drained ice and placed under refrigeration at 4°C. One sample of each of the species of fish was opened for organoleptic evaluation and microbial analysis on alternate days of storage.

Fish were also packaged under aerobic conditions in polyethylene bags. The products were iced down in plastic tubs with drainage holes and refrigerated at 4°C. Storage time consisted of 14 days. The day the products were packaged was considered Day One.

MICROBIAL ANALYSIS

Each sample, aerobic and anaerobic, was analyzed for the total aerobic plate count at 25°C. Fifty gram portions of each species were taken aseptically using sterile scissors and forceps and blended with 450ml of .1% sterile Peptone buffer in a Stomacher 400 for 30 seconds.

Using 90ml dilution blanks of .1% Peptone, appropriate dilutions were made into prepoured Standard Methods agar using the spread method. The inoculated plates were incubated at 25°C for 48 hours.

The predominant bacterial flora was identified through oxidase tests, gram staining and catalase reactions.

ORGANOLEPTIC EVALUATION

Spoilage was assessed organoleptically in the raw state as well as after cooking. The products were allowed to aerate for four minutes prior to the sensory evaluation after the vacuum packages were opened. The products were considered spoiled when no longer edible based on the following criteria:

QUALITY/FRESHNESS
Excellent
Slight Decrease
Decrease, still OK
Unacceptable
Unacceptable

TEXTURE/APPEARANCE
Flesh Translucent
Slight Opaqueness
Slight Darkening
Pronounced Darkening
Tissue breakdown, mushy

ODORS
Fresh, no odors
Slight, fishy odors
Off odors
Strong, sweet/fishy
Ammonia, putrid

Product deemed inedible had strong unacceptable odors with some texture degradation.

Portions of the fish were placed in boiling bags with a small amount of water. The bags were sealed with twist ties and boiled for at least three minutes. The products were assessed for off flavors and odors.

RESULTS AND DISCUSSION

One of the principal factors of fresh fish spoilage is bacterial growth, primarily that of gram negative psychrotrophs such as *Moraxella, Pseudomonas, Acinetobacter* and *Flavobacterium*. The by-products formed by the bacterial action on the organic matter yields unpleasant odors which contribute to the eventual unacceptable state of the fish. In addition, increases in temperature over time further contribute to the deterioration of fish as a result of bacterial proliferation.

Under modified atmosphere packaging, the growth of strict aerobes is suppressed by the absence of oxygen. Oxygen is depleted either by flushing the packaged systems with nitrogen or carbon dioxide or through evacuation with a vacuum pump as done in this study. Any residual oxygen is quickly utilized by the existing aerobic flora and converted to carbon dioxide creating an anaerobic system. Tissue respiration also contributes to this chemical change.

As the anaerobic system is established within the package, a shift in the microbial flora of the fish occurs. The predominant gram negative spoilage groups including *Pseudomonas, Acinetobacter* and *Moraxella* are inhibited while gram positive organisms such as *Lactobacillus* species flourish. (Mokhele 1983)

In this study, sole, shark and trout had the longest shelf life under modified atmosphere, 10, 12 and 15 days respectively (See Fig. 1, 2 and 7). Organoleptic spoilage under aerobic conditions occurred on Day 6 for the sole (Fig. 1) with the predominant organism being *Pseudomonas*.

For the shark, organoleptic spoilage under aerobic conditions was not

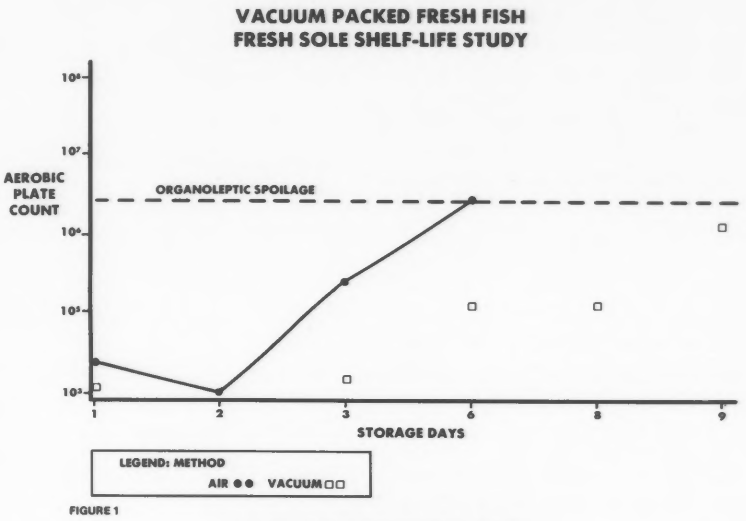


FIGURE 1

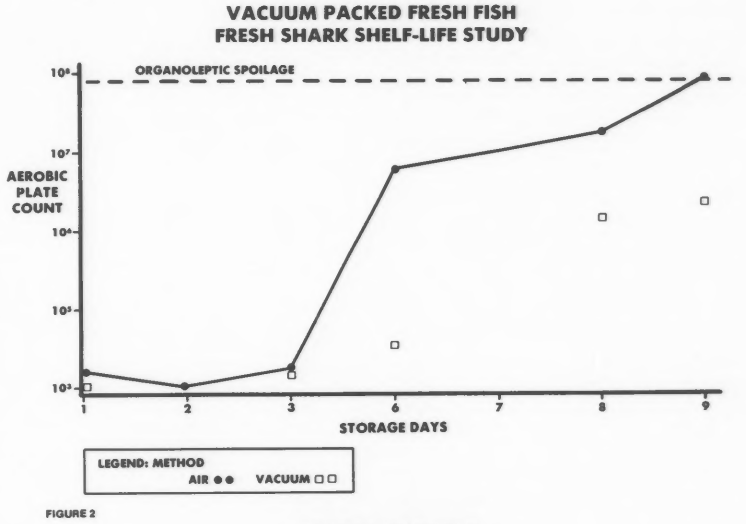


FIGURE 2

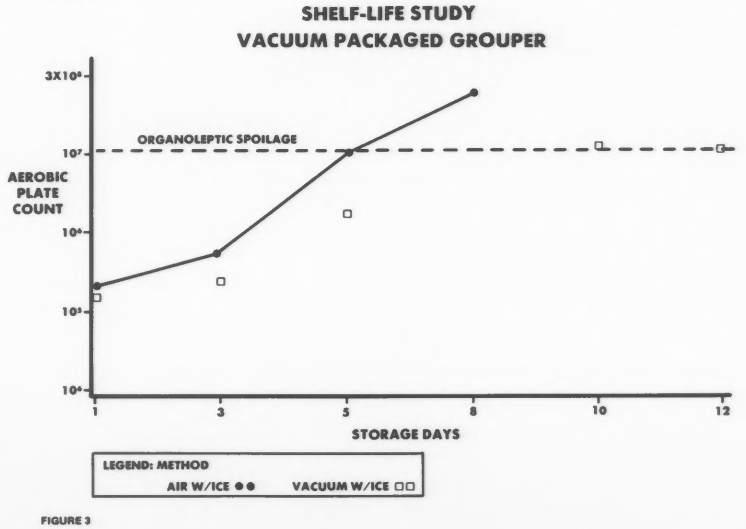


FIGURE 3

evident until Day 9. However, even though the product was edible on Day 8, the color faded and the flavor was bland due to a "leaching out" process of the fish juices resulting from the direct ice storage. In contrast, the vacuum packaged shark was of excellent appearance through Day 15.

A longer aerobic shelf life was noted on the trout (Fig. 7). Because this was a freshwater species, the initial microbial flora was predominantly gram positive. Spoilage was delayed since putrefactive psychrotrophs were not in predominance. The vacuum packaged product however, rendered a "fresher" looking product after the eighth day.

Permeable and impermeable pouches were compared (Fig. 5). Both types of bags successfully prolonged the shelf life of the grouper. The impermeable bag allowed for a slightly longer shelf life. The points between days 10 and 12 in Figure 5 are joined representing the growth rates of the aerobic flora after the bags were opened and the products were stored aerobically under ice.

Figure 6 depicts the shelf life obtained for monk. Monk is a fish which usually is considered a "by-catch". As a result of this, it may suffer greater temperature abuse prior to processing and thus have greater initial bacterial counts. The initial counts for this product were 2 x 10^6. Within three days the product was unacceptable aerobically but acceptable under vacuum through the ninth day of storage.

Overall, an average increase of seven days was obtained for the products stored under vacuum packaging over the aerobically stored fish. (Table 1)

There are several concerns which have been associated with the vacuum packaging of low acid, non sterile products such as fish. One such concern is the potential growth of *Clostridium botulinum*.

Growth of *C. botulinum* has been reported as low as 3°C. (Wilhelm 1982) Toxin production under 10°C, however, is so slow that organoleptic spoilage ensues before appreciable

TABLE 1
FRESH FISH STORAGE LIFE TESTS
Spoilage evidenced organoleptically.

FISH	ATMOSPHERE	STORAGE TEMP. °C	STORAGE DAYS
Shark	Air	32°	9
Shark	Vacuum	32°	15
Monk	Air	32°	3
Monk	Vacuum	32°	10
Grouper	Air	32°	6
Grouper	Vacuum	32°	10
Sole	Air	32°	6

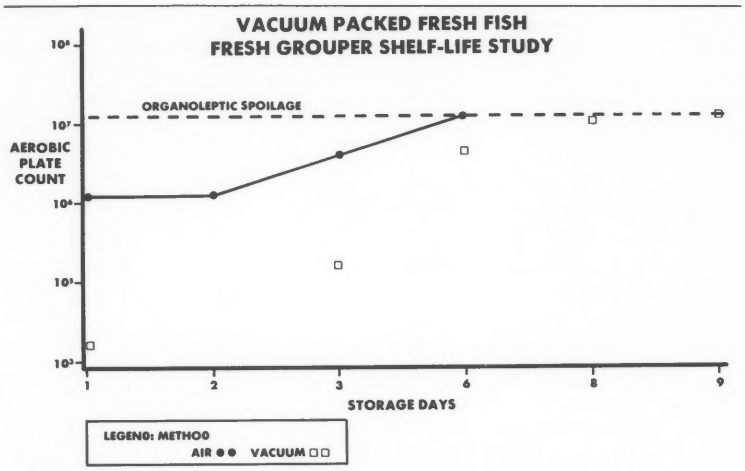


FIGURE 4

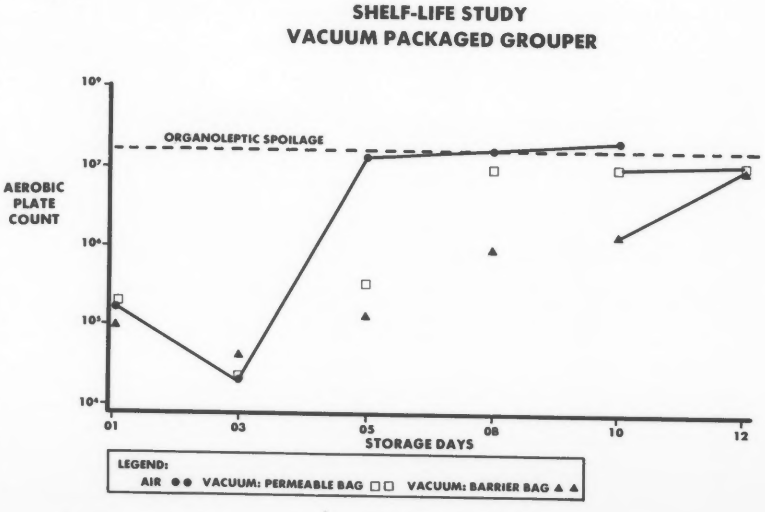


FIGURE 5

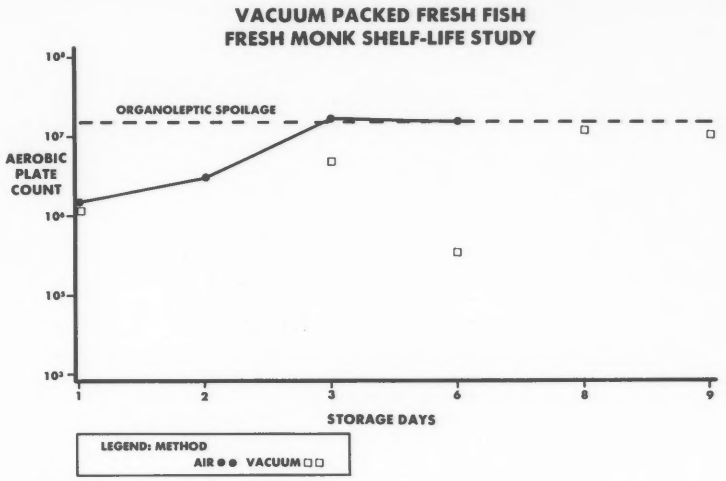


FIGURE 6

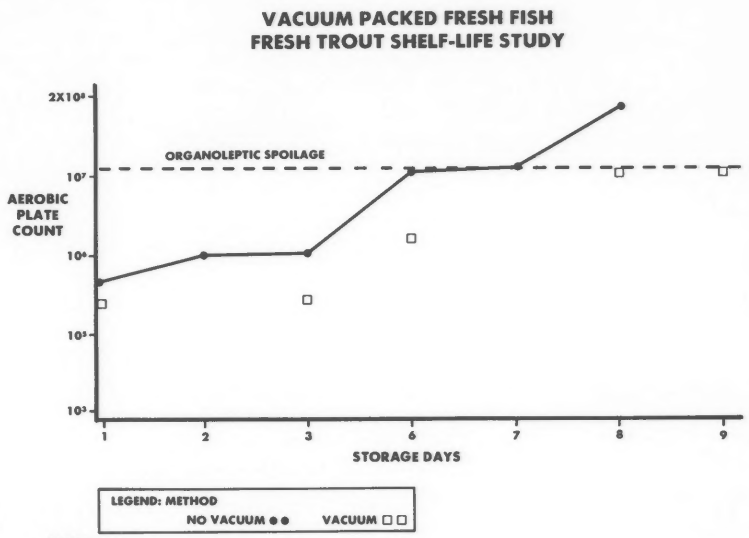


FIGURE 7

amounts of toxin are produced. (Eyles & Warth 1981)

Ecklund (1982) showed that the earliest toxicity identified in heavily inoculated haddock fillets occurred after 55 days of storage.

Another concern associated with vacuum packaging is the "false security" which the actual package may impart to the consumer. The packages could be mistaken for retorted products and imply that temperature control is not necessary. This potential hazard can be minimized through clear labeling of the packages. Labeling should include instructions for refrigeration as well as an expiration or use-by date.

The use of some type of time temperature monitor is of primary importance in the distribution of vacuum packaged fish as an indicator of temperature abuse.

Based on the results of this study it can be concluded that vacuum packaging does prolong the shelf life of fresh fish by suppressing the growth of psychrotrophic aerobic organisms associated with spoilage. However, it must be emphasized that the success of a vacuum packaging program is completely dependent on the initial quality of the fish being packaged and proper temperature control (under 4.5°C) throughout the distribution and storage of the products.

The consumer's demand for high quality fresh fish can be met at the retail and foodservice level as a result of prolonging the shelf life of fresh fish. Through vacuum packaging the utilization of many available species can be increased throughout inaccessible noncoastal areas while ensuring the freshness, safety and quality of these products.

REFERENCES

1. Ecklund, M.W. 1982. Significance of *C. botulinum* in Fishery Products Preserved Short of Sterilization. *Food Tech.* Dec. pp. 107-112.
2. Eyles, M.J., Warth, A.D. 1981. Assessment of the Risk of Botulism from Vacuum Packaged Raw Fish: A Review. *Food Tech* in Australia Vol. 33 (11) Nov. pp. 574-580.
3. Herbert, R.A. 1975. Microbial Ecology of Fish Spoilage. *Process Biochemistry,* Dec. pp. 9-11.
4. Lindsay, R.C. 1981. Controlled Atmospheric Packaging of Refrigerated Fresh Fish. Fourth International Seafood Conference Munich, W. Germany.
5. Mokhele, K. et al 1983. Microbiological Analysis of Rock Cod (Sebastes spp.). Stored Under Elevated Carbon Dioxide Atmospheres. *Applied and Env. Micro.* Mar. pp. 878-883.
6. Shewan, J.M., Murray, C.K. 1979. The Microbial Spoilage of Fish with Special Reference to the Role of Psychrophiles. *Cold Tolerant Microbes in Spoilage and the Environment.* p. 123.
7. Wilhelm, K. 1982. Extended Fresh Storage of Fishery Products with Modified Atmospheres: A Survey. *Marine Fisheries Review.* Feb. pp 17-20.

Diers Joins Engineering Staff at C.E. Rogers Company

The C.E. Rogers Company, design engineers of evaporators and spray dryers for the dairy and food industries, announces the appointment of Paul B. Diers to their engineering staff as a process engineer.

Graduating from the University of Minnesota with a Masters degree in agricultural engineering, Diers' responsibilities will include evaporative and spray drying systems design.

Should You Participate In The Dairy Herd Buyout Program?

The dairy herd buyout program is likely to appeal most to people who are considering getting out of dairying for good, say University of Minnesota extension dairy specialists. That is because retooling and starting over (after the program ends) is likely to be expensive, as dairy farm technology is changing rapidly, says Robert Appleman, dairy specialist with the Minnesota Extension Service.

To help dairy producers make the decision whether or not to participate, Appleman and other extension specialists offer these factors to consider. The first four are paramount; the others may apply in specific cases:

1. Time left to retirement. If you planned to retire soon anyway, then by all means give this program serious consideration.
2. Expected annual earnings from the dairy herd.
3. Alternative earning opportunities for your labor and facilities. A major decision will be how to use operator and family labor if dairying is stopped.
4. Historical base vs. expected production. If the average production expected in the next five years is considerably above the base milk sales certified, a relatively high bid will be needed.
5. Sales value of breeding stock.
6. Reduced value of your dairy farm.
7. Consider the lender.
8. Consider income tax implications.
9. Cost of re-entry into the dairy business.
10. Selection of method of payment.
11. Expectations about other bidders.
12. Geographical limitations. There may or may not be limitations on the number of bids accepted in any region.

These same factors will influence the bid price necessary to entice producers to quit milking cows, Appleman says. A thorough financial analysis should be done to decide whether or not to make a bid for program participation. Three worksheets using partial and/or complete farm budgeting approaches are available from the Minnesota county extension offices. All are titled, "The Dairy Herd Buyout Program--How Much to Bid?"

Equipment Enterprises, Inc. Opens New Corporate Headquarters

Equipment Enterprises, Inc., leading designer and distributor of water treatment equipment for the soft drink, baking and dairy industries, has announced the opening of a new corporate headquarters, warehouse and manufacturing facility. Still located in Atlanta, Georgia, the new facility will house all corporate offices, a manufacturing unit for the design and fabrication of custom-made water treatment systems, and a fully-stocked parts and supplies warehouse.

Rapid growth has necessitated the move to a larger Atlanta location. Says EEI President, Lamar Meeks, "We have seen our customer base increase fourfold this past year, and this new facility will afford us five times the space as our former location." With installations in virtually all 50 states, EEI offers a full range of services for water treatment equipment, including design, manufacture, installation and maintenance.

Equipment Enterprises is now located at 1444 Mayson Street, Atlanta, GA 30324. For further information on this move or on the services offered by EEI, please call Lamar Meeks at 1-800-221-3681.

DRINC Products Undergo Consumer Testing

Consumers first sampled diet milk, high-calcium milk, and butter-like spread in small-scale taste testing at shopping malls beginning on January 27. The Dairy Research Inc., (DRINC) tests lasted two to three weeks and results will help DRINC Development laboratory staff refine the three all-dairy preliminary products which are funded by the National Dairy Promotion and Research Board.

Test participants compared traditional skim milk to plain, banana, and peach-flavored diet milk in one evaluation. The high-calcium beverage competed with skim and 2 percent milk in another. In the third, butter, and margarine sat next to DRINC's butterlike spread.

Interviewers screened from 120 to 130 people to

take part in each test. Some product characteristics identified in the evaluation included taste, flavor, aroma, texture, refreshment, color, and aftertaste.

"We use technologies not yet applied to dairy processing to develop new products," said Anthony J. Luksas, Ph.D., president of DRINC. "These technologies enable us to develop new all-dairy foods without anticipating the use of additives that could alter taste or texture."

Evaluation of the studies will continue through February by McDonald Research, Inc., and Marketing and Economic Research Division of United Dairy Industry Association. Results will enable DRINC laboratory staff to make adjustments and increase consumer appeal for the products.

Home usage studies are next in the evaluation of new DRINC products. More than 500 random households will try products in varied environments on a day-to-day basis. Limited and full market testing will complete the consumer feasibility studies and are likely to be initiated within two years. These final steps will help forecast national sales of diet milk, high-calcium milk and butterlike spread.

Dairy Research Inc. conducts product/process research and development programs as part of the total dairy product promotion effort of United Dairy Industry Association. UDIA represents 95 percent of the nation's dairy farmers and 85 percent of domestic milk marketed.

Drinking Water Has Hidden Sodium

Those whose doctors have told them to follow a low-sodium diet find sodium comes from more places than just the salt shaker. There's sodium in drinking water.

"Most people don't think about the sodium content in drinking water," says Mary K. Sweeten, nutritionist with the Texas A&M University Agricultural Extension Service.

The *Journal of the American Dietetic Association* reports adults can get 10 percent of their daily intake of sodium from the two and a half quarts of water that most adults drink each day.

Other "hidden sources" of sodium include distilled and bottled water and carbonated water in soft drinks.

A home water softener is not the solution since it can add even more sodium, she says.

"Those needing to soften water for bathing or washing clothes might consider connecting only hot water lines to the water softener," says Sweeten. "Or, they might not connect the kitchen lines to a softener."

She says that studies have shown that most water supplies fall within the recommended range of sodium content, but there may be locations where this is not true.

"If you want to know the sodium level of the water you are drinking," she says, "contact your local water company."

Owners of private wells may want to have their water supply checked for sodium since levels fluctuate in the same area, the nutritionist says.

American Sanitation Institute Appoints New Technical Director

Dr. Joseph D. Foulk has joined the American Sanitation Institute, a division of the Huge' Co. Inc., as Technical Director of Field Operations. Dr. Foulk spent eight years with the Pabst Brewing Co. in Milwaukee, and was with the Rose Exterminating Co., San Francisco, as their National Sanitation Consultant for six years. He also lived for two years in New Zealand as a Scientific Officer for the Entomology Division of the Department of Science and Industry. Dr. Foulk received a Ph.D. in Entomology from Cornell University.

The American Sanitation Institute is the nation's largest and oldest sanitation consulting firm, covering all 50 states, Puerto Rico, the Virgin Islands and Canada. The resident staff sanitation consultants service food processing and related industries with simulated Food and Drug-type inspections. The company's home office is in St. Louis, Missouri.

For more information contact: John Henry, Publicity, 7625 Page Blvd., St. Louis, MO 63133. 314-725-2555.

Maximize The Iron In Your Diet

Getting enough iron in your diet is not simply a matter of eating iron-rich foods, says a Texas A&M University Agricultural Extension Service nutritionist.

Iron intake is determined both by the amount of iron-rich foods eaten and how well the iron is absorbed into your body, says Dr. Alice Hunt.

"Generally, iron added to foods or taken in the form of supplements is not absorbed as well as that which comes from natural food," she explains.

Since many factors influence the absorption of iron

from foods and additives, taking an iron supplement does not automatically insure you're getting an adequate amount, Hunt points out.

To maximize your body's absorption of iron, the nutritionist recommends the following:

• Eat red meats regularly. They are the best source of iron and also facilitate iron absorption when eaten with other foods. Select lean cuts and remove the visible fat before cooking.

• Eat fruits and vegetables rich in vitamin C such as citrus fruits and juices, dark green vegetables, and tomatoes. Vitamin C rich foods will substantially increase the absorption of iron from other foods.

• Look for processed foods that are enriched. Some white bread, rolls, crackers and cereals are enriched with iron. Check the nutrition labels on these and other refined grain foods to make sure you are getting an enriched product.

• When you cook acid foods, such as tomato sauce, use an iron pan. Significant amounts of iron can leach from the pan into the foods.

• Don't drink coffee and tea at meals. Coffee can decrease iron absorption by as much as 39 percent and tea, by 87 percent when consumed with a meal. But there is some research to show you can counter the effect by eating a food high in vitamin C along with these beverages at a meal.

• Don't go overboard on fiber. Bran and other high-fiber foods can interfere with iron absorption. However, you're only likely to run into problems if your diet is already low in iron and you regularly eat large amounts of high-fiber foods or bran supplements.

Proper Cooking and Storing Can Save Vitamin C

Cooking ahead and the heating and reheating of foods in a microwave has become a way of life in many busy families. But the saving in cooking time can be at the expense of nutrients.

According to a Texas A&M University Agricultural Extension Service nutritionist, storing fresh vegetables and then heating or reheating them causes loss of vitamin C.

Vegetables have about three-fourths as much vitamin C after one day in the refrigerator as when freshly cooked and about two-thirds as much after two days, says Dr. Dymple Cooksey.

Cooked vegetables reheated after two or three days in the refrigerator will supply only one-third to one-half as much vitamin C as when freshly prepared.

"Eating heated and reheated vegetables shouldn't cause concern if your meals include other, more dependable sources of vitamin C each day, such as citrus fruits and juices," she notes.

Freshly squeezed, canned or reconstituted frozen orange juice can be held in the refrigerator for several days before any vitamin C is lost, Cooksey explains.

The nutritionist adds that even a few hours outside the refrigerator won't cause any serious loss in vitamin C from orange juice, although it may impair the flavor.

It's not necessary to take vitamin C tablets if you're eating a balanced diet that includes vegetables and citrus fruits, Cooksey maintains.

MEMBERSHIP RECRUITMENT DRIVE...

The Californians are really "going to town" on the Membership Drive. Austin Olinger has recruited 12 new members and John Bruhn, 1. In Ontario, Reinhard Purfurst has recruited 1 new member.

Remember, there are terrific prizes for the winners.

5 new members...bonus buck $10 off your 1987 membership.

10 new members...FREE 1987 Membership (includes Dairy and Food Sanitation).

20 new members... Free Registration and social events, plus an Appreciation Certificate presented at the Annual Meeting.

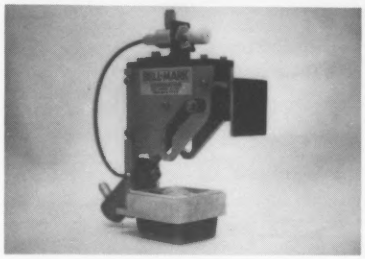
30 new members...AIR Transportation to the meeting, free registration and social events, Membership Recruiter of the Year Plaque, plus personal recognition during the Annual Awards Banquet, with seating at the head table.

You've got everything to win by getting involved, and you still have time. Contest ends June 30, 1986!!

Way to go Austin, John and Reinhard!

New Product News

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



Bell-Mark US-4101 Cup Coding System

• The Bell-Mark Corporation of East Orange, New Jersey is introducing to the dairy food manufacturers who utilize cup filling systems the revolutionary new *US-4101 Cup Coding System* with bracketry and controls for coding either the bottom or top lids on cups. This machine has been designed to attach quickly and easily on all automatic cup filling machines used primarily in the dairy industry to print sell-by dates, establishment codes or any other coding requirement on the bottom or top lids of cups. These systems are commonly used for packaging ice cream, yogurt, cottage cheese and all cultured products.

The new *US-4101 Cup Coding System* is adaptable to all cup filling systems such as Maryland Cup, Autoprod, and R. H. Packaging. It is far superior to any of its competition in the following ways:

• Less than 1/3 the initial cost of existing systems.

• Excellent print quality on all cup surfaces and lidding materials.

• Easy to operate and maintain.

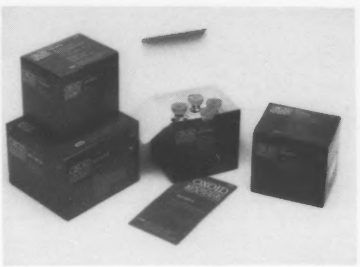
• No mess with Bell-Mark's Patented Cartridge Inking System.

• Generally 1/5 the cost to operate of existing systems.

Installation is extremely simple and maintenance required is minimal. The bracket may be installed for both coding the bottom and the top of the cup, in addition to a fine verticle adjustment insuring excellent print quality on convex or concave cup surfaces.

For more information contact: Darcy Davies, Advertising Director, Toll-Free 800-526-1391.

Please circle No. 248
on your Reader Service Page



Range of Kits Available for Toxin Detection

• Oxoid have launched a range of kits for the detection of bacterial toxins in food, faeces, and cultural isolates. A reversed passive latex agglutination (RPLA) technique is employed. The four kits detect staphylococcal enterotoxins A,B,C, and D (SET-RPLA; Code DR 900); *Vibrio cholerae* enterotoxin/*E. coli* heat labile enterotoxin (VET-RPLA; Code DR 920); *Clostridium perfringens* enterotoxin (PET-RPLA; Code DR 930); and staphylococcal toxic shock syndrome toxin (TST-RPLA; Code DR 940). The use of highly purified specific antibodies ensures a sensitivity as low as 1-2 ng of toxin per ml. The simplicity of the method, coupled with the remarkable sensitivity, permits the detection of these important toxins by almost any laboratory.

For more information contact: Oxoid Limited, Wade Road, Basingstoke, Hampshire, England RG24 OPW. 0256 461 144. International: 256 461 144. Telex: 858793. Telegrams: Oxoid Basingstoke.

Please circle No. 249
on your Reader Service Page

A.G. Chemicals, Inc. Introduces New Epoxy Compound

• AGRI-PATCH, a 100% epoxy compound that permanently patches all size holes in concrete or where pitting is excessive. It is ideal for use where concrete cannot be dried well or where fast curing is required. Once AGRI-PATCH is troweled in, it bonds directly to the concrete, creating a surface that is impervious to all acids, solvents, H.D. powerwashing, scrapers, and weather variations. Excellent for patching parlor floors, water troughs, basements or heavy traffic concrete floors.

For more information, write or call collect: A.G. Chemicals, Inc., 215 East 79th Street, New York, NY 10021. 212-249-0444.

Please circle No. 250
on your Reader Service Page

Non-Chemical Bacteria Removal

• The KATADYN water filters remove all waterborne microorganisms (including bacteria, fungi, cysts, protozoa) through physical filtration without the use of chemicals. The ceramic filter element has a porosity of 0.2 micron and can be cleaned to restore the full flow rate - a cost effective method of microfiltration. Filter housings are made of stainless steel, and different size filters are available for many applications in the food service and food processing industry. EPA registered.

For more information contact: Katadyn U.S.A, Inc., 3020 North Scottsdale Road, Scottsdale, Arizona 85251.

Please circle No. 251
on your Reader Service Page

On-Line Continuous Curd Tension Monitor

• The CTM-1000 is a sensitive, yet rugged instrument designed to measure curd tension (commonly referred to as gel firmness) in the manufacture of fermented dairy products such as cheese. Curd tension measurements are made by measuring the resistance to the vertical movement of a stainless steel disk immersed in the coagulating milk. As milk coagulation increases during the fermentation process, the resistance to probe movement increases until it reaches a pre-determined value at which time an audible/visual alarm is activated to signal that it is time to cut the curd. The system has an automatic mode under which the operation is somewhat simplified.

A unit is now commercially available for use on open vats with a closed vat system available in approximately six months. For additional information, please contact the CEM Company at 1-800-334-6317.

Please circle No. 252
on your Reader Service Page

Food Science Facts
For The Sanitarian

Dr. Robert B. Gravani
Cornell University
Ithaca, NY

ASSURING FOOD QUALITY

In order to monitor and maintain the quality of food products, a well organized and systematic quality program is essential for every food processing, retailing and food service establishment. Most companies have a quality objective or goal and use a quality assurance program along with good quality control techniques to achieve these goals.

Quality Assurance

Quality assurance is a term that has become widely used (and misused) in the food industry today. It is a system designed to prevent, detect and correct product defects that would cause customer dissatisfaction. Companies who have an effective quality assurance program, are providing consumers with continuing assurance that the products they purchase are at a level of quality they expect. Quality assurance programs operate in behalf of consumers and are much broader than traditional quality control activities. Quality assurance oversees the entire scope of product handling from its beginning to its ultimate use by the consumer. A well-organized and well-run quality assurance program allows management to make observations, which might affect final product quality, at any level in the manufacturing process.

Quality assurance is concerned with surveys, audits, and the evaluation of the quality factors that affect the specifications, inspection and consumer acceptance of a particular product. It also involves a continuing evaluation of the adequacy and effectiveness of the quality control program.

Quality Control

Quality control is usually part of the quality assurance program and involves the daily activities that carry out the quality objectives of the company. In most food companies, the functions of quality control are to standardize the raw material used, control the manufacturing process and the product so that each food item produced will be uniform and be free from defects. This is achieved by maintaining the quality at certain levels and tolerances that are acceptable to consumers and to regulatory officials.

Although the terminology may be a bit confusing, remember that quality assurance is a broad program that tries to *anticipate* and *prevent* potential defects from occuring while quality control attempts to *detect* and *correct* the defects in products.

A well organized and properly functioning quality program will:

- Improve product quality;
- Reduce defective items and rejects;
- Maintain uniform quality;
- Improve plant sanitation and housekeeping;
- Decrease consumer complaints;
- Increase customer satisfaction;
- Improve employee awareness and bolster morale; and
- Minimize costs.

Organizing For Quality

The organization of a food quality program must have top management commitment and involvement. The quality assurance program should report directly to top management and not to or through any other departments.

The diagram below shows how a quality assurance department would fit into a processing plant's organizational chart.

Some of the responsibilities of a quality assurance department are to:

1) *Develop Specifications* - specifications for raw materials, ingredients, packaging materials, machinery and supplies must be developed by quality assurance with the help of the sales, marketing, production and purchasing departments. Certainly consumer requirements, product availability and processing limitations must be taken into consideration.

2) *Determine Test Procedures* - procedures for measuring the quality attributes of the products being processed must be developed. This means that chemical, microbiological and/or physical testing as well as sensory evaluation of the product should be done routinely. Important steps in the production process such as line speeds, temperatures, weights, etc. should also be tested. These test procedures can be developed with the help of the research department or they can be adopted from existing information developed by trade associations, government agencies, universities or other research organizations.

3) *Establish Sampling Schedules* - an efficient system for determining the number of products to sample, the frequency of sampling as well as a method for properly handling samples is very important. Product quality needs to be determined with good reliability at minimum cost.

4) *Report Results* - the quality assurance department must record the results of product and line testing and report the results to other pertinent departments within the company.

5) *Solve Problems* - when the process is out of control, quality assurance personnel must solve the problem and correct the situation. Problems resulting from consumer complaints, raw materials being out of specification or equipment problems also are examples of the types of problems that quality assurance personnel usually solve.

Good communication between all departments in a company is *VITAL* for the production of quality food products. The quality assurance department can be an excellent channel of communication between all departments.

The production control and assurance of quality food products is not the sole responsibility of the quality assurance department but a responsibility of every worker in the company.

Every food industry employee should be "quality minded" and work toward producing foods of excellent quality.

New Members

California

Phillip J. Baker
Rio Linda Chemical
Sacramento

Daryl Betts
Intergrated Processing Tech
Diamond Bar

Robert Boynton
Dairy Institute of California
Sacramento

Travis Burgeson
Azumaya Inc.
San Francisco, CA

Robert Cheng
Safeway Stores Inc.
Los Angeles

Ron Clark
San Bernardino Co.
Helendale

Steven Cooper
Sonoma Cheese Factory
Sonoma

Dr. Jairus R. David
Real Fresh Inc.
Visalia

Julian O. Hicks
Rio Linda Chemical Co.
Sacramento

Dean W. Larson
Danish Creamery Asso.
Fresno

Morgan C. Morgan
CA Milk & Dairy Foods Control
West Covina

Stephen Pierson
San Bernardino Dairy Inspection
Ontario

Kris Purcell
Idetek Inc.
San Bruno

Ed Walker
Dairy and Food Labs
Modesto

Florida

Linda B. Lubin
Burger King Corp.
Miami

Illinois

Michael L. Jamison
Gaines Foods Inc.
Kankakee

Joseph A. O'Donnell
Dairy Research Foundation
Rosemont

Indiana

Mary Dean
Jennings Co. Board of Hlth.
Vernon

Iowa

Lloyd Doane
Iowa State Health Dept.
West Des Moines

Norris Fagerhaug
Mid America
Sioux City

Douglas J. Wells
Wells Dairy Inc.
Lemars

Maryland

W. Thomas Moore
Maryland & VA Milk Assoc.
Street

Michigan

Alan R. Budinger
Marquette Co. Hlth. Dept.
Negaunee

Joseph S. Wisk
Dearborn Hlth. Dept.
Dearborn

Alice J. Zapletal
Mason Co. Hlth. Dept.
Ludington

Minnesota

Hassan Gourama
Univ. of Minnesota
St. Paul

Stanley L. Hendricks
Watertown

Missouri

William F. Osborne
Boise Cascade
Hazelwood

New Jersey

Fred Weber
NJDL Supplies Inc.
East Windsor

New York

Robert Charvat
Bison Foods Co.
Buffalo

John R. Johnson
Dairylea Cooperative Inc.
Syracuse

North Dakota

Roger C. Cilke
1st District Hlth. Unit
Minot

John E. Ringsrud
ND Dept of Agriculture
Lakota

Pennsylvania

Linda J. Knotwell
Hersey Chocolate Co.
Hershey, PA

Texas

Eva M. Goforth
Plains Creamery Inc.
Amarillo

Barry H. Price
City of Pasadena
Pasadena

Glen Rector
Crouch Supply Co. Inc.
Fort Worth

B. J. Shultz
Klensade Div. Econ. Labs
Dallas

John R. Skaggs
Mesquite Hlth. Dept.
Mesquite

Ralph D. Smith
USDA C&MS
Dallas

Wayne Weatherford
Borden Inc.
Houston

Virginia

Brian Shook
Richmond

Wisconsin

Gerhard H. Simon
Stauffer Cheese Inc.
Blue Mounds

Elizabeth A. Temple
WI Division of Health
Madison

Canada

C.S. Coutts
Metro Windsor Essex
County Health Unit
Windsor, Ontario

Don Gauthier
DuBois Chemical
Weston, Ontario

Ronald A. Green
Palm Dairies
Edmonton, Alberta

Singapore

Dr. Lor Kim Loon
SATS Catering Pte Ltd.
Singapore

CRYPTOSPORIDIUM AND TRAVEL - BRITISH COLUMBIA

Cyptosporidium, an intestinal protozoan parasite, is a newly recognized pathogen of the gastrointestinal tract of man. In the past it was regarded as an animal parasite, particularly found in calves, but in the last few years it has been shown to be a cause of diarrhea in humans. When healthy individuals are infected, mild flu-like symptoms are most often experienced, although in some cases the diarrhea may be quite severe. The symptoms generally disappear within 2-3 weeks. In the immuno-suppressed, however, the diarrhea is persistent and can be life-threatening. The mode of transmission is fecal-oral with indirect transmission suspected via contaminated water, food and possibly milk.

Between 1 October 1983, when stool specimens were first examined for *Cryptosporidium,* and 31 May 1985, 66 cases of cryptosporidiosis were diagnosed in the B.C. Provincial Laboratories. Initially, only specimens from patients suspected of having the acquired immuno-deficiency syndrome (AIDS) were checked for the presence of the oocysts. However, as more reports were being published implicating *Cryptosporidium,* as the causitive agent of diarrhea in non-immunosuppressed patients, the Provincial Laboratories began to screen routinely all specimens from children, travellers, and patients with diarrheal symptoms.

At the beginning of 1985 the number of positives increased significantly. In order to investigate the epidemiology of the organism, questionnaires were sent to the patients' physicians, covering the time period from 1 October 1983 to 31 May 1985.

Conclusion: From the information recorded on the questionnaires and the requisitions accompanying the specimens, it appears that the majority of the cases acquired the infection while travelling, particularly in Mexico and more specifically, Puerto Vallarta.

Ice cubes, untreated water, milk or milk products, and salads could be implicated as the mode of transmission.

Several of the patients were children under 10. However, because some of the questionnaires were incomplete and only one physician indicated that the child attended day care, it could not be determined if the organism was contracted in day-care centers. Only 3 cases were AIDS patients.

Can. Diseases Weekly Report 10-12-85.

A CASE OF FOOD POISONING CAUSED BY *CRYPTOSPORIDIUM* - ENGLAND

A 32-year old man presented to his general practitioner with vomiting, abdominal pain, and blood-stained watery diarrhea. Laboratory investigations failed to demonstrate infection with *Campylobacter, Salmonella, Shigella* or *Yersinia* species, but large numbers of *Cryptosporidium* oocysts were seen on examining an auramine-stained fecal smear by indirect light fluorescence microscopy.

The patient had not been abroad recently, was not on steroids, or otherwise immunosuppressed. There was no recent family history of diarrhea and he did not appear to be part of a community outbreak. He had no contact with farm animals and the only pet, a dog which was well, had not had diarrhea recently and was not shedding *Cryptosporidium* oocysts in its feces. However, the patient did explain that while preparing tripe for the dog's dinner, some of it had accidently gotten into his mouth. The tripe was bought frozen and kept in this state until it was thawed for use. It was not cooked before being eaten.

A sample of the suspect tripe was examined in the laboratory. A few single *Cryptosporidium* oocytes were observed, and one group of 8 was attached to the edge of a single piece of debris (possibly stomach mucosa). Hematoxylin and eosin- and auramine-stained sections of the tripe showed numerous bacteria but failed to reveal further evidence of *Cryptosporidium.*

Comment: There is evidence that cryptosporidiosis in humans can follow direct contact with farm animals, domestic pets, and infected individuals, particularly children. Water and unpasteurized milk have been suggested as vehicles of infection. In a mixed outbreak of *Cryptosporidium* and *Campylobacter* infections, it was found that cases were more likely than controls to have eaten sausages frequently. This is the first recorded instance of cryptosporidiosis in which the organism had been demonstrated in a sample of the food which was ingested.

Cryptosporidium colonization usually occurs in the small and large intestines in mammals but can involve tonsils, bronchi, stomach, pancreatic and bile ducts, and gall bladder. The tripe in this case was probably prepared from the stomach of a cow colonized with *Cryptosporidium,* although contamination of the tripe during processing is possible. Tripe for human consumption goes through a series of scrubbing, boiling and bleaching processes but cross contamination resulting in *Salmonella* infections can occur. Boiling will kill *Cryptosporidium* oocytes and eating raw untreated tripe cannot be recommended. The presence of infection following the consumption of frozen material indicates that the organism can remain viable when frozen. This differs from experimental work indicating that *Cryptosporidium* is killed by freezing, and suggests that it may be possible to store reference strains in this way.

The absence of oocysts in the dog's feces may have been due to immunity induced by repeated exposure to infected material.

Cryptosporidium in cats and dogs may be passed directly from individual to individual but this case indicates that the organism may originate in their food. Offal products may present an important source of infection for humans and their pets.

Can. Diseases Weekly Report 10-12-85

HEMORRHAGIC COLITIS IN A NURSING HOME - ONTARIO

Between 8-25 September 1985, 53 of 169 residents of a London nursing home became ill with diarrhea. A surveillance case definition of 2 or more loose stools in one day or frank blood on stools was met by an additional 17 staff members. Incubation period has ranged from 3 to 9 days, with a median of 4 days. Epidemiological investigations conducted to date point to a common source outbreak following a lunch meal of sandwiches on 5 September, with a secondary wave of cases mainly among nursing staff caring for ill residents.

The majority of cases have had bloody diarrhea and the only pathogen isolated has been *Escherichia coli* 0157:H7. Laboratory studies are incomplete on the latest cases. Twelve of 53 resident cases have died and 5 others remain in serious condition in hospital. Fatalities and the most severe cases have been restricted to the elderly with serious underlying disease. At least

1 fatal case had a clinical course and postmortem findings which suggest the adult form of hemollytic uremic syndrome.

Control measures taken in the institution have centered around food preparation practices and isolation nursing of affected residents. Of particular note in this outbreak has been the case-fatality rate of 23%, much higher than has been reported in other outbreaks of hemorrhagic colitis.

The occurrence of this outbreak reconfirms the need to consider *E. coli* 0157:H7 as a cause of bloody diarrhea/hemorrhagic colitis in this setting as well as in sporadic cases.

Can. Diseases Weekly Report 10-5-1985.

SHIGELLOSIS - UNITED STATES, 1984

In 1984, 12,790 *Shigella* isolates from humans were reported to CDC. This is a 14.4% decrease from the 14,946 isolates reported in 1983. The number of isolates continues to be less than the 15,334 reported during the peak year, 1978.

Shigella serotypes were reported for 12,179 of the 12,790 isolates. The most frequently isolated serotype, *S. sonnei,* comprised 64.4% of all isolates serotyped. *S. flexneri* la accounted for 14.1% of all *S. flexneri* subtyped; 1b, 2.6%; 2a, 28.1%; 3a, 24.3%; and 6, 13.3%.

The number of reported isolates in every serotype decreased, compared with the numbers reported in 1983. *S. sonnei* decreased 15.3%; *S. flexneri,* 10.8%; *S. boydii,* 6.5%; and *S. dysenteriae,* 3.2%. The decreases were not confined to one state or region.

The age-specific rate of reported isolated per 100,000 population was highest for 2-year-old children, lower for older children, and lowest for adults. The age-specific rate for 20- to 29-year-olds was slightly higher than the rates for the older children and the remaining age groups. In addition, in the 20- to 29-year-age group, a slightly higher rate was reported for females than for males. Rates of reported isolates by patient sex were similar for the remaining age groups.

Since some populations have higher rates than others, data were tabulated separately for patients residing in certain institutions (e.g. nursing homes, facilities for the mentally ill, and other resident-care centers) and on American Indian reservations. Only 2,416 (18.9%) of the reports included data on residence at the time of onset of illness. Of those specified, 22 (0.9%) lived in institutions, and 67 (2.8%), on Indian reservations. Fifteen (68.2%) of the reported isolates from residents of institutions were *S. sonnei,* and five (22.7%) were *S. flexneri.* Twenty-four (36.4%) of the reported isolates from Indian reservation residents were *S. sonnei,* and 42 (63.6%) were *S. flexneri.* For other known residences, *S. sonnei* accounted for 1,634 (71.7%); *S. flexneri,* for 587 (25.8%); *S. boydii,* for 34 (1.5%); and *S. dysenteriae,* for 24 (1.1%).

MMWR 10-4-85

TETANUS - UNITED STATES, 1982-1984

From 1982 through 1984, 253 U.S. cases of tetanus were reported to the MMWR (88 in 1982, 91 in 1983, and 74 in 1984). Forty states and the District of Columbia reported at least one case; 19 states reported cases in all 3 years. The 10 states reporting no cases are located in the western and northeastern United States. The average annual incidence rate for 1982-1984 was 0.036 cases per 100,000 total population, compared to 0.39/100,000 in 1947, when national reporting began. The estimated average annual age-specific incidence rates progressively increased by age group, with a seven-fold increase from the 5- to 19-year age group and a ninefold increase from the 20- to 29-year to 60 years and older age group.

Case report forms for 234 (92%) patients with onset during these years provided information on demographic characteristics, immunization history, circumstances of injury or other medical condition, and tetanus prophylaxis used in wound management. Extrapolating from 229 patients for whom race was known, the estimated average annual incidence rate for whites was 0.033/100,000 (177 cases); for blacks, 0.059/100,000 (45 cases); and for all other races, 0.040/100,000 (seven cases).

One hundred fifty-nine (71%) of the 224 patients with known ages were 50 years of age or older; six (3%) were 1 month to 19 years of age; and 56 (25%) were 20-49 years of age. Three cases of neonatal tetanus were reported (Texas--two; California--one); two of the mothers had no history of prior immunization, and the third had no history of completing primary immunization. All three infants survived. The remainder of this report covers 231 cases of tetanus that occurred among individuals ages 1 month and older.

The case-fatality rate was 26% (52% for patients 60 years of age and older and 13% for those under age 60.) No deaths occurred among patients under 30 years of age.

Eleven (5%) of the 231 patients had received at least a primary series of tetanus toxoid before onset. Of these, three received their third dose of tetanus toxoid as part of wound prophylaxis, and three had not received a dose within the preceding 10 years. Two hundred fifteen patients (93%) had received fewer than two doses of toxoid before onset of illness or had received an unknown number of doses.

Tetanus occurred after an identified acute injury in 166 cases (72%). The most frequently reported acute injuries were puncture wounds (37%) and lacerations (35%). Injuries incurred indoors accounted for 41% of acute wounds; gardening and other outdoor injuries, for 39%; animal-associated injuries and major trauma, for 4% each; and other and unknown circumstances, for 12%. The median incubation period for the 142 tetanus patients with known interval between acute injury and onset was 8 days. One hundred thirty-one (92%) had an incubation period of 14 days or less. For 18 (13%) patients, the interval between wound and onset was reported to be 3 days or less. Tetanus toxoid was given as prophylaxis in wound management to 42 patients (25%) with acute wounds; two patients also received tetanus immune globulin (TIG). Of the 42 patients, 43 (81%) received prophylaxis within 3 days of the injury.

Fifty-six patients had acute wounds severe enough to require debridement after injury but before onset of tetanus. Based on the current recommendations of the Immunization Practices Advisory Committee (ACIP) for wound management, 55 of these patients were candidates for both Tetanus and Diphtheria Toxoids (Td) and TIG; none received TIG, and 22 (40%) received Td in the course of wound management. One patient was a candidate for Td only but did not receive tetanus toxoid.

Forty-eight cases (21%) were associated with chronic wounds or underlying medical conditions, such as skin ulcers, abscesses, or gangrene; a history of parenteral drug abuse was the only associated medical condition reported for five (2%) patients. A known acute injury, a chronic wound, or any other preexisting medical condition was not reported for 17 (7%) patients.

Editorial Note: Following a steady decline in the average annual crude incidence rate of tetanus between 1947 and 1976, the rate has not changed substantially. The decline results both from immunization and careful wound management, since

naturally acquired immunity against tetanus is undocumented in the United States. However, tetanus is a continuing health burden and has a high case-fatality ratio, primarily among the unimmunized and inadequately immunized. Approximately 95% of patients reported with tetanus during 1982-1984 had not received a primary series of tetanus toxoid. Vaccination with a primary series of three doses of tetanus toxoid and booster doses every 10 years is highly effective in preventing tetanus. Single-antigen tetanus toxoid is not recommended for use in routine immunization or in general wound management. The recommended preparation for individuals 7 years of age and older is Tetanus and Diphtheria Toxoids Absorbed (For Adult Use) (Td). The recommended preparation for children before the seventh birthday is Diphtheria and Tetanus Toxoids and Pertussis Vaccine (DPT); Diphtheria and Tetanus Toxoids (For Pediatric Use) (Dt) is recommended for children before the seventh birthday for whom pertussis antigen is contraindicated.

Tetanus cases are most frequently associated with acute wounds; most of these patients did not receive tetanus proyhylaxis following the wound. It is uncertain what proportion of patients sought care for their wounds. Among tetanus patients in whom the associated wound was debrided, health care contact did not result in the use of recommended Td/TIG. Under-prophylaxis may have occurred in other tetanus patients who sought care. Primary immunization and routine maintenance of an up-to-date immunization status is necessary to prevent tetanus that is not associated with acute wounds or that occurs in persons who do not seek medical care for their wounds. Routine use of tetanus toxoid-containing preparations would also eliminate the need for, or simplify, tetanus prophylaxis in wound management for a given individual.

The relative absence of tetanus among persons 5-19 years of age reflects the success of the U.S. childhood vaccination program. Forty-seven states and the District of Columbia require primary immunization against tetanus for entry into school. Annual nationwide surveys indicate over 95% of children entering school since 1980 had received a primary series of tetanus immunizations. However, immunity levels in older populations are lower. In particular, serosurveys done since 1977 indicated that 49%-66% of persons 60 years of age or older lacked protective levels of circulating antitoxin antibody against tetanus. Expanded efforts to ensure that vaccination against tetanus is up-to-date in individuals of all ages could reduce further the remaining burden of tetanus in the United States. Efforts need to be directed primarily towards older adults, especially those 50 years of age and older who account for over 70% of current cases. One method to ensure adequate protection is to routinely provide booster doses of Td at mid-decade ages, i.e., 15 years, 25 years, 35 years, etc. Td is the only universally recommended immunization for individuals of all ages. As with tetanus, a substantial proportion of the remaining morbidity and mortality from other vaccine-preventable diseases now occurs among older adolescents and adults. The ACIP and the American College of Physicians have published recommendations for immunization of adults. All persons providing health care to older adolescents and adults should review the immunization status of patients and provide tetanus and diphtheria toxoids and, when indicated, measles, rubella, influenza, pneumococcal, and hepatitis B vaccines to persons found to be inadequately immunized.

MMWR 10-4-85

Excerpts from the article "Evaluation of Microwave Cooking Procedures and Ovens for Devitalizing Trichinae in Pork Roasts". W. J. Zimmermann. Jour. of Food Science 48:856-860, 899 (1983).

ABSTRACT

Pork roasts from pigs experimentally infected with *Trichinella spiralis* were cooked in five microwave ovens. Twenty-nine procedures, generally recommended by the oven manufacturers or pork interest groups, were used. Infective trichinae were present after cooking in 50 of 189 roasts. Factors affecting infectivity included procedure used, use or nonuse of post-cooking standing or temperature holding, weight of roast, and internal temperature attained. Five visually well done roasts contained infective trichinae including one in which all five temperatures taken exceeded 76.7C. One other infective roast, with a small red spot, also had all temperatures at or above the 76.7C level. Recommendations are made to minimize the potential that trichinae may survive in microwaved-cooked pork.

INTRODUCTION

Although Trichinosis is a relatively minor public health problem, it continues to be a favorite topic of the news media as demonstrated after recent releases by the United States Department of Agriculture (1981, 1982) and Centers for Disease Control (1982) cautioning the consumer against potential problems in microwave cooking of pork products. A recommendation was made that if any part of the product does not attain 76.7C (170F) additional cooking should be carried out. The 76.7C level is an arbitrary value which gives a juicy, flavorable product and still provides an adequate safety margin of more than 17C for conventionally cooked products containing trichinae. Since the initial release in 1981, two related microwave studies have been published. Zimmermann and Beach (1982), generally using recommended cooking procedures, obtained infective trichinae from 8 to 48 roasts and 1 of 3 groups of pork chops. Carlin et al. (1982), using various cooking times and microwave power settings for meat loaves containing trichinous pork and beef, obtained infective trichinae in eight of 30 samples tested.

Kotula et al. (1982) evaluated various quick cooking methods for preparing pork chops. Infective trichinae were obtained from frozen chops thawed in a microwave oven then charbroiled to 71 and 77C. Motile, but noninfective trichinae were obtained from chops precooked in a microwave oven, then cooked to 77C by deep fat frying. Motile larvae were obtained from chops cooked to 66C by conventional oven, convection oven, flat grill, and microwave oven-deep fat frying method, but infectivity was not determined. Temperatures of 71C or higher induced by the first three methods destroyed all trichinae.

This study was carried out to obtain a broader overview of the potential problem produced by microwave cooking of pork than obtained in the earlier study of Zimmermann and Beach (1982). Five microwave ovens and 29 basic procedures were used. The procedures generally were those provided to the homemaker by the manufacturers of pork industry groups.

RESULTS AND DISCUSSION

Fifty (26.5%) of the 189 microwave-cooked pork roasts were infective to rats. The results by ovens were: oven 1, 3 positives (13.0%) from 23 roasts; oven 2c, 7 (30.6%) of 21 roasts; oven 3b, 4 (19.0%) of 121 roasts; oven 4, none of 3 roasts; and

oven 6, 6 (28.6%) of 21 roasts. Trichinae from three (21.4%) of 14 roasts cooked with rotating trays were infective. The variation between ovens probably was more a reflection of procedures utilized for each oven than of the efficiency of a particular oven. This is supported by the high rates of infectivity obtained from roasts cooked by related procedures 5-7 in the 4 primary ovens utilized.

Overall, in this study and the previous two studies (Zimmermann and Beach, 1982; Carlin et al. 1982), nine microwave ovens representing six brands have been used. Infective products came from eight ovens and all brands. Only four roasts were cooked in the ninth oven. These findings along with the infective products obtained when rotating trays were used, would indicate that the trichina-microwave problem is not unique to one or two brands of ovens, but is industry-wide in scope.

The USDA (1981, 1982) recommends cooking pork products to 76.6C (170F) throughout. Although some homemakers may take a single temperature reading, it was the premise of this and our previous microwave studies that few homemakers would take the time and effort necessary to make a thorough temperature evaluation of a roast after cooking. However, a series of five temperatures was taken after cooking and standing (if applicable) for each roast in this study.

The most disturbing finding of this study was that five infective roasts were visually judged well done. Educational programs in the U.S. have centered on the thorough cooking of pork. The most commonly accepted consumer guideline for safe cooking of pork is appearance. If the cooked pork is pink, it is considered dangerous; if gray, it is considered safe. The findings of this study would indicate this guideline is not always valid for microwaved pork. Roast 1 not only appeared well done, but all five temperatures were above 76.7C. The minimum recorded temperature for three other well done infective roasts was 73.3%C.

According to the USDA guidelines, if any temperature is below 76.6C, the pork product should be recooked. Since there currently is no guidance for additional cooking time, some recooked products could become overdone, while others could require multiple recookings.

Although the results are an indication of a potential problem, they do show that the risks can be minimized by the following recommendations: (1) cook roast using low wattage (50% or less power); (2) use roasts, with bone-in or boneless, weighing 2 kg or less; (3) allow roasts to stand covered with foil or hold with oven temperature probe inserted and set for 76.7C, for 10 min or more; (4) measure the temperature of the roast at several locations, including center, ends and near bones; if any temperature is below 76.7C, recook until all temperatures reach 76.7C; (5) make visual observations of cut-up product; if any pink or red meat is evident, cook longer.

This study has demonstrated that potential hazard does exist when trichinous pork is cooked in a microwave oven. However, the low prevalences of 0.125% in grain fed swine and 0.5% in garbage-fed swine (Zimmermann and Zinter, 1971), along with other factors discussed by Zimmermann and Beach (1982), apparently reduces the problem. There have been no reported cases of human trichinosis thus far attributed to microwave-cooked pork.

Visit Minnesota in 86!

Hotel Reservation Form
1986 IAMFES Annual Meeting
August 3-7, 1986

We in Minnesota extend a warm invitation to you to attend the 73rd Annual Meeting of IAMFES, August 3-7, 1986 at the Radisson Hotel South, Minneapolis, Minnesota. Besides the stimulation of the educational portion of the program, there will be many other things to do including a trip to the Minnesota Zoo followed by a pig roast.

MAIL THIS FORM DIRECTLY TO THE

RADISSON SOUTH
7800 Normandale Blvd.
Minneapolis, MN 55435

Name(s) _____

EMPLOYER _____

ADDRESS _____

CITY _____ STATE/PROVINCE _____ COUNTRY _____ ZIP _____

PHONE NUMBER _____

SHARING ROOM WITH _____ NUMBER OF PERSONS _____

ARRIVAL _____ DEPARTURE _____

SPECIAL REQUESTS _____

Accomodations will only be confirmed with a check for the first night's deposit. Or use your credit card to guarantee your reservation. You will be charged for the first night if reservations are not canceled prior to 6 pm.

Credit Card # _____

Type of Credit Card _____

Expiration Date _____

Cardholder's signature _____

RESERVE ROOMS PRIOR TO JULY 1, 1986 to ASSURE SPACE

ROOM RATES $63 plus tax (9%)
up to four persons in a room

QUESTIONS? Call the Radisson South at 800-228-9822
Telex # 484314

Meeting Registration Form
1986 IAMFES Annual Meeting
August 3-7, 1986

NAME _____ COMPANION _____

EMPLOYER _____

ADDRESS _____ PHONE #_____

CITY _____ STATE/PROVINCE_____COUNTRY_____ZIP_____

Please check where applicable

Affiliate Delegate____ Speaker____
Affiliate Member____ 30 year member____
IAMFES Member____ 50 year member____
Past President____ Non Member____
Executive Board____ Student____
Exhibitor____ Honorary Member____

Certificates of Attendance will be available this year. Contact Registration Desk, Wednesday August 6, 1986.

ADVANCE REGISTRATION (note, all prices at the door are at least 20% higher)
Advance register before July 1 and SAVE. Refundable if canceled prior to June 30, 1986.

	Member	Companion(s) Each	Student	Non Member
Registration	___$30	___$10	___Free	___$40
Early Bird Reception*	___Free	___Free	___Free	___Free
Zoo and Pig Roast	___$19	___$19**	___$19	___$19
Banquet and Reception	___$20	___$20	___$20	___$20
*National Mastitis Council	___Free	___Free	___Free	___Free

*Indicate attendance
**Children 16 and under $5 each. No. ____

SPECIAL EVENTS
choose the special events you wish to attend and include with your registration

An information booth will be available to assist you in your recreational plannings of Minneapolis sites.

Tuesday, August 5 — 9:30 a.m. to 3:30 p.m.
Comprehensive tour of the Twin Cities including such attractions as Guthrie Theater, St. Paul's Cathedral, St. Anthony Falls, Landmark Center, Minneapolis lakes and much more. Also included is lunch at Forepaughs, a haunted Victorian Mansion.
Cost (including lunch) $26/person. (Min. of 30 people)

Wednesday, August 6 — 9:30 a.m. to 2:30 p.m.
Minibus service to Southdale Shopping Center. Transportation provided free.

Monday, August 4
9:30 a.m. to 2:30 p.m.
Guided tour of Ard Godfrey House, Lady of Lourdes Church, shopping and browsing at redeveloped riverfront area. Lunch - own expense. Cost $11/person. (Min. of 30 people)

Tuesday, August 5 — 9:00 a.m. to 4:00 p.m.
Spend a fun-filled day at Valley Fair, an outdoor entertainment center featuring carnival rides, games, exhibits, etc. Included in price is admission, transportation, lunch, Day Tours Hostess/Guide and an adult escort. (No one under 10 unless accompanied by an adult) Cost $20/person (Min. of 30 people)

MAIL TODAY TO:
Dr. David Smith
Registration Chairman
%MSA
PO Box 13694
Roseville, MN 55113

U.S. Funds only
Make check or money order payable to:
IAMFES 1986 Meeting Fund

Ard Godfrey House ___ at $11 = _____
Tour of Twin Cities ___ at $26 = _____
Valley Fair ___ at $20 = _____
Shopping ___ _____
Registration Total from above _____
Grand Total $ _____

Synopsis of Papers for the 73rd Annual Meeting

Identification, Disinfection, and Quality Control Intervention of *Salmonella Typhimurium* in the Shrimp Industry, *Melvin N. Kramer, PhD., M.P.H., President,* Environmental Health Associates, Ltd., 2406 Sugarcone Road, Baltimore, Maryland 21209.

In the Fall of 1983, a review of the sanitary practices and procedures, as well as physical structure and equipment of a medium-sized Shrimp processing plant located on the Caribbean side of Colombia, South America commenced. This plant receives shrimp on the dock, directly from the boats in a frozen state (frozen on the boat), defrosts, sizes, packages, and freezes the shrimp for export primarily to the United States and Japan. Sanitary inspections laboratory surveillance of environmental samples from the plant and of the finished product was undertaken. This was primarily due to a previously identified Salmonella problem, which resulted in the detention of a conch shipment for Salmonella by the U.S. Food and Drug Administration processed in this plant. It was of concern, to the firm's management, that the Salmonella problem could be present either in the plant, and/or in the shrimp, which was their major product and be of significant economic impact. In the course of the inspection and laboratory surveillance of both the environment in the plant and of the product itself, *Salmonella typhimurium* was identified. Of most interest, was the finding that we were able to recover the Salmonella from the sanitizing tank, with chlorine utilized as the bactericidal agent. We performed disinfection studies and learned that the plant strain of *Salmonella typhimurium* could be grown in 200 ppm of chlorine, as well as in other disinfectants; namely, iodine and quartinary ammonium compounds. It was discovered that by reducing the pH of the disinfectant, primarily the chlorine, a much more satisfactory bactericidal action could be obtained without effecting the taste, color, or texture of the shrimp. This combination of chlorine and acetic acid or ascorbate is acceptable under the Food, Drug and Cosmetic Act for additives.

An ELISA Method for the Detection of *Listeria monocytogenes* in Raw Milk, *J. M. Farber*, and J. I. Speirs,* Microbiology Research Division, Bureau of Microbial Hazards, Health Protection Branch, Health & Welfare Canada, Sir Frederick Banting Research Centre, Tunney's Pasture, Ottawa, Ontario K1A 0L2

An ELISA method for the detection of *Listeria monocytogenes* in raw milk was developed. Initial trials using antibodies prepared in rabbits were unsuccessful in that false positive reactions were observed. Subsequent trials with monoclonal antibodies directed against flagellar antigens appeared more promising. Inoculated raw milk samples, either with or without a 24 h enrichment in a selective broth containing 15 mg/L acriflavin HCl and 40 mg/L naladixic acid, were filtered through hydrophobic grid membrane filters (HFMF). The ELISA reaction was performed either directly on the HGMF or on a nitrocellulose "blot". Alternatively, sediments from raw milk samples were fixed onto wells of Immulon II microtiter plates and the ELISA reaction carried out using horseradish peroxidase - antimouse G, A, M as the labelled antibody and o-phenylenediamine as the substrate.

Analysis of Raw Milk for the Epidemic Serotype of *L. monocytogenes* Linked to an Outbreak of Listeriosis in California. *C. W. Donnelly*, E. H. Briggs,[1] and G. J. Baigent[2],* Departments of Animal Science[1] and Medical Microbiology[2], University of Vermont, Burlington, Vermont 05405

An outbreak of listeriosis which occurred in Los Angeles and Orange Counties, California between January and June 1985 was linked to consumption of Mexican-style fresh cheese by susceptible individuals, most of whom were pregnant Hispanic women. 1,123 raw milk samples from 27 farms which supplied the incriminated cheese plant and 27 control farms were analyzed in an attempt to isolate the epidemic serotype of *L. monocytogenes* responsible for this outbreak. Analyzed samples consisted of milk from individual farm bulk tanks as well as strings of 25-40 cows. Raw milk samples were directly enriched for 24 hours at 37°C and analyzed by flow cytometry, or cold enriched at 4°C for 1 month and analyzed by flow cytometry. Growth from direct or cold enrichment was streaked to McBrides *Listeria* agar and suspect colonies were biochemically identified as *L. monocytogenes* using the BBL Minitek system. The epidemic serotype of *L. monocytogenes* was not isolated from raw milk of farms supplying the incriminated cheese plant. *L. monocytogenes* serotype 1 was isolated from 16 string samples of one control farm. Results from flow cytometry analysis yielded a 5.86% false positive rate and a 0.53% false negative rate when compared with cultural procedures.

Control of Mold and Indoor Air Quality, *Andrew J. Streifel, MPH, Hospital Environmentalist,* University of Minnesota, Boynton Health Service, Room W-140, 410 Church Street S.E., Minneapolis, MN 55455

In 1979 indoor air quality at the University of Minnesota Hospitals became an important issue with bone marrow transplant (BMT) patients becoming infected with common airborne thermotolerant fungi. Volumetric air sampling using Andersen sieve cascade impactors and inhibitory mold agar revealed a mean thermotolerant fungal count of 167 cfu/m^3, range 4.2 - 1415. In-room HEPA filters reduced the ambient fungal levels to <10 cfu/m^3. A corresponding decrease in disease was also noted prompting on-going air quality surveillance, in and around the BMT unit. Since 1983 high volume slit samplers (3.5 m^3/sample) have been used for assessing airborne fungal concentrations. Noteworthy since then has been the observation of fungal burst phenomena due to a variety of indoor/outdoor disturbances such as building demolition, construction activity, landscaping, wet wood, and cleaning procedures. These observations have led to initiation of control measures including dilution ventilation, window seals, sturdy barrier construction during renovation projects, controlled airflow, cleaning and temp./humidity control. In one instance a moldy sink generated >500,000 cfu of penicillium species/hr. These fungal bursts can affect mold sensitive individuals including those with allergies. Current energy conservation practices can exasperate many of indoor air quality *parameters* due to a decrease in net air/changes.

IAMFES Affiliate Officers

ALBERTA ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS

Pres., Dr. M. E. Stiles ..... Edmonton
Past Pres., Dr. Harry Jackson .... Edmonton
Pres. Elect, Lorne Clarke ..... Edmonton
Sec'y., Cherise Foster ..... Edmonton
Treas., Jim Eisen ..... Edmonton
Directors:
Sam Sohal ..... Edmonton
Dr. Gordon Greer ..... Lacombe
Rick Leyland ..... Red Deer
Mail all correspondence to:
Jim Eisen
Field Representative
Luceme Foods, Ltd.
11135 151 St.
Edmonton, Alberta, Canada
403-451-0817

CALIFORNIA ASSOCIATION OF DAIRY AND MILK SANITARIANS

Pres., Bill Bordessa, Bureau Milk & Dairy Foods Control, P.O. Box 2022, Merced, CA 95344
1st Vice Pres., Austin D. Olinger .... Upland
2nd Vice Pres., Willard L. Howder .. Martinez
Recording Sec'y., Ralph Smith ..... Tulare
Past Pres., Joe M. Cardoza ..... Santa Clara

Mail all correspondence to:
Richard C. Harrell
CADMS Executive Sec.
1554 West 120th St.
Los Angeles, CA 90047
213-757-9719

CONNECTICUT ASSOCIATION OF DAIRY & FOOD SANITARIANS, INC.

Pres., Louis Palumbo ..... Hamden
Vice Pres., Nicholas Macelletti ..... Unionville
Sec'y., Paul Gottheff ..... Bozrah
Treas., William Peckham ..... Killingworth

Board of Governors:
Dr. Benjamin Cosenza
George Norman
William Geenty
Dr. Lester Hankin
David Herrington
C. Rodney Banks
Paul Danilowicz
Dr. Jesse Tucker
Philip Vozzola
Lucy Bassett
Henry Fournier
J. Frank Martin
John Karolus

Mail correspondence to:
Dr. Lester Hankin
The Conn. Agric. Exper. Sta.
PO Box 1106
New Haven, CT 06504
203-789-7219

FLORIDA ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS, INC.

Pres., Cliff Muncy ..... Miami
Pres. Elect, Dick Jolley ..... Bradenton
Past Pres., Jim Strange ..... Tallahassee
Sec'y. Treas., Dr. Franklin Barber

Board:
Dave Fry
Dr. Jim Jezeski
Dr. Oliver Kaufman
Chester Marsh
Marian Ryan

Mail all correspondence to:
Dr. Franklin Barber
1584 Cumberland Ct.
Fort Myers, FL 33907
813-936-4769

IDAHO ENVIRONMENTAL HEALTH ASSOCIATION

Pres., Nancy Bowser, 1455 North Orchard, Boise, ID 83706
Pres. Elect, Brian Dixon ..... St. Anthony
Sec'y. Treas., Jaren Tolman
Mail all correspondence to:
Jaren Tolman
Rt. 3, Box 293
Burley, ID 83318
208-678-7524

ILLINOIS MILK, FOOD AND ENVIRONMENTAL SANITARIANS

Pres., Ken Anderson, Harold Wainess & Assoc., 464 Central Ave., Northfield, IL 60093
Pres. Elect, Robert Crombie ..... Joliet
1st Vice Pres., Joe Byrnes ..... Glenview
2nd Vice Pres., Phil Hermsen .. Schaumburg
Sec'y. Treas., Clem Honer ..... Glen Ellyn
Mail all correspondence to:
Clem J. Honer
1 S. 760 Kenilworth Ave.
Glen Ellyn, IL 60137
312-693-3200

INDIANA ENVIRONMENTAL HEALTH ASSOCIATION INC.

Pres., Ted Alexander ..... Indianapolis
Pres. Elect, David E. Holder .... Indianapolis
Sec'y., Nancy Landau ..... Indianapolis
Treas., Barbara Meyer Susorney . Indianapolis

Mail all correspondence to:
Indiana Environmental Health Assoc.
Attn: Tammy Fleenor
Indiana State Board of Health
1330 W. Michigan Street
Indianapolis, IN 46206
317-633-0173

IOWA ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS, INC.

Pres., Derward Hansen ..... Exira
Pres. Elect, Ralph Sanders ..... Waterloo
1st Vice Pres., Monty Berger ..... Decorah
2nd Vice Pres., Wilbur Nielson . Independence
Sec'y. Treas., Karen Scherer ..... Monticello
Mail all correspondence to:
Dale Cooper
Box 69
Manchester, IA 52057
319-927-3212

KANSAS ASSOCIATION OF SANITARIANS

Pres., Alan Gremmel, Milk Control, 1900 East 9th St., Wichita, KS 67214
1st Vice Pres., Loren Brock
2nd Vice Pres., Mary May
Sec'y. Treas., John M. Davis
Mail all correspondence to:
John M. Davis
Wichita - Sedgewick Co.
Dept. of Comm. Health
1900 E. 9th
Wichita, KS 67214
316-268-8351

KENTUCKY ASSOCIATION OF MILK, FOOD & ENVIRONMENTAL SANITARIANS, INC.

Pres., Bland Doris
Vice Pres., Dale Marcum
Sec'y. Treas., Betty Kelly
Directors:
Region I — Max Weaver
Region II — Wiliam Montgomery
Region III — Ross Stratton, Kenny Yeager, Joseph Schureck
Region IV — D. S. Hughes
Region V — David Atkinson, William Murphy, Brenda Ward
Region VI — Berford Turner
Region VII — Gary Coleman
Mail all correspondence to:
Betty Kelly
Rt. 7, Box 55A
Shelbyville, KY 40065
502-564-7647

MICHIGAN ENVIRONMENTAL HEALTH ASSOCIATION

Pres., Terry Anderson ..... Lansing
Pres. Elect, Guy Estep ..... Grand Rapids
Past Pres., Stephen R. Tackitt . Mt. Clemens
Sec'y., Joseph Hibberd ..... Lansing
Treas., Debra L. VandeBunte ..... Holland
Directors:
Glenn Beers
William DeHaan
David Gregg
Douglas Park
Peggy French
Roger Stroh
Mail all correspondence to:
Joseph Hibberd
Michigan Dept. of Public Health
P.O. Box 30035
Lansing, MI 48909

MINNESOTA SANITARIANS ASSOCIATION INC.

Pres., Michael Pullen, 5530 Peterson Rd., White Bear Lake, MN 55110
Pres. Elect, William Coleman ... Apple Valley
Vice Pres., Larry Hemmingsen ... Minneapolis
Sec'y. Treas., Roy Ginn
Mail all correspondence to:
Roy Ginn
Dairy Quality Inst.
2353 N. Rice St., Suite 110
St. Paul, MN 55113
612-484-7269

MISSISSIPPI ASSOCIATION OF SANITARIANS, INC.

Pres., Andy Cotton, Oktibbeha County Health Dept., Lamkin St., PO Box 108, Starkville, MS 39759
Pres. Elect, L. B. Barton ..... Lucedale
1st Vice Pres., John Campbell ... Vicksburg
2nd Vice Pres., Charles Blakely ... Grenada
Sec'y Treas., Maurice Herington .... Gulfport
Mail all correspondence to:

Maurice Herrington
2400 14 Street
Suite 203
Gulfport, MS 39501

MISSOURI MILK, FOOD AND ENVIRONMENTAL HEALTH ASSOCIATION

Pres., Barry Drucker ..... Clayton
Pres. Elect, David Welde ..... Springfield
Vice Pres., Douglas Dodson ..... St. Louis
Sec'y., Reid Stevens ..... Jefferson City
Treas., John G. Norris ..... Jefferson City
Mail all correspondence to:
John Norris
Division Health
Box 570
Jefferson City, MO 65101
314-751-3696

NEW YORK STATE ASSOCIATION OF MILK AND FOOD SANITARIANS

Pres., Joseph Ferrara, NYS Dept. of Ag. & Markets, Bldg. 8, State Campus, Albany, NY 12235
Pres. Elect, Gaylord Smith ..... Schenectady
Past Pres., John R. Bartell ..... Alfred
Members:
John Baxter ..... Canajoharie
Paul Dersam ..... Leroy
Robert J. Gales ..... Hancock
Mail all correspondence to:
David Bandler
11 Stocking Hall
Cornell University
Ithaca, NY 14853
607-256-3027

NORTH DAKOTA ENVIRONMENTAL HEALTH ASSOCIATION

Pres., Robert Hennes, Chief Sanitarian, State Laboratories Dept., P.O. Box 937, Bismarck, ND 58505
Past Pres., Keith Johnson ..... Stanton
Sec'y., Scott Holmes, State Health Dept., Div. of Environmental Sanitation, Bismarck, ND 58505-5520
1st Vice Pres., Donna Becker, 1st District Health Unit, Minot, ND 58701
Mail all correspondence to:
Scott Holmes
State Health Dept.
Div. of Environmental Sanitation
Bismarck, ND 58505-5520
701-224-4600

OHIO ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS

Pres., Dean Devore, Fieldman - Famarack Farm, 1701 Tamarack Rd, Newark, OH 43055
Vice Pres., Edward Leavitt ..... Dayton
2nd Vice Pres., Emil Mikolajcik .... Columbus
Intl. Advisor, Harry Haverland ..... Cincinnati
Mail all correspondence to:
Donald L. Barrett
6727 Deepwood Ct.
Reynoldsburg, OH 43068
614-222-6195

ONTARIO FOOD PROTECTION ASSOCIATION

Pres., J. D. Cunningham, Dept. of Environmental Biology, University of Guelph, Guelph, Ontario, N1G-2W1
Vice-Pres., I. R. Patel ..... Teeswater
Secy'. Treas., J. Willekes ..... Scarborough
Past Pres., G. Huber ..... Toronto
Directors
M. Brodsky ..... Toronto
J. Roth ..... Niagra Falls
F. Eckel ..... Waterloo
P. Kwan ..... Toronto
R. Brown ..... Harriston
J. Schramek ..... Cambridge
Mail all correspondence to:
Ontario Food Protection Assn.
P.O. Box 79
Streetsville, Ontario
Canada L5M 2B7

OREGON ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS, INC.

Pres., Al T. Rydmarck, 1165 North Locust, Canby, OR 97013
Vice Pres., Robert Williams ..... Salem
Sec'y Treas., Floyd W. Bodyfelt .... Corvallis
Directors:
Ron McKay ..... Salem
Robert Gerding ..... Philomath
Mail all correspondence to:
Floyd Bodyfelt
Wiegand Hall 240
Oregon State University
Corvallis, OR 97331
503-754-3463

PENNSYLVANIA DAIRY SANITARIANS ASSOCIATION

Pres., James R. Barnett ..... Strasburg
Pres. Elect, Arthur C. Freehling
Vice Pres., Donald Lerch
Assoc. Advisors:
Stephen Spencer
Sidney Barnard
George W. Fouse
Mail all correspondence to:
Audrey Hostetter
Hershey Choc. Co.
19 E. Chocolate Ave.
Hershey, PA 17033
717-534-4031

SOUTH DAKOTA ENVIRONMENTAL HEALTH ASSOCIATION

Pres., Robert McGrath ..... Brookings
Pres. Elect, Morris Forsting ..... Sioux Falls
Sec'y. Treas., Stanley A. Iwagoshi . Sioux Falls
For more information contact:
Stanley A. Iwagoshi
South Dakota Dept. of Health
1320 S. Minnesota, Suite A
Sioux Falls, SD 57105
605-339-7113

TENNESSEE ASSOCIATION OF MILK, WATER AND FOOD PROTECTION

Pres., Ray Rottero
Past Pres., Carl Moore
Pres. Elect, David Mayfield
Vice Pres., Dr. B. J. Demott
Sec'y-Treas., Cecil White
Archivist, Ruth Fuqua
Mail all correspondence to:
Cecil White
Dept. Agriculture
Ellington Agri. Center
Box 40627 Melrose Station
Nashville, TN 37204
615-360-0155

TEXAS ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL PROTECTION

Pres., Joe Goddard, Texas Tech Univ., Envir. Health and Safety, PO Box 4369, Lubbock, TX 79409
Vice Pres., James Roberson ... San Antonio
Sec'y., Ron Richter ..... College Station
Treas., Chris Woelfel ..... College Station
Mail all correspondence to:
Prof. Ron Richter
Kleburg Center
Texas A&M University
College Station, TX 77843
409-845-4409

VIRGINIA ASSOCIATION OF SANITARIANS AND DAIRY FIELDMEN

Pres., Greg Snow
Past Pres., Joe Satterfield
1st Vice Pres., Ray Hall
2nd Vice Pres., Donna Izac
Sec'y, Treas., W. J. Farley ..... Staunton
Mail all correspondence to:
W. J. Farley
Route 1, Box 247
Staunton, VA 24401
703-434-3897

WASHINGTON MILK SANITARIANS ASSOCIATION

Pres., Donald Penders, WSDA, N. 222 Havana, Spokane, WA 99201
Pres. Elect, Paul Nelson ..... Seattle
Sec'y. Treas., Lloyd Luedecke ..... Pullman
Mail all correspondence to:
Lloyd Luedecke
NW 312 True St.
Pullman, WA 99163
509-335-4016

WISCONSIN ASSOCIATION OF MILK AND FOOD SANITARIANS

Pres., Eugene Lindauer, WI Dpt. of Ag, Trade & Cons. Prot., 220 N. Jefferson St., Suite 146 A, Green Bay, WI 54301
Vice Pres., Dale Hachmann
1st Vice Pres., Randy Daggs ..... Madison
Sec'y. Treas., Neil Vassau ..... Madison
Past Pres., David Meyers ..... Arcadia
Mail all correspondence to:
Neil M. Vassau
PO Box 7883
Madison, WI 53707
608-267-3504

WYOMING PUBLIC HEALTH SANITARIANS ASSOCIATION

Pres., Gary Hickman, Cheyenne/Laramie Co. Health Dept., 1710 Snyder Ave., Cheyenne, WY 82001
Pres. Elect, Kathy Johnson ..... Capper
Sec'y., Sandra Knop ..... Green River
Treas., Sandra Palmer ..... Cheyenne
Mail all correspondence to:
Sandra Knop
Wyoming Dept. of Health
PO Box 1153
Green River, WY 82935
307-875-5846

Abstracts of papers in the May Journal of Food Protection

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

Production and Characterization of Antibody Against Deoxynivalenol Triacetate, Guang-Shi Zhang, Shu Wen Li and Fun Sun Chu, Food Research Institute and Department of Food Microbiology and Toxicology, University of Wisconsin, Madison, Wisconsin 53706

J. Food Prot. 49:336-339

Antibodies against deoxynivalenol-triacetate (Tri-Ac-DON) was prepared by immunizing rabbits with a hemisuccinate derivative of 7,8 dihydroxycalonectrin (DHC) conjugated to bovine serum albumin. Using tritiated Tri-Ac-DON as the testing ligand, antibody titers were observed as early as 4 wk after immunization. Useful antibody for radioimmunoassay (RIA) of Tri-Ac-DON was obtained from the rabbits 7 wk after immunization, with one booster injection. Competitive RIA revealed that the antibody was most specific for Tri-Ac-DON. The relative cross-reactivity of this antibody with Tri-Ac-DON, T-2 toxin tetra-acetate, 15-acetyl-deoxynivalenol and acetyl-T-2 toxin was 1 (most cross-reactive), 0.003, 0.002, and 0.001, respectively. Practically no cross-reactivity was observed with deoxynivalenol (DON), diacetoxyscirpenol, nivalenol and T-2 toxin. The detection limits for Tri-Ac-DON by RIA was about 0.1 ng/assay. The use of this antibody for quantitation and confirmation of DON in cereals after acetylation of sample extracts is proposed.

Antimicrobial Activity of (+)-Tuberine, Said O. Gnan and G. M. Sheriha, University of Al-Fateh and Medicinal Plant Research Program, NASR, Tripoli, Lybia

J. Food Prot. 49:340-341

A new alkaloid, (+)-tuberine isolated from *Haplophyllum tuberculatum,* had high antimicrobial activity against *Staphylococcus aureus, Bacillus subtilis* and *Saccharomyces cerevisiae* at 1 μg/ml. (+)-Tuberine was slightly inhibitory to *Escherichia coli.*

A Simple Qualitative Method for Detecting Cleanliness of Food Contact Surfaces, M. E. Anderson, H. E. Huff, R. T. Marshall and H. D. Naumann, U.S. Department of Agriculture, Agricultural Research Service, Bioengineering Research Unit and Department of Food Science and Nutrition, University of Missouri, Columbia, Missouri 65211

J. Food Prot. 49:342-346

Two tests were developed for detecting protein on food contact surfaces. Wetted swabs rubbed over surfaces on which 3 μg of protein was dried became visibly blue when reacted with Folin's test reagents. Wetted Chemstrips, available to test for protein in urine, became visibly colored on rubbing on surfaces with 0.25 μg of protein. Sensitivity of the tests varied with type of protein.

Dairy Products, Produce and Other Non-Meat Foods as Possible Sources of *Campylobacter jejuni* and *Campylobacter coli* Enteritis, Noreen V. Harris, Terri Kimball, Noel S. Weiss and Charles Nolan, Communicable Disease Control Section, Seattle-King County Department of Public Health, 1200 Public Health Safety Building, Third and James, Seattle, Washington 98104; Department of Epidemiology, University of Washington, Seattle, Washington 98195; and Epidemiology, Tacoma-Pierce County Health Department, 3629 South D Street, Tacoma, Washington 98408

J. Food Prot. 49:347-351

To determine the role of dairy products and produce in the occurence of *Campylobacter jejuni* and *Campylobacter coli* (CJC) enteritis, we analyzed dietary histories obtained from 218 persons with campylobacter enteritis who were diagnosed by culture betwen April, 1982, and September, 1983. For comparison, similar histories were obtained from 526 persons without CJC enteritis. Both ill and well subjects were enrollees of the Group Health Cooperative of Puget Sound (GHC). Raw milk (relative risk (RR) = 4.6) and mushrooms (RR = 1.5) were the only non-meat foods consumed significantly more often by cases than by controls. Cases infected with strains carrying plasmid-mediated tetracyline resistance (R factors) were somewhat more likely (RR = 8.5) than those infected with other strains (RR = 2.5) to have acquired their infections from raw milk (P = 0.03). In this population, approximately 10% of the tetracycline-resistant CJC infections were attributable to raw milk consumption as compared to only 2% of the infections with tetracycline-sensitive strains.

Association of [^{32}P] with *Clostridium botulinum* 52A Vegetative Cells Following Growth in a Medium Containing Sodium Dihydrogen [^{32}P]-Pyrophosphate, M. K. Wagner and F. F. Busta, Department of Food Science, University of Minnesota, 1334 Eckles Avenue, St. Paul, Minnesota 55108

J. Food Prot. 49:352-354

The association of [^{32}P] with *Clostridium botulinum* 52A vegetative cells following growth in a medium containing either sodium dihydrogen [^{32}P]-pyrophosphate ([^{32}P]-SAPP) or sodium dihydrogen [^{32}P]-orthophosphate ([^{32}P]-orthophosphate) was studied. Absorbency measurements at 630 nm were used in addition to [^{32}P] recovery in determining [^{32}P] association with cellular growth and metabolism. Radiolabeling experiments showed [^{32}P]-orthophosphate was associated with vegetative cells during logarithmic growth, yet was released once stationary phase was attained or upon lysis. [^{3P}]-SAPP was also associated with cells during growth, but was not released once stationary phase was attained. Results suggested [^{32}P]-SAPP continued to bind cells or other metabolic materials following attainment of the stationary phase of cells. Fractionation of 24 and 48 h-old cultures grown in the presence of [^{32}P]-SAPP showed a higher percentage of [^{32}P] associated with the RNA fraction (3.91 and 2.48%, respectively) compared to the DNA fraction (0.09 and 0.07%, respectively).

Influence of Electrical Stimulation and Conditioning Periods Upon Hot-Boned Cooked Beef Semitendinosus Roast, Earl E. Ray, C. Farrell and D. E. Hood, Agricultural Research Institute, Dunsinea Research Centre, Castleknock Co., Dublin, Ireland

J. Food Prot. 49:355-360

Forty-eight beef sides from 24- to 36-month-old Holstein and various crosses were used to evaluate the influence of electrical stimulation and conditioning periods upon physical changes, shear force, panel tenderness scores, palatability traits and cooking yield of prerigor and postrigor semitendinosus (ST) muscle roast. The intact ST muscle was excised from the left sides [20] within 30 min postexsanguination and electrically (ES) stimulated (50 v; 5 ms on; 70 ms off; 3 min), while the remaining paired muscles [20] served as controls (NS). In addition, the left side from four carcasses was ES and the right side served as the control (NS). These eight sides were aged for 7 d before removal of the ST muscle. After stimulation, the [40] muscles were placed in a L600 Cryovac® bag and assigned to the following conditioning periods: 0, 1, 2, 3 h and 7 d. The remaining ST muscles [8] were removed from the sides after 7 d of aging. All muscles were cooked in hot water to an internal temperature of 66°C. The 2-h conditioning period yielded beef with the highest moisture and fat content, highest cooking yield and lowest protein level. ES did not have an influence upon physical characteristics of the ST roast, while the 7-d carcass conditioning period caused the least change in length and depth. ES lowered the pH and cooking loss after stimulation, improved the sensory panel tenderness scores and decreased the Instron® shear values of the cooked product. The most tender product was from the 7-d carcasses, while the 7-d excised muscle, and the beef given the 1-h conditioning period were the least tender. There was more variation in tenderness scores for the 8-mm than the 4-mm slices; but the lowest overall acceptability scores (4 mm and 8 mm) was for the 2-h conditioning period, which had low scores for flavor and flavor intensity. This problem could be overcome by adding a seasoning to the roasts before cooking.

Cell-Wall-Associated Proteinases in *Lactobacillus casei* and *Lactobacillus plantarum*, M. El Soda, M. J. Desmazeaud, D. Le Bars and C. Zevaco, Laboratoire de Microbiologie Laitière and Laboratoire de Biochimie et Technologie Laitières, Institut National de la Recherche Agronomique (INRA), CNRZ-78350 Jouy-en-Josas, France

J. Food Prot. 49:361-365

Information concerning cell-wall associated proteinases of lactobacilli is limited. In *Lactobacillus casei* and *Lactobacillus plantarum*, presence of such proteinase is clearly shown. Differences between several strains were noticed. Higher cell-wall-associated proteinase activity can be measured in extracts obtained from milk-grown cells when compared to MRS-grown cells. No aminopeptidase, dipeptidase or carboxypeptidase activities were detected in the cell-wall-associated proteinase fraction. Isoelectric focusing of α_{s1}-casein hydrolysates obtained by the action of this fraction from *L. casei* grown in milk revealed the presence of a major hydrolysis product and three minor degradation products with isoelectric points more acidic than α_{S1}. Beta-casein was also degraded by the cell-wall extract with formation of one major product and several minor products with isoelectric points more acidic than β-casein. Two major hydrolysis products with isoelectric points higher than β-casein were also detected. Isoelectric focusing of α_{s1}- and β-casein hydrolysates obtained by the action of the intracellular extracts of *L. casei* grown either in milk or in MRS broth shown identical patterns. As with *L. casei*, two strains of *L. plantarum* exhibited cell-wall proteinase activity. Milk-grown cells were more proteolytic than MRS-grown cells. Generally *L. plantarum* was significantly less proteolytic than *L. casei*.

Salmonella in Swine at Slaughter: Incidence and Serovar Distribution at Different Seasons, Martin Currier, Mark Singleton, Joey Lee and Don R. Lee, Biological Sciences Department, East Texas State University, Commerce, Texas 75428

J. Food Prot. 49:366-368

Throughout a 1-year period samples were obtained from 874 hogs at slaughter at one local, state-inspected slaughter plant. Caecal contents were the source of the samples. A total of 118 salmonellae was isolated yielding 16 different serovars. Major serovars were *derby* (57%), *alachua* (11%), *agona* (8%), and *newport* (5%). The average number of hogs sampled per trip was 17. The maximum number of serovars obtained at any one sampling day was 3. The maximum number of *Salmonella*-positive samples in any one day was 11 of 17 samples (64.7%). Total numbers of *Salmonella* isolates did not vary with season; however, during the hot, dry summer and fall seasons, 10 and 11 different serovars were isolated, respectively, compared to 3 and 1 serovars for the cooler, wetter winter and spring seasons, respectively.

Donairs (Gyros) - Potential Hazards and Control, Ewen C. D. Todd, R. Szabo and F. Spiring, Food Directorate, Health Protection Branch, Sir Frederick G. Banting Research Centre, Tunney's Pasture, Ottawa, Ontario, Canada K1A 0L2

J. Food Prot. 49:369-377

Because of concerns that meat in donairs could allow growth of pathogens during cooking and overnight cooling of leftovers, 34 donairs from eleven establishments had temperatures taken and were examined microbiologically. Temperatures varied depending on depth of measurement and stage from the raw product to reheated leftovers. These were frequently >4 or <60°C and could be considered at temperatures favorable for growth of pathogens. Although aerobic colony counts were high (mean of 10^5 to 10^7 CFU/g), counts tended to decrease the longer the donair remained cooking on the spit. *Staphylococcus aureus, Bacillus cereus, Clostridium perfringens* and *Escherichia coli* were never more than 10^4/g despite some abusive practices, such as leaving donairs on the spit with the heat source turned off because the demand was low. *Salmonella* was found only in raw chicken slices to be used in donairs. It is recommended that good hygienic practices be encouraged at donair establishments and temperature measurements of donairs taken to verify these. Only if meat is <50°C at 1 cm below the surface during cooking or >5°C for the raw product or cooled leftovers, should samples be considered for microbiological analysis unless abusive practices have been observed. Because temperatures may vary over a short period of time during cooking, at least five measurements are recommended for each stage of the donair life (raw product, cooking donair, cooled leftovers and reheating donairs).

Effect of Sucrose Esters in Combination with Selected Mold Inhibitors on Growth and Aflatoxin Production by _Aspergillus parasiticus_, Douglas L. Marshall and Lloyd B. Bullerman, Department of Food Science and Technology, University of Nebraska, Lincoln, Nebraska 48583-0919

J. Food Prot. 49:378-382

The effects of sucrose esterified with a mixture of palmitic and stearic acids (commonly referred to as sucrose ester) in combination with cinnamon, potassium sorbate, or calcium propionate on growth of and aflatoxin production by *Aspergillus parasiticus* was studied in broths at two pH values. Cinnamon in combination with sucrose ester did not result in additive or synergistic inhibitory effects on growth or aflatoxin production. At pH 4.0, subinhibitory amounts of cinnamon were stimulatory toward growth and antagonistic to inhibition of growth by sucrose ester. Complete inhibition of growth and aflatoxin production was observed with a cinnamon level of 1.0%, alone and in combination with sucrose ester. Low levels (0.1%) of calcium propionate or potassium sorbate combined with sucrose ester did not enhance inhibition of growth or aflatoxin production. A synergistic effect on inhibition of growth was observed with high levels of propionate or sorbate in combination with sucrose ester, while aflatoxin production remained relatively unaffected. However, subinhibitory levels of propionate resulted in a 10-fold increase of aflatoxin production and a shift in the ratio of aflatoxin B_1 and G_1 from 1:1 to 1:8. Subinhibitory levels of sorbate also caused a stimulation of aflatoxin production during the latter stages of incubation, though to a lesser degree than propionate.

HPLC Analysis of Oxytetracycline Residues in Honey, Peter Sporns, Suet Kwan and Lawrence A. Roth, Department of Food Science, University of Alberta, Edmonton, Alberta, Canada T6G 2P5 and Food Laboratory Services Branch, Alberta Agriculture, O.S. Longman Building, Edmonton, Alberta, Canada T6H 4P2

J. Food Prot. 49:383-388

Oxytetracycline (OTC), also known commercially as Terramycin, was determined to be more stable in honey than in buffered aqueous solutions at similar pH values and temperatures. A rapid high performance liquid chromatography (HPLC) method was developed to detect and quantitate OTC using a 1:1 dilution (wt/wt) of honey samples in water. Using 355 nm as the wavelength of detection, amounts as low as 0.5 µg/ml could be detected in the above solution. The limits of detection were lowered considerably by a double extraction procedure.

Sources of Shellfish in Outbreaks of Probable Viral Gastroenteritis: Implications for Control, John J. Guzewich and Dale L. Morse, Food Protection Section and Bureau of Communicable Disease Control, New York State Department of Health, Albany, New York 12201

J. Food Prot. 49:389-394

Shellfish have been identified as vehicles of foodborne enteric disease in the United States since the first part of the twentieth century. Between 1900 and 1983, 198 incidents or outbreaks involving 8,659 cases were reported nationally. In New York State, reports of shellfishborne gastroenteritis and/or hepatitis A began to increase in 1981, when one outbreak involving 234 cases of gastroenteritis was reported. In subsequent years, the following were reported: 1982, 103 outbreaks of gastroenteritis involving 1,017 cases and 10 cases of hepatitis A; 1983, 33 outbreaks of gastroenteritis involving 504 cases; 1984, 15 gastroenteritis outbreaks and 256 cases; and the first five months of 1985, 10 outbreaks of gastroenteritis involving 98 cases. States, countries or provinces identified as sources of shellfish implicated in these outbreaks included: New York, Massachusetts, Rhode Island, England North Carolina and Prince Edward Island. The source investigations were seriously impaired by numerous inadequacies in current shellfish-tagging regulations and the manner in which these are enforced. Possible solutions to prevent further shellfishborne disease outbreaks include: (a) improve shellfishborne disease surveillance and reporting; (b) embargo shellfish sold by shippers implicated in disease outbreaks; (c) adopt strict state and federal laws to control the sanitary quality of all shellfish; (d) accomplish greater participation in the Interstate Shellfish Sanitation Conference; (e) provide an adequate number of enforcement officers; (f) develop a microbiologic growing water and/or product standard that assures viral as well as bacteriologic safety; (g) properly classify shellfish-harvesting waters; (h) mandate a manifest-type tagging system; (i) strictly enforce wholesale and retail shellfish-tagging requirements; (j) require depuration of all shellfish sold; and (k) advise the public against the consumption of raw or partially cooked shellfish. If these or other approaches fail to prevent morbidity, a ban on the sale of raw shellfish may be the only solution.

Acceleration of Cheese Ripening: Recent Advances, M. El Soda, Department of Agricultural Industries, Faculty of Agriculture, Alexandria University, Alexandria, Egypt

J. Food Prot. 49:395-399

Much attention has been given recently to accelerated cheese ripening due to its numerous economic benefits. This review describes the different methods used to shorten the ripening period of cheese. Special attention is given to the new technologies used in this field.

READER SERVICE INFORMATION

To receive information on membership in the International Association (IAMFES) Circle 360 on this page.

International Association of Milk, Food and Environmental Sanitarians, Inc.

Use this Reader Service Page to receive information on products and services in this issue. . .

Please complete all information.
Circle numbers and mail today →
Limit 10 inquiries

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

Expires July 1, 1986; Foreign, August 1, 1986

Name _____

Company Name _____

Title _____

Address _____

City _____ State/Province _____

Zip _____ Country _____

Occupation _____

Phone Number ( ) _____

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

Tear out, fold, staple and mail - self addressed on opposite side

Place
Stamp
Here

IAMFES, Inc.
Reader Service Information
P.O. Box 701
Ames, IA 50010

Equipment / Supplies

USED EQUIPMENT AVAILABLE

4000 TO 7000 GAL S.S. TANK
500 GAL S.S. TANKS SINGLE SHELL
C.B. 2500 GPH H.T.S.T. PASTEURIZER
APV—300 GPH PASTEURIZER
AMERIO PLATE FREEZER
GAULIN K-24 HOMOGENIZER
500-1000 GAL. P.W. PROCESSORS.
2000 GAL TANK TRUCK.

LESTER KEHOE MACHINERY CORP.
2581 Richmond Terrace
Staten Island, NY 10303
(718) 447-3410 TELEX: DRURY 423496

—20,000 gallon silo
(7)—4,000 gallon tanks with stainless steel heads
—CB & CP & York Heat Exchangers
—Kettles, Agitators 600 gallons & smaller
—CB Rotary Filler with 10 spouts
—CB-660 Filler
—Fittings up to 4". valves

CARMEL EQUIPMENT

246 Beacon Ave. • Jersey City, NJ 07306
(201) 656-4030

AMMONIA TESTED
LITE ONE CANDLE
OUR EXPERIENCE/SKILL & ENTHUSIASM BUILDS & SELLS BETTER EQUIPMENT

200 Freezers in Stock 80 to 1800 GPH
Rebuilt Admirals, Stars & 3D90's 300-1200
Back up Parts & Hotline Service
Delivery USA Martin's Rigs
603 Cherry Rebuilt 900 G.P.H. 3BBL
Flavor Tanks 3 compt. 100 & 500 gals.
Anderson Fillers and Clutches Rebuilt
Only Martin tests own ammonia

ADVANCE INSTANT EXCHANGES

Rechromed freezer barrels: V1D, V1F, 150's, V2D, VA300's, VS200-400-500 Star's, V3100, 303, 403, 612, 614, 3D90, 3D121, 33D180, 6 bbl. 33D, 242, 672 Therm., C.P. KM340, 3M30, M55, M30.
Stainless freezer outlets: V1D, V1F, VA 150's V2D, V2F, VA300's, VS200-400-500 Star's
Rebilt & New dashers: 603 & 612, VS500, 400 & 200—V1D-VA150—V20 & VA300
Rebilt pumps some freezers *new way*.
Call Lamar, former I.C. Plant Mgr.

Martin Brothers
816 ADAMS—BOX 630
WINNSBORO, LOUISIANA 71295
Bill (318) 435-4581 Caleb
VITALINE REBILT UPGRADE
"No bad deal from good dealer"

SELECT used machinery
DAIRY EQUIPMENT NEEDED
M & E will purchase your used equipment, either complete plants or individual items
We are THE Liquidators
and
We Come With CASH
Call Don Rieschel

MACHINERY & EQUIPMENT CO.
PO BOX 7632-W SAN FRANCISCO, CA 94120
TOLL FREE: National 800-227-4544
California 800-792-2975
Local & International 415-467-3400
Telex 340-212

THE PERRY PROFESSIONALS

Nimco 550 S.S. ½ p. to ½ gal.
Nimco 5110 E S.S. Eco Pack
Haskon model 340, 74 OU
Amerio3 1 autoplate freezer, 800 GPH
DeLaval SS Mdl. A 10-RCF plate exch., unused
Excello Q-80 S.S. ½ p. to qts.
FMC Mdl. SSE & B-75 juice finishers
Unilloy 350R2 blow molder, 4WD, 1 gal.
Hartig H-140 blow molder, 1985

WE BUY DAIRIES

PERRY / EQUIPMENT CO. INC.
Box DF. Hainesport, N.J. 08036
Phone: 609-267-1600

1—5000 gal. cold wall tank
1—lot of 1"-4" pipe valves & fittings
1—500 gal. complete H T S T w/homo
2—6000 gal. milk storage tanks
2—600 gal. processing vats
1—1000 gal. conventional starter vat
1—3500 **Damrow** deep make vat
1—1000 Gal. pressure wall vat
1—6000 Gal. cold wall tank
1—10,000 gal. rectangular cold wall tank

Midwest Food Supply Co.
MIDCO

504 Clay St., Waterloo, IA 50704
(319) 234-5554

STERILE SAMPLE VIAL

One piece 45 ml vial, easy one hand handling, durable, resists cracking, food grade polypropylene.

Phone: 518-853-3377
For samples call or write:

Diversified Vial Corp.
P.O. Box 611
Fonda, NY 12068

Immediate Delivery — Direct From The Factory

60,000 Gallon Silos with Cold Wall
50,000 Gallon Silos with Cold Wall
40,000 Gallon Silos with Cold Wall
30,000 Gallon Silos with Cold Wall
20,000 Gallon Silos with Cold Wall
10,000 Gallon Silos with Cold Wall
6,000 Gallon Horizontals with Vert. & Horiz. Agitators
1,000 and 2,000 Gallon Cone Bottom Processors
1,000 and 2,000 Gallon Pitched Bottom Processors

Plate Heat Exchangers
Tubular Heat Exchangers
Single Wall Tanks
Portable Tanks
Cooling/Storage Tanks

PAUL MUELLER COMPANY
P.O. Box 828/Springfield, MO 65801
Outside MO Toll Free 1-800-641-2830
In MO Call Collect 0-417-831-3000

MUELLER
Processing Equipment

Attention:
BREDDO HIGH SPEED BLENDERS
Available in All Sizes From:
25 gallons through 300 gallons
CHOOSE FROM
Complete Inventory Including
Single Wall or Jacketed Units
Contact: **BREDDO LIKWIFIERS**
18th & Kansas
Kansas City, KS 66105
800-255-4092

Equipment / Supplies

Services / Products

Services / Products

Positions Available

Consulting Services

3-A Sanitary Standards for Tubular Heat Exchangers for Milk and Milk Products

Number 12-05

Formulated by
International Association of Milk, Food and Environmental Sanitarians
United States Public Health Service
The Dairy Industry Committee

It is the purpose of the IAMFES, USPHS, and DIC in connection with the development of the 3-A Sanitary Standards program to allow and encourage full freedom for inventive genius or new developments. Tubular heat exchangers heretofore and hereafter developed which so differ in design, material, fabrication, or otherwise as not to confrom with the following standards, but which, in the fabricator's opinion are equivalent or better, may be submitted for joint consideration of the IAMFES, USPHS, and DIC, at any time.

A

SCOPE

A.1

These standards cover the sanitary aspects of tubular heat exchangers without agitators for milk and milk products. The standards do not cover high pressure (greater than 250 psig product pressure) heat exchangers which require special tubing and/or fittings.

A.2

In order to confrom with these 3-A Sanitary Standards, tubular heat exchangers shall comply with the following design, material, and fabrication criteria.

B

DEFINITION

B.1

Product: Shall mean milk and milk products.

B.2

Tubular Heat Exchangers: Shall mean a heat exchanger having one continuous tube, two or more concentric tubes, or two or more tubes in parallel.

B.3

Product Contact Surfaces: Shall mean all surfaces which are exposed to the product and surfaces from which liquids may drain, drop, or be drawn into the product.

B.4

Non-Product Contact Surfaces: Shall mean all other exposed surfaces.

B.5

Mechanical Cleaning or Mechanically Cleaning: Shall denote cleaning, solely by circulation and/or flowing chemical detergent solutions and water rinses onto and over the surfaces to be cleaned, by mechanical means.

C

MATERIALS

C.1

All product contact surfaces shall be of stainless steel of the AISI 300 series[1] or corresponding ACI[2] types (See Appendix, Section E), or equally corrosion-resistant metal that is non-toxic and non-absorbent. except that:

C.1.1

Rubber and rubber-like materials may be used for bonded or removable gaskets, seals, and parts having the same functional properties. These materials shall comply with the applicable provisions of the 3-A Standards for Multiple-Use Rubber and Rubber-Like Materials, Number 18-00.

C.1.2

Plastic materials may be used for bonded or removable gaskets, seals, and parts having the same functional properties. These materials shall comply with the applicable provisions of the 3-A Standards for Multiple-Use Plastic Materials, Number 20-13.

C.1.3

Bonded rubber and rubber-like materials and bonded plastic materials having product contact surfaces shall be of such composition as to retain their surface and conformation characteristics when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment.

C.1.4

The final bond and residual adhesive, if used, of bonded rubber and rubber-like materials and bonded plastic materials shall be non-toxic.

C.2

All non-product contact surfaces shall be of corrosion-resistant material or material that is rendered corrosion-resistant. If coated, the coating shall adhere. All non-product contact surfaces shall be relatively non-absorbent, durable, and cleanable. Parts removable for cleaning having both product contact and non-product surfaces shall not be painted.

D

FABRICATION

[1]The data for this series are contained in the following reference: AISI Steel Products Manual, Stainless & Heat Resisting Steels, Dec. 1974, Table 2-1, pp. 16-17. Available from: American Iron & Steel Institute, 1000 16th St., NW, Washington, DC 20036.

[2]Steel Founders' Society of America, Cast Metal Federation Bldg., 455 State St., Des Plaines, IL 60016.

D.1

Product contact surfaces shall have a finish at least as smooth as a No. 4 ground finish on stainless steel sheets and be free of imperfections such as pits, folds, and crevices in the final fabricated form (See Appendix, Section F).

D.2

All permanent joints in metallic product contact surfaces shall be welded, except that tubes may be either expanded and rolled or welded into tube sheets or return fittings. When tubes are expanded and rolled into tube sheets or return fittings, the resulting joint shall be completely rigid and without pockets or crevices. All welded areas of product contact surfaces shall be at least as smooth as the adjoining surfaces except that welded joints in tubes in tubular heat exchangers designed to be mechanically cleaned need only to be smooth and free from pits, cracks, inclusions, or other defects.

D.3

All product contact surfaces shall be easily accessible for cleaning and inspection either when assembled or when removed except that the product contact surfaces of tubular heat exchangers designed to be mechanically cleaned do not have to be accessible for inspection if the heat exchange surface is one continuous tube. If the tubular heat exchanger is two or more tubes in parallel, the product contact surfaces shall be accessible for manual cleaning and inspection. Removable parts shall be readily demountable.

D.4

Tubes shall be supported in a manner that will prevent sagging. In a heat exchanger designed to be mechanically cleaned of the type that incorporates two or more concentric tubes, means shall be provided to keep the tubes equally spaced. The means provided to keep tubes equally spaced shall not interfere with mechanical cleaning.

D.5

Sanitary tubing and fittings in product contact surfaces shall conform to 3-A Standards for Fittings Number 08-17, Rev. and/or to the applicable provisions for welded sanitary product pipelines found in the 3-A Accepted Practices for Permanently Installed Pipelines and Cleaning Systems, Number 605-02, except where, for mechanical reasons, a smaller size may be required.

D.6

The minimum diameter of circular heat exchange tubing shall be 0.902 inch I.D. except that circular cross section heat exchange tubing used in a heat exchanger may be of smaller diameter if the heat exchanger is designed for mechanical cleaning.

D.7

Gaskets having a product contact surface shall be removable or permanently bonded to the surface. Any gasket groove or gasket retaining groove, except in the bonded area, shall be no deeper than its width and shall not exceed 1/4 inch in depth or be less than 1/4 inch wide except that:

D.7.1

Grooves for cover gaskets shall be no deeper than their width and minimum radius of any internal angle shall not be less than 1/8 inch.

D.7.2

In grooved gaskets, the length of the shorter leg shall not exceed twice the width of the groove, the minimum width of the groove being 1/4 inch and the maximum depth 1/2 inch.

D.7.3

All gasket grooves and gasket retaining grooves for removable gaskets shall be readily cleanable.

D.7.4

Bonded gaskets shall be bonded in a manner that the bond is continuous and mechanically sound, and when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment, the rubber or rubber-like material does not separate from the base material to which it is bonded.

D.8

All internal angles of 135 degrees or less on product contact surfaces shall have minimum radii of 1/4 inch, except that:

D.9

Where smaller radii are required for essential functional reasons, smaller radii may be used provided the product contact surfaces are readily accessible for cleaning and inspection.

D.10

The minimum radii in gasket grooves or gasket retaining grooves, other than those for standard 1/4 inch and smaller O-Rings, shall be not less than 1/8 inch.

D.11

The minimum radii in grooves for standard 1/4 inch O-Rings shall be not less than 3/32 inch and for standard 1/8 inch O-Rings shall be not less than 1/32 inch.

D.12

There shall be no threads on product contact surfaces.

D.13

Legs, if used shall be smooth with rounded ends. Legs made of hollow stock shall be sealed. The minimum clearance between lowest part of frame and floor shall be six inches. Bases, when used, shall have smooth exterior surfaces.

D.13.1

Bases, which because of size or type cannot be mounted on legs, shall be designed for grouting and sealing.

D.14

Non-product contact surfaces shall be readily cleanable and shall be free of pockets and crevices. Surfaces to be coated shall be effectively prepared for coating.

con't. p. 227

3-A Sanitary Standards for In-Line Strainers for Milk and Milk Products

Number 42-00

Formulated by
International Association of Milk, Food and Environmental Sanitarians
United States Public Health Service
The Dairy Industry Committee

It is the purpose of the IAMFES, USPHS, and DIC in connection with the development of the 3-A Sanitary Standards program to allow and encourage full freedom for inventive genius or new developments. In-line milk and milk product stainers specifications heretofore or hereafter developed which so differ in design, materials, and construction, or otherwise, as not to conform to the following standards but which in the manufacturer's or fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAMFES, USPHS, and DIC at any time.

A

SCOPE

A.1

These standards cover the sanitary aspects of in-line strainers for milk and milk products.

Straining devices which employ mechanical action are *not* covered by this standard.

A.2

In order to conform with these 3-A Sanitary Standards, in-line strainers shall comply with the following design, material, and fabrication criteria.

B

DEFINITIONS

B.1

Product: Shall mean milk and milk product.

B.2

Strainers: Shall mean equipment having a perforated screen or multiple perforated screens. Woven wire is not permitted.

B.3

Product Contact Surface: Shall mean all surfaces that are exposed to the product, or from which liquid may drain, drop, or be drawn into the product.

B.4

Non-Product Contact Surface: Shall mean all other exposed surfaces.

C

MATERIALS

C.1

Product contact surfaces shall be of stainless steel of the AISI 300 series[1] or corresponding ACI[2] types (see Appendix, Section E) or metal which under conditions of intended use is at least as corrosion-resistant as stainless steel of the foregoing types and is non-toxic and non-absorbent, except that:

C.1.1

Rubber and rubber-like materials may be used for gaskets, sealing applications, and parts having the same functional purposes.

C.1.2

Rubber and rubber-like materials when used for the above specified applications shall comply with the applicable provisions of the 3-A Standards for Rubber and Rubber-Like Materials, Number 18-00.

C.1.3

Plastic materials may be used for gaskets, sealing applications, and parts having the same functional purposes.

C.1.4

Plastic materials when used for the above specified applications shall comply with the applicable provisions of the 3-A Standards for Plastic Materials, Number 20-13.

C.1.5

Rubber and rubber-like materials and plastic materials having product contact surfaces shall be of such composition as to retain their surface and conformation characteristics when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment.

C.1.6

The final bond and residual adhesive, if used, of bonded rubber and rubber-like materials and bonded plastic materials shall be non-toxic.

C.2

Non-product contact surfaces shall be of corrosion-resistant material, relatively non-absorbent, durable, and cleanable.

D

FABRICATION

D.1

Product contact surfaces shall have a finish at least as smooth as a No. 4 ground finish on stainless steel sheets and be free of imperfections such as pits, folds, and crevices in the final fabricated form (see Appendix, Section F).

---

[1]*The data for this series are contained in the following references: AISI Steel Products Manual, Stainless & Heat Resisting Steels, Dec. 1974, Table 2-1, pp. 18-19. Available from: American Iron & Steel Institute, 1000 16th St., NW, Washington, DC 20036.*

[2]*Steel Founders' Society of America, Cast Metal Federations Bldg., 455 State St., Des Plaines, IL 60016.*

D.2
Permanent joints in metallic product contact surfaces shall be continuously welded. Welded areas on product contact surfaces shall be at least as smooth as a No. 4 ground finish on stainless steel sheets free of imperfections such as pits, folds, and crevices.

D.3
Product contact surfaces shall be easily accessible for cleaning and inspection. Removable parts shall be readily demountable.

D.4
Product contact surfaces shall be self-draining except for normal clingage or shall be readily drainable.

D.5
Pipeline connections shall conform to 3-A Standards for Fittings, Number 08-17, Rev.

D.6
Gaskets having a product contact surface shall be removable or permanently bonded to the surface in such a manner that the bond is continuous and mechanically sound so that in the environment of its intended use the gasket does not separate from the surface to which it is bonded.

D.7
Gasket retaining grooves in product contact surfaces shall be no deeper than their width and shall not exceed 1/4 inch in depth or be less than 1/4 inch wide.

D.8
Internal angles of 135 degrees or less on product contact surfaces shall have radii of not less than 1/16 inch, except gasket recesses and grooves in which all sharp corners are avoided.

D.9
There shall be no threads on product contact surfaces.

D.10
Any coil spring having product contact surfaces shall have at least 3/32 inch openings between coils including the ends when the spring is in the free position.

D.11
Perforations in the strainer or the strainer element shall be not less than 1/32 inch in diameter and shall be readily accessible for cleaning and free of burrs.

D.12
Non-product contact surfaces shall have a smooth finish, be free of pockets and crevices, and be readily cleanable.

APPENDIX

E

STAINLESS STEEL MATERIALS

Stainless steel conforming to the applicable composition ranges established by AISI[1] for wrought products, or by ACI[2] for cast products, should be considered in compliance with the requirements of Section C.1 herein. Where welding is involved, the carbon content of the stainless steel should not exceed 0.08%. The first reference cited in C.1 sets forth the chemical ranges and limits of acceptable stainless steel of the 300 series.

Cast grades of stainless steel corresponding to types 303, 304, and 316 are designated CF-16F, CF-8, and CF-8M, respectively. These cast grades are covered by ASTM[3] specifications A296-68 and A351-70.

F

PRODUCT CONTACT SURFACE FINISH

Surface finish equivalent to 150 grit or better as obtained with silicon carbide, properly applied on stainless sheets, is considered in compliance with the requirements of Section D.1 herein.

[3]*Available from ASTM, 1916 Race St., Philadelphia, PA 19103.*

These standards shall become effective September 25, 1986.

3-A Standard Number 12-05 *con't. from p. 225*

APPENDIX

E

STAINLESS STEEL MATERIALS

Stainless steel conforming to the applicable composition ranges established by AISI[1] for wrought products, or by ACI[2] for cast products, should be considered in compliance with the requirements of Section C.1 herein. Where welding is involved, the carbon content of the stainless steel should not exceed 0.08%. The first reference cited in C.1 sets forth the chemical ranges and limits of acceptable stainless steels of the 300 series. Cast grade of stainless steel corresponding to types 303, 304, and 316 are designated CF-16F, CF-8, and CF-8M, respectively. These cast grades are covered by ASTM[3] specifications A 296-68 and A 351-70.

F

PRODUCT CONTACT SURFACE FINISH

Surface finish equivalent to 150 grit or better as obtained with silicon carbide properly applied on stainless steel sheets, is considered in compliance with the requirements of Section D.1 herein.

G

When the tubular heat exchanger is mounted on ceiling supports, means should be provided to facilitate inspection and manual cleaning, if necessary.

[3]*Available from ASTM, 1916 Race St., Philadelphia, PA 19103.*

These standards shall become effective September 25, 1986, at which time "3-A Sanitary Standards for Tubular Heat Exchangers for Milk and Milk Products", Number 12-04, are rescinded and become null and void.

Calendar

1986

May 12-15, ASEPTIC PROCESSING AND PACKAGING WORKSHOP, to be held at Purdue University, West Lafayette, IN. For more information contact: James V. Chambers, Food Science Department, Smith Hall, Purdue University, West Lafayette, IN 47907. 317-494-8279.

May 12-15, 3-A SANITARY STANDARDS COMMITTEE ANNUAL MEETING, to be held in Kansas City, MO. For more information contact: Lisa M. Devery, Dairy and Food Industries Supply Association, Inc., 6245 Executive Boulevard, Rockville MA 20852. 301-984-1444.

May 12-14, PENNSYLVANIA DAIRY SANITARIANS ASSOCIATION MEETING, to be held at Pennsylvania State University. For more information contact: Sidney Barnard, Pennsylvania State University, 8 Borland Lab, University Park, PA 16802. 814-863-3915.

May 12-16, APPLICATION AND TROUBLESHOOTING MICROPROCESSOR CONTROL CIRCUITS. For more information contact: Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

May 26-31, 2ND WORLD CONGRESS FOODBORNE INFECTIONS AND INTOXICATIONS will take place in Berlin (West) at the International Congress Centre (ICC). For more information contact: FAO/WHO Collaborating Centre for Research and Training in Food Hygiene and Zoonoses, Institute of Veterinary Medicine (Robert von Ostertag-Institute), Thielallee 88-92, D-1000 Berlin 33.

June 2-3, TEXAS ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL PROTECTION ANNUAL MEETING, to be held at the Executive Plaza, Austin, TX. For more information contact: Kirmon Smith, Texas Department of Health, 1100 W. 49th, Austin, TX 78756. 512-458-7111.

June 9-20, COOKIE TECHNOLOGY. For more information contact: Bev Martin, Research Department, American Institute of Baking, 1213 Bakers Way, Manhattan KS 66502.

June 13-14, WATER ACTIVITY: THEORY AND APPLICATIONS, Institute of Food Technologists & International Union of Food Science and Technology 10TH BASIC SYMPOSIUM, to be held at the Grenelefe Hotel, Dallas, TX. For more information contact: Miss Marlene Myszkowski, Institute of Food Technologists, 221 North LaSalle Street, Suite 300, Chicago, IL 60601. 312-782-8424.

June 16-19, BASIC FOOD PLANT MICROBIOLOGY. For more information contact: Shirley Grunder, Sanitation Education Department, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

June 23-27, CRACKER TECHNOLOGY. For more information contact: Bev Martin, Research Department, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

June 29-July 2, 29TH CONFERENCE OF THE CANADIAN INSTITUTE OF FOOD SCIENCE AND TECHNOLOGY, to be held in Calgary, Alberta, Canada. For more information contact: Terry Smyrl, Ph.D., Alberta Horticultural Research Center, Brooks, Alberta, Canada, T0J 0J0. 403-362-3391.

June 30-July 3, SPECIALITY INGREDIENT AND PROCESSING (COOKIE). For more information contact: Bev Martin, Research Department, American Institute of Baking, 1213 Bakers Way, Manhattan KS 66502.

July 12-19, SIXTH INTERNATIONAL WORKSHOP ON RAPID METHODS AND AUTOMATION IN MICROBIOLOGY, to be held at Kansas State University. For more information concerning Program contents contact: Daniel Y.C. Fung, Call Hall, Kansas State University, Manhattan, KS. 66506. 913-532-5654. For registration information contact: Joe Pittle, Conference Center, Wareham building, Anderson Avenue, Manhattan, KS 66502. 913-532-5575.

July 14-18, TECHNOLOGIA DE PRODUCTION DE PAN (BREAD PRODUCTION FOR SPANISH SPEAKING BAKERS). For more information contact: Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

July 14-18, IN-STORE BAKERY TRAINING-FROZEN DOUGH OPERATIONS. For more information contact: Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

July 15-19, PURDUE CANNERS TECHNICIANS MOLD COUNT SCHOOL. For more information contact: Dr. James V. Chambers, Food Science Department, Smith Hall, Purdue University, West Lafayette, IN 47907. 317-494-8279.

July 21-25, PRINCIPLES OF BAKERY PRODUCTION-BREAD OR CAKE. For more information contact: Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

July 22-25, FOOD SAFETY TRAINING COURSE to be held at the Holiday Inn-University Center, Gainesville, Florida. For more information contact: Sara Jo Atwell, ABC Research Corporation, 3437 SW 24th Avenue, Gainesville, FL 32607. 904-372-0436.

AUGUST 3-7, IAMFES ANNUAL MEETING to be held at the Radisson South, Minneapolis, MN. For more information contact: Kathy R. Hathaway, IAMFES, Inc., P.O. Box 701, Ames, IA 50010. 515-232-6699.

AUGUST 10-15, 1986 ANNUAL MEETING OF THE SOCIETY FOR INDUSTRIAL MICROBIOLOGY to be held at the Sheraton-Palace Hotel, San Francisco, CA. For more information contact: Mrs. Ann Kulback - SIM Business Secretary, SIM Headquarters, P.O. Box 12534, Arlington, VA 22209. 703-941-5373.

September 15-17, IFDA ADVANCED FOODSERVICE BUYERS SEMINAR to be held at Tysons Corner Marriott Hotel. For more information contact: Chuck Brimmer. 703-532-9400.

September 22-26, 70TH ANNUAL SESSIONS OF THE INTERNATIONAL DAIRY FEDERATION. For more information contact: Congress Organizing Department, c/o Netherlands Congress Centre, P.O. Box 82000, 2508 EA The Hague, The Netherlands.

September 23-25, WYOMING PUBLIC HEALTH SANITARIANS ASSOCIATION ANNUAL MEETING, to be held at the Holiday Inn, Thermopolis, WY 82443. For more information contact: William George, 118 1/2 N. 11th, Worland, WY 982401. 307-347-2617.

September 23-26, FOOD SAFETY TRAINING COURSE to be held at the Holiday Inn-University Center, Gainesville, Florida. For more information contact: Sara Jo Atwell, ABC Research Corporation, 3437 SW 24th Avenue, Gainesville, FL 32607. 904-372-0436.

October 21-22, CALIFORNIA ASSOCIATION OF DAIRY AND MILK SANITARIANS ANNUAL MEETING, to be held at Holiday Inn Downtown, Fresno, CA. For more information contact: Richard C. Harrell, 1554 West 120th St., Los Angeles, CA 90047. 213-757-9719.

November 1-6, FOOD SANITATION 29TH ANNUAL NATIONAL EDUCATIONAL CONFERENCE & EXPOSITION, Scottsdale, Arizona. For more information contact: Harold Rowe at 813-586-5710 or write: Jean Day, Registrar, Food Sanitation Institute, 1019 Highland Ave., Largo, FL 33540.

1987

AUGUST 2-6, IAMFES ANNUAL MEETING to be held at the Disneyland Hotel, Anaheim, CA. For more information contact: Kathy R. Hathaway, IAMFES, Inc., P.O. Box 701, Ames, IA 50010. 515-232-6699

September 26-30, DFISA's FOOD & DAIRY EXPO '87, to be held at McCormick Place, Chicago, IL. For more information contact: DFISA, 6245 Executive Boulevard, Rockville, MA 20852. 301-984-1444.

Journal of Applied Bacteriology

Published for the Society for Applied Bacteriology

Editors: **M. Sussman** *Newcastle-upon-Tyne*
F.A. Skinner *Harpenden*
G.I. Barrow *Salisbury*

The Society for Applied Bacteriology launched the *Journal of Applied Bacteriology* in 1954 and since that time the journal has grown in size, in prestige and in the subject matter covered. It has established an international reputation with readers and authors; indeed each number of the journal contains papers from worldwide sources. The Society's interest in the systematics and ecology of groups of microorganisms is reflected in the journal, which publishes five types of article:

Review articles: a substantial survey with an adequate historical perspective

Observation articles: a succinct discussion of current concepts and developments in applied microbiology

Full-length papers: the development of concepts as well as the recording of facts

A note on …: research having narrow, readily defined limits, or contributions to the knowledge but not the development of concepts

Technical notes: details of new methods, techniques or apparatus

Subscription Information

Journal of Applied Bacteriology is published monthly and includes a rapid publication section *Letters in Applied Microbiology*. The subscription also includes the Annual S.A.B. Symposium volume and rates for 1986 are £105.00 (UK), $197.50 (USA & Canada), £126.00 (elsewhere) post free.

Order Form

Please tick the appropriate box and return to **Blackwell Scientific Publications Ltd, P.O. Box 88, Oxford, England.**

☐ I would like to subscribe to *Journal of Applied Bacteriology*

☐ I wish to pay by cheque/money order *(delete as necessary)* and enclose the sum of .....

☐ I wish to pay by Access/Barclaycard/VISA/Mastercard *(delete as necessary)*

Please debit my credit card no. ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Expiry date..... with the sum of .....

Signature..... Date .....

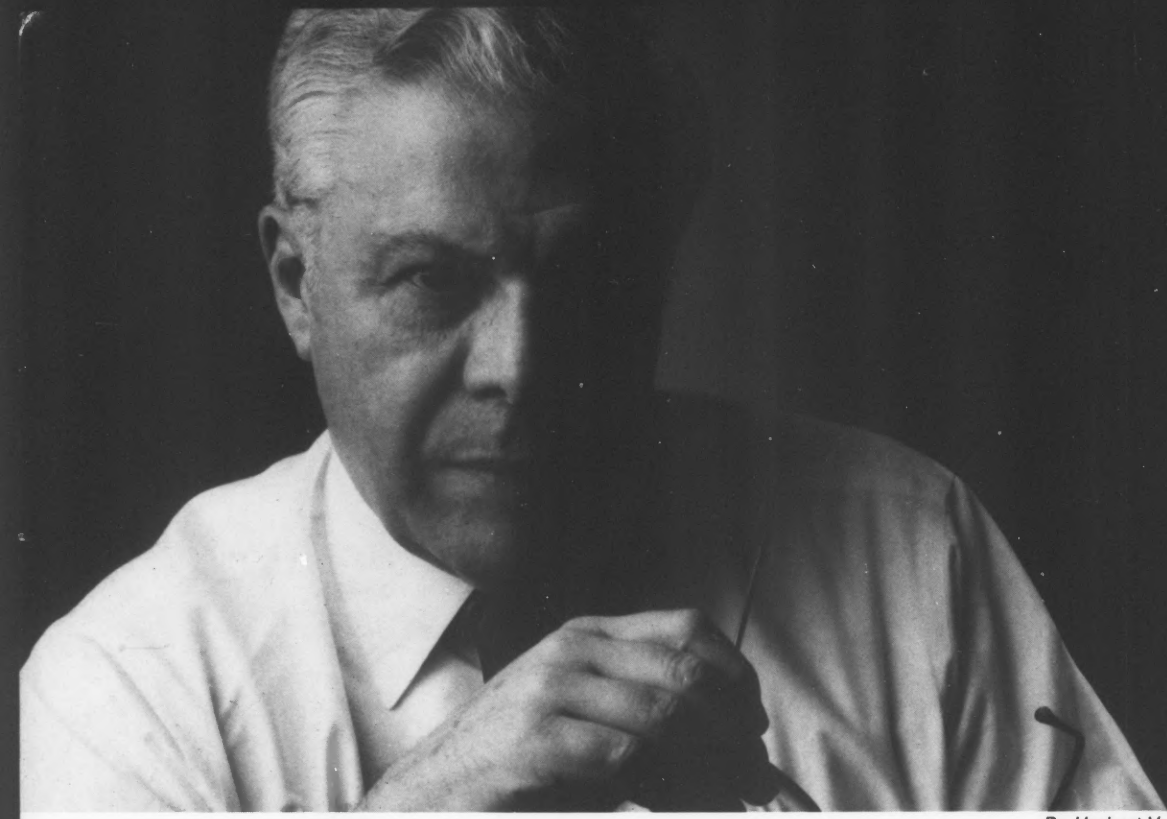
☐ Please send me a specimen copy of *Journal of Applied Bacteriology*

Name.....

Address.....

.....

Blackwell Scientific Publications
P.O. Box 88, Oxford, England



Dr. Herbert V. Shuster

"I've done my homework"

". . . so microbiologists won't have to work nights."

I invented these FISHER*brand*® Disposable Dilution Bottles with a single purpose in mind: fast, easy dilutions.

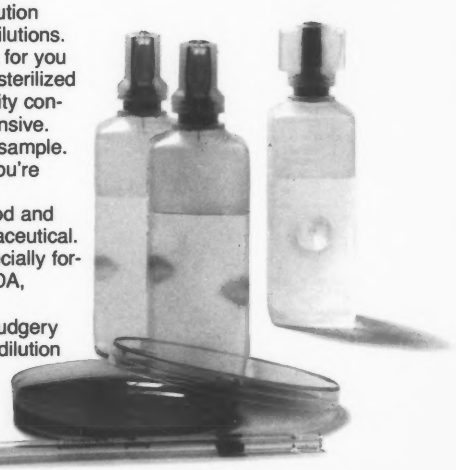
Please observe how I've done all the hard work for you beforehand. Prefilled them with exact amounts of sterilized dilution water. Factory tested them for built-in quality control. Made them disposable and pleasantly inexpensive.

You merely snap off the protective top and add sample. After you remove required portions for analysis, you're done.

In addition, I've prepared three formulations: food and dairy, water/wastewater, and cosmetic and pharmaceutical. Perfect for your present procedures — they're specially formulated to conform to appropriate APHA, EPA, FDA, AOAC, USP, and CTFA standard methods.

Now there really is no excuse for after-hours drudgery such as washing, drying, autoclaving, dispensing dilution blanks, and so forth. But if you like working late, well, I suppose I can't help everybody.

For literature and a free sample (Butterfield's buffer) call 412-562-8543 or check number below.



Please circle No. 196 on your Reader Service Page for free literature or circle No. 197 on your Reader Service Page to see a sales representative

Fisher Scientific