

JANUARY, 1964

Vol. 27

P. 1-28

No. 1

Journal of

MILK and FOOD TECHNOLOGY

Official Publication

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



New **RAPID DISK METHOD**

for Detection of

PENICILLIN in MILK

Reliable Sensitive Practical

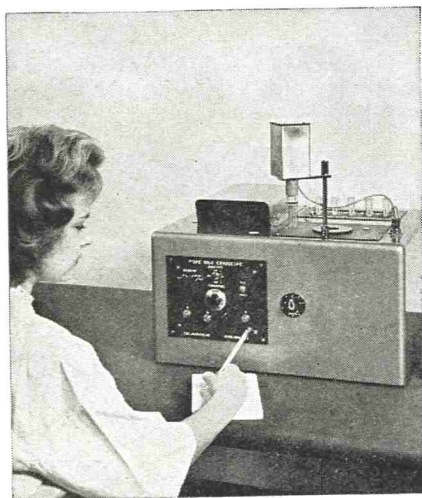
Direct assay method of Arret and Kirshbaum (FDA) for determining presence of penicillin in milk and dairy products.

- Media* BACTO — ANTIBIOTIC MEDIUM I
BACTO — SPORULATING AGAR
- Inoculum* BACILLUS SUBTILIS ATCC 6633
Standardized Spore Suspension
in 1 ml. ampuls
- Penicillinase* BACTO — PENASE CONCENTRATE
in 20 ml. and 100 ml. vials
BACTO — PENASE DISKS
Standardized Impregnated Disks
- Penicillin* STANDARDIZED IMPREGNATED DISKS
0.05 units, 0.1 unit and other
concentrations

INFORMATION ON REQUEST

DIFCO LABORATORIES
DETROIT 1 MICHIGAN USA

FISKE MILK CRYOSCOPE...the leader in the field



The problem of added water in milk concerns you, both from the profit angle and the quality control necessary in maintaining the reliability and reputation of your products.

Fiske MILK CRYOSCOPES determine accurate water content in milk and other dairy products by the freezing point method. It enables you to process small test samples rapidly and easily, with a minimum of technically trained personnel.

A decisive factor in Fiske leadership in precision cryoscopy is continuous research and development. The Fiske MILK CRYOSCOPE is the instrument around which the official procedures are written, as described in latest Standard Methods for the Examination of Dairy Products, A.P.H.A., and in Laboratory Manual Milk Industry Foundation. The Fiske Cryoscope also meets the specifications of the A.O.A.C.

Address any inquiries directly to the plant, or through our authorized agents.

The NEW compact laboratory model of the FISKE MILK CRYOSCOPE is economically priced; includes all the leadership features of the previous model and is available for immediate delivery.



FISKE ASSOCIATES, INC.
BETHEL, CONNECTICUT
Creators of
Precision Electronic Devices

International Association Of Milk, Food And Environmental Sanitarians, Inc.

EMPLOYMENT OPPORTUNITY

ANNOUNCEMENT

The Executive Board of the International Association of Milk, Food and Environmental Sanitarians, Inc., is seeking qualified persons to apply for a position as Assistant Executive Secretary. The Association publishes a monthly journal — The Journal of Milk and Food Technology — and other technical papers and bulletins in this general field. The primary responsibilities of the Assistant Executive Secretary would be that of managing and editing the Journal of Milk and Food Technology.

The Association has a membership of about 4000, has thirty affiliated associations throughout the United States and Canada, and is the largest association of its kind in the country.

The Association has its headquarters in Shelbyville, Indiana.

SALARY

The beginning salary is between \$5500.00 - \$6500.00 per year. There is provision of annual vacation and sick leave after six months of service.

QUALIFICATIONS

1. A Sanitarian holding a Bachelor's degree from an accredited college or university or a person holding a Bachelor's degree in Journalism.
2. Preferably one year of successful professional experience in the journalistic field in technical, trade or scientific writing, or in the field of Milk, Food, or Environmental Sanitation. Person should have had experience in technical writing and in public relations.

DUTIES OF THE POSITION

1. To be the editor of a professional publication in the field of milk and food control, environmental sanitation, and public health.
2. Compose and organize the News and Events Section of the Journal of Milk and Food Technology and stimulate communication and contact with affiliates and with other organizations having parallel interests.
3. Edit auxiliary publications of the Association including Committee Reports, special reports and develop promotional materials.
4. Do literature research in terms of articles dealing with newer technical developments within the areas of interests; keep abreast of legislative and regulatory matters of interest to the Association. Contribute articles, abstracts and summaries.
5. Write editorials in the field of environmental sanitation or in areas of related interests; enlist the services of others as guests editorial contributors, or both.
6. Attend meetings, conferences, affiliate meetings and the annual meeting of the Association to gather news and to represent the Journal and the Association.
7. Become acquainted with the managerial and other duties of the office of the Executive Secretary, assist him, and, in his absence, assume his duties.
8. Continue the improvement of the format, contents, appearance of the Journal and suggest such improvements as may enhance the publication and its acceptance among members and subscribers.

OTHER CONDITIONS

The successful candidate should not be more than 50 years of age. He must be personable, with ability to make presentations before the public. He must be of good moral character and physically able to carry out his duties.

The successful candidate will be expected to establish residence in Shelbyville, Indiana, or within reasonable commuting distance of Shelbyville.

Closing date for applications: April 15, 1964.

Persons interested in this position should request an application from Mr. Karl K. Jones, Secretary-Treasurer, International Association of Milk, Food, and Environmental Sanitarians, 1330 West Michigan Street, Indianapolis, Indiana 46207.

INDEX TO ADVERTISERS

Advanced Instruments, Inc. -----27

Babson Bros. Co. -----Back Cover

Britex Corp. -----27

Difco Laboratories -----Inside Front Cover

Fiske Associates, Inc. -----Inside Front Cover

Johnson & Johnson -----II

Lazarus Laboratories, Inc., - Div.

West Chemical Products, Inc. -----25

Monarch Chemicals, Inc. -----II

The Haynes Mfg. Co. -----Inside Back Cover



Sep-ko
removes milk residues

Sep-ko
rinses residue free

Sep-ko
leaves pails, strainers,
tanks sparkling clean
without acid rinsing...
just cold water.

**Unmatched in the
Milkhouse
Tops in the
Home too...**

**You can tell a
Sep-ko
USER by the
SHINE on his
EQUIPMENT**

ASK YOUR SUPPLIER
OR WRITE
MONARCH CHEMICALS, INC.
3801 N.E. 5th St., Mpls. 21, Minn.
SEP-KO CHEMICALS OF CANADA LTD.
Toronto, Ontario, Canada

**PROVED
ON OVER 6400
BULK TANK FARMS**

Johnson & Johnson
Milk Filters Are More
Efficient In Sediment
Removal Than Any
Other Brand



Dairymen who care enough...to
produce clean milk use Johnson
& Johnson Milk Filters, the
most trusted name in filtration.
*Available in disks, squares, rolls, tubes
and strips.*

Filter Products Division
Johnson & Johnson
4949 W. 65th St. Chicago 38, Ill.
©1964, Johnson & Johnson, Chicago, Ill.

OFFICERS

- President, JOHN H. FRITZ, Washington, D. C.
 President-Elect, WALLACE C. LAWTON, Minneapolis, Minn.
 First Vice-President, FRED E. UETZ, West Englewood, N. J.
 Second Vice-President, PAUL R. ELLIKER, Corvallis, Oregon
 Secretary-Treasurer, KARL K. JONES, Indianapolis, Ind.

Executive Board

- CHARLES E. WALTON
 RAY A. BELKNAP
 JOHN H. FRITZ
 WALLACE C. LAWTON
 FRED E. UETZ
 PAUL R. ELLIKER
 KARL K. JONES

Publication Board

- DR. J. C. OLSON, JR. H. L. THOMASSON
 KARL K. JONES

Editors

- DR. J. C. OLSON, JR., Associate Editor, Dept. Dairy Industries, University of Minn., St. Paul 1, Minn.
 H. L. THOMASSON, Executive Secretary and Managing Editor, Box 437, Shelbyville, Indiana.

Associate Editors

- C. A. ABELE-----Chicago, Illinois
 H. S. ADAMS-----Indianapolis, Indiana
 M. P. BAKER-----Ames, Iowa
 F. W. BARBER-----New York, New York
 F. C. BASELT-----Monte Sereno, Calif.
 L. A. BLACK-----Cincinnati, Ohio
 J. C. FLAKE-----Chicago, Illinois
 L. G. HARMON-----East Lansing, Mich.
 E. K. HARRIS-----Cincinnati, Ohio
 R. P. HAYWARD-----Bowie, Md.
 C. A. HUNTER-----Topeka, Kansas
 C. K. JOHNS-----Ottawa, Ontario, Canada
 O. W. KAUFMANN-----East Lansing, Mich.
 W. C. LAWTON-----St. Paul, Minnesota
 W. S. MUELLER-----Amherst, Mass.
 K. G. WECKEL-----Madison, Wisconsin
 J. C. WHITE-----Ithaca, New York

The Journal of Milk and Food Technology is issued monthly beginning with the January number. Each volume comprises 12 numbers. Published by the International Association of Milk, Food and Environmental Sanitarians, Inc. with executive offices of the Association, Blue Ridge Rd., P. O. Box 437, Shelbyville, Ind.

Entered as second class matter at the Post Office at Shelbyville, Ind., March 1952, under the Act on March 3, 1879.

EDITORIAL OFFICES: J. C. Olson, Jr., Associate Editor, Dept. Dairy Industries, University of Minn., St. Paul, Minn.; H. L. Thomasson, Managing Editor, P. O. Box 437, Shelbyville, Ind.

Manuscripts: Correspondence regarding manuscripts and other reading material should be addressed to J. C. Olson, Jr., Associate Editor, Dept. Dairy Industries, University of Minn., St. Paul, Minn.

"Instruction to Contributors" can be obtained from the editor for the use of contributors of papers.

Journal of

MILK and FOOD TECHNOLOGY

INCLUDING MILK AND FOOD SANITATION

Official Publication

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

REG. U. S. PAT. OFF.

Volume 27

January, 1964

Number 1

The Microbiology of Self-Service, Prepackaged, Fresh Pork Sausage W. A. Miller -----	1
Population of Citrate-Fermenting Bacteria in Lactic Cultures W. W. Overcast and J. D. Skean -----	4
A Study of the Microbiological Quality of Haddock Fillets and Shucked, Soft-Shell Clams Processed and Marketed in the Greater Boston Area J. T. Nickerson and S. A. Goldblith -----	7
Bacteriological Survey of Filleting Processes in the Pacific Northwest III. Bacterial and Physical Effects of Pughing Fish Incorrectly Wayne I. Tretsven -----	13
Special Feature: Retail Misbranding of Foods Frank E. Fisher -----	18
News and Events -----	20
Index to Advertisers -----	II

Business Matters: Correspondence regarding business matters, advertising, subscriptions, orders for single copies, etc., should be addressed to H. L. Thomasson (address above).

Subscription Rates: One volume per year, Individual non-members, Governmental and Commercial Organization subscription.

- 1 yr. ----- \$8.00
- Public and Educational Institution
- Libraries, 1 yr. ----- \$6.00
- Single Copies ----- \$1.00

Orders for Reprints: All orders for reprints

should be sent to the executive office of the Association, P. O. Box 437, Shelbyville, Ind

Membership Dues: Membership in the International Association of Milk, Food and Environmental Sanitarians, Inc., is \$7.00 per year, which includes annual subscription to the Journal of Milk and Food Technology. All Correspondence regarding membership, remittances for dues, failure to receive copies of the Journal, changes in address, and other such matters should be addressed to the Executive Secretary of the Association, H. L. Thomasson, Box 437, Shelbyville, Indiana

Journal of Milk and Food Technology

INSTRUCTIONS TO CONTRIBUTORS

The Journal of Milk and Food Technology is designed primarily for the publication of scientific and technical papers concerned with milk and food sanitation and technology, and other subjects in the area of environmental sanitation.

Manuscripts are accepted, subject to editorial review. Membership in the Association is *not* a prerequisite for acceptance of a manuscript for publication.

Papers, when accepted, become the copyright of the Journal and can be reprinted only through arrangement with the Association Office.

All manuscripts should be submitted *in duplicate* by first class mail in flat form to the Managing Editor, H. L. Thomasson, P. O. Box 437, Shelbyville, Indiana.

PREPARATION OF MANUSCRIPTS

1. The Style Manual for Biological Journals (published by The American Institute for Biological Sciences, 2000 P Street N.W., Washington, D. C. Price \$3.00) has been adopted as a guide for authors in the preparation of manuscripts submitted for publication.

2. All manuscripts should be typed double-spaced on 8½ by 11-inch bond paper. Preferably use paper with pre-numbered lines. The side margins should be one inch wide.

3. The title should appear at the top of the first page followed by the author(s) name and affiliation(s).

4. Manuscripts reporting the results of experimental work generally should be organized as follows in the order indicated: summary; an introductory statement of the problem and objective(s) of the work; procedures or methods; results and discussion (separate or combined); conclusions; acknowledgements, if any; and references.

5. General discussion type manuscripts should be divided into sections with appropriate subtitles descriptive of the subject of the pertinent section.

6. Figures consisting of drawings, diagrams, charts and similar material should be done in India ink on tracing paper, white drawing paper or blue linen. Sheets should not exceed 8½ x 11 inches. Do not use paper with green, red or yellow lines. Titles for all figures must be on separate sheets. A letter guide should be used for all lettering on figures. Submit original figures rather than photographs of them.

7. Tables should be typed on a separate sheet of 8½ x 11-inch bond paper; place only one Table on a sheet. Use Arabic numbers for numbering Tables. Titles should be as brief as possible but fully descriptive. Heading and subheadings should be concise with columns or rows of data carefully centered below them. Use *only* horizontal lines to separate sections of Tables. Data in Tables should not be repeated in Figures.

8. Refer to the Style Manual for Biological Journals for correct abbreviations and punctuation for titles of periodicals and for biological, chemical, physical, mathematical and statistical terms.

9. References should be arranged alphabetically by author(s). Use initials rather than full first and middle names. Reference citations in the text should be given by the number in parentheses corresponding to that number in the list of references. For guidance in the form of listing references, see a recent issue of the Journal.

10. News items and announcements should be typed double spaced with an appropriate title given at the top of the item. News of the activities of affiliate associations, members and events is particularly desirable. Letters to the Editor are encouraged. Such letters must be signed by the writer.

THE MICROBIOLOGY OF SELF-SERVICE, PREPACKAGED, FRESH PORK SAUSAGE¹

W. A. MILLER,

Department of Bacteriology,
Kansas State University, Manhattan

(Received for publication September 11, 1963)

SUMMARY

Ten different brands of self-service, prepackaged shipped-in fresh pork sausage (227 packages) were purchased during 22 months from 4 large volume stores. Bacterial counts at purchase ranged from 10,000 to 180 million per g. Samples taken from packages and stored at 3 to 7.5 C. for 3 to 7 days showed a wide range of bacterial populations, varying from fewer than 100,000 to more than 2 billion per g. Microbacteria and lactobacilli dominated the flora in the majority of packages of wrapped-roll sausages; conversely, *Pseudomonas-Achromobacter* types dominated in most of the skinless link type sausages.

This study is concerned with the numbers and kinds of microorganisms and their possible effect on the quality of numerous brands of prepackaged fresh pork sausage available in retail markets. Ingredients vary in different brands of sausage from highly spiced to mildly spiced. Prices also cover a wide range.

Cavett (1) concluded that vacuum sealed bacon with a sodium chloride content of 5 to 7% in the aqueous phase spoiled in about 15 days with a sour odor when stored at 20 C, probably due to the combined activities of micrococci and lactic acid bacteria.

Deibel, Niven, and Wilson (2) found that lactobacilli dominated the flora of processed sausage. Pseudomonads and other gram negative rods were present in small numbers, but were not cultured from finished products.

Dyett and Shelly (3) reported that British sausage containing 65% fresh pork wrapped in cellulose film yielded a plate count of 10⁸ organisms per g in three to four days at 22 C when a sulphite preservative was added. Approximately the same count was obtained in sausage without a preservative stored three to four days at 3 to 5 C.

Halleck, Ball, and Stier (4) reported that fresh, ground fat pork with an initial count of 65,000 bacteria per g, then packaged in cans and stored at 1 to 3.5 C had a bacterial count of 1.4 million per g after 14 days. Then *Pseudomonas-Achromobacter* types out-numbered the lactobacilli 7 to 1.

In a similar experiment ground fat pork with an initial count of 130 per g was stored 14 days at 4.5 to 6.5 C. The bacterial count after this holding

period was 19 million per g, mainly *Pseudomonas-Achromobacter* types.

Miller (5) found 1.5 million Gram-negative psychrophilic bacteria per g in unseasoned ground pork prepared from a carcass stored 10 days at 1 C; they decreased to 40,000 per g in 10 months at -17.8 to -22 C.

Miller (6) observed that a species of *Microbacterium* almost invariably dominated the flora of square slices of self-service, prepackaged cooked ham that soured when stored 3 to 7 days at 4 to 8 C.

Sulzbacher (7) reported that counts of lipase forming organisms increased in fresh pork sausage stored at -3.9 C when the samples were protected from desiccation; this was thought to be significant because of rancidity in frozen pork.

Sulzbacher and McLean (8) observed that *Pseudomonas*, *Alcaligenes*, and *Achromobacter* comprised approximately 30% of the flora of fresh pork sausage. They noted, however, that species of *Microbacterium* made up a rather large proportion of the flora of fresh pork sausage stored at home refrigerator temperatures (5 to 8 C). They reasoned that these microbacteria may have contributed to the acid flavor of the samples.

Turner and Campbell (9) examined more than 300 packages of smoked sausage and sliced cured ham. Bacterial numbers varied widely between replicate samples of one code-date from each packer, suggesting the need for extensive replicating of samples for reliable estimates of bacterial numbers in a product. They suggested that processing methods for sliced cooked ham are not adequate to provide reasonable storage life under normal retail conditions. They recommended use of a code-dating system for consumers.

EXPERIMENTAL PROCEDURE

Ten brands of self-service, prepackaged fresh pork sausages were purchased at weekly intervals for 22 months from 4 large volume stores in Riley County, Kansas. The sausages were not packaged at the retail stores. Sausage processed and wrapped at the store was not included in these studies, since it was felt that this would be less representative than a product packaged at a central plant and distributed to

¹Contribution 404, Dept. of Bacteriology, Kansas Agr. Exp. Sta., Manhattan.

TABLE 1. MICROBIAL POPULATIONS OF PACKAGED FRESH PORK SAUSAGE (ROLLS) SOON AFTER PURCHASE, AND AFTER STORING AT 3 TO 7.5 C FOR 3 TO 7 DAYS

Brands of sausage	Number of packages	Initial counts	Approximate numbers of microorganisms per g			
			Time and temperature of storage (portions of opened packages)			
			3 to 4 days at:		7 days at:	
			3 to 4 C	7 to 7.5 C	3 to 4 C	7 to 7.5 C
A Highly seasoned	11	10T-540T MD. = 90T	30T-4.8M MD. = 290T	60T-30M MD. = 1.4M	200T-100M MD. = 10M	17M-400M MD. = 95M
A Mildly seasoned	11	10T-150T MD. = 50T	10T-800T MD. = 180T	70T-7M MD. = 720T	20T-20M MD. = 2.6M	23M-150M MD. = 100M
B Highly seasoned	17	3T-60M MD. = 4.5M	4T-800M MD. = 15M	36T-700M MD. = 29M	40T-400M MD. = 52M	340T-1B MD. = 130M
B Mildly seasoned	24	6T-65M MD. = 145T	20T-400M MD. = 900T	20T-800M MD. = 5.5M	250T-400M MD. = 20M	650T-1.2B MD. = 65M

T = Thousand; M = Million; B = Billion; MD = Median

many stores.

Seven brands of sausage were packaged in 1-lb rolls, with an occasional 2-lb roll; 3 brands were boxed as "skinless link" type fresh sausages. Within 15 min after purchase the packages were placed at 3 to 4 C and initial microbiological analyses were made on each package within 5 hr.

Four portions from each package were removed and re-wrapped in "saran wrap." Two of the portions were placed at 3 to 4 C, and 2 at 7 to 7.5 C. After 3 to 4 days 1 sample from each of the 2 temperature ranges was removed and analyzed; the 2 remaining samples were held 7 days before analysis.

Appropriate dilutions in 0.15% peptone water were made starting with 10 g of sausage. The first 1 in 10 dilution was shaken 5 min on a Kahn type shaker; further dilutions from the liquid phase were shaken 25 times by hand. Eugonagar was the medium used, and plates were incubated 3 to 4 days at 23 C.

RESULTS AND DISCUSSION

Initial microbial counts made within 5 hr after purchase on 2 brands (A and B, Table 1) of higher priced fresh pork sausage (63 packages) ranged from 10,000 to 65 million per g with medians of 50,000 to 4.5 million.

Initial counts on 66 packages (brands C, D, E, F, and G, Table 2) of fresh pork sausage, cheaper than brands A and B, varied from 10,000 to 180 million with medians ranging from 4.5 million to 44 million per g.

Median counts on highly seasoned sausage in

brands A and B (Table 1) and brand D (Table 2) were generally higher than corresponding median counts on mildly seasoned packages sold under the same brand.

Abnormal odors (sour or otherwise) were observed oftener in samples from brands C, D, and H (Tables 2, 3), especially after 3 to 7 days storage at 3 to 7.5 C. Brands C, D, and H yielded higher initial median counts, and higher counts on samples stored at refrigerator temperatures 3 to 7 days, than did brands A, B, E, F, G, and I.

Representatives of several genera of microorganisms were cultured from the different brands. Catalase negative lactic acid bacteria and catalase positive microbacteria were found most commonly in wrapped rolls. Colonies of *Pseudomonas-Achromobacter* types were observed, especially in brands B, C, and D, and dominated the flora in several samples. Pinpoint colonies were seen in a few samples, and dominated the flora occasionally; they usually occurred along with *Pseudomonas-Achromobacter* types.

The microbiology of brands H, I, and J (skinless link sausage) differed considerably from that of the wrapped roll brands. *Pseudomonas-Achromobacter* types dominated the flora in 75% of brands I and J, and in 33% of brand H. Conversely, microbacteria and lactobacilli dominated the flora in the majority of packages of rolls.

ACKNOWLEDGMENT

The author acknowledges the technical assistance of Satish C. Nivas, former graduate student in the Dept. of Animal Husbandry, Kansas State University, Manhattan.

TABLE 2. MICROBIAL POPULATIONS OF PACKAGED FRESH PORK SAUSAGE (ROLLS) SOON AFTER PURCHASE, AND AFTER STORING AT 3 TO 7.5 C FOR 3 TO 7 DAYS

	Number of packages	Initial counts	Approximate numbers of microorganisms per g			
			Time and temperature of storage (portions of opened packages)			
			3 to 4 days at:		7 days at:	
		3 to 4 C	7 to 7.5 C	3 to 4 C	7 to 7.5 C	
C	19	260T-120M MD. = 10M	4M-600M MD. = 38.5M	3M-650M MD. = 104M	6.5M-1B MD. = 94M	60M-2B MD. = 300M
D Highly seasoned	12	110T-180M MD. = 44M	6.5M-600M MD. = 92M	8M-2B MD. = 500M	54M-1.3B MD. = 330M	50M-3B MD. = 900M
D Mildly seasoned	16	200T-100M MD. = 32.5M	10M-380M MD. = 71M	18M-900M MD. = 160M	17M-900M MD. = 150M	75M-1.3B MD. = 400M
Miscellaneous brands E, F, G	19	10T-40M MD. = 4.5M	5M-136M MD. = 45.5 M	7½M-208M MD. = 58M	13M-325M MD. = 96M	50M-450M MD. = 170M

T = Thousand; M = Million; B = Billion; MD = Median

TABLE 3. MICROBIAL POPULATIONS OF FRESH PORK SAUSAGE (SKINLESS LINKS) SOON AFTER PURCHASE, AND AFTER STORING AT 3 TO 7.5 C FOR 3 TO 7 DAYS

Brands of sausage	Number of packages	Initial counts	Approximate numbers of microorganisms per g			
			Time and temperature of storage (portions of opened packages)			
			3 to 4 days at:		7 days at:	
		3 to 4 C	7 to 7.5 C	3 to 4 C	7 to 7.5 C	
H	28	332T-29M MD. = 11M	15.5M-336M MD. = 75M	17M-500M MD. = 100M	48M-1.1B MD. = 235M	92M-2.3B MD. = 290M
I	37	14T-17.5M MD. = 600T	20T-354M MD. = 5.5M	12T-418M MD. = 14M	60T-1.6B MD. = 25M	390T-2.7B MD. = 41M
J	33	28T-17½M MD. = 3.4M	2M-118M MD. = 21½M	4M-240M MD. = 34M	3½M-1.6B MD. = 54M	23M-2.4B MD. = 344M

T = Thousand; M = Million; B = Billion; MD = Median

REFERENCES

1. Cavett, J. J. The microbiology of vacuum packed sliced bacon. *J. of Applied Bacteriol.*, 25:282-289. 1962.
2. Deibel, R. H., Niven, C. F., and Wilson, G. D. Microbiology of Meat Curing. III Some microbiological and related technological aspects in the manufacture of fermented sausages. *Applied Microbiol.*, 9:156-161. 1961.
3. Dyett, E. J., and Shelly, D. Microbiology of British fresh sausage. *J. of Sci. of Food and Agri.*, 13: ii, 166. 1962 (Abst).
4. Halleck, F. E., Ball, C. O., and Stier, E. F. Factors affecting quality prepackaged meat. IV. Microbiological studies. A. Cultural studies on bacterial flora of fresh meat; classification by genera. *Food Technol.*, 12:17. 1958.
5. Miller, W. A. Effect of freezing ground pork and subsequent storing above 32 F upon the bacterial flora. *Food Technol.*, 9:332-334. 1955.
6. Miller, W. A. The microbiology of self-service, packaged, square slices of cooked ham. *J. Milk and Food Technol.*, 23:311-314. 1960.
7. Sulzbacher, W. L., and McLean, R. A. The bacterial flora of fresh pork sausage. *Food Technol.*, 5:7-8. 1951.
8. Sulzbacher, W. L. Survival of microorganisms in frozen meat. *Food Technol.*, 4:386-390. 1950.
9. Turner, Rosemary J., and Campbell, N. E. R. A bacteriological survey of certain processed meats. *Can. J. of Public Health*, 53:382-386, 420-424. 1962.

POPULATION OF CITRATE-FERMENTING BACTERIA IN LACTIC CULTURES

W. W. OVERCAST AND J. D. SKEAN

Department of Dairying,
Tennessee Agricultural Experiment Station, Knoxville

(Received for publication October 10, 1963)

SUMMARY

The total bacteria and citrate-fermenting bacteria in 72 lactic cultures were enumerated. The numbers of citrate-fermenting bacteria varied from fewer than 10,000 to 2.1 billion per ml. The citrate-fermenting bacteria per ml expressed as per cent of each corresponding total count on Tomato Juice Agar (TJA) had a median of 13%. The mean percentages of citrate-fermenting bacteria were not significantly different among lactic cultures grouped according to their original source, time maintained in the dairy plant, or their particular use.

The general belief seems to be that about 5-10% of the population of lactic cultures as used in the dairy industry are citrate-fermenting bacteria, but the literature contains few data to support this view. Several media for the differentiation of the so-called "aroma" bacteria of lactic cultures have been introduced. In 1933, Benchetrit (2) suggested the addition of α bromopropionic acid to tomato juice agar for differentiating the *Leuconostoc* species. Prouty (7) suggested the use of brom cresol purple as an indicator for differentiation and Lundstedt (4) reported that colonies of these organisms were iridescent on a citrate whey agar. More recently Mayeux *et al.* (5) suggested the use of a medium containing 75 ppm of sodium azide, while McDonough *et al.* (6) added 0.15 $\mu\text{g/ml}$ of tetracycline to tomato juice agar to inhibit the lactic streptococci. However, none of these workers have enumerated the citrate-fermenting bacteria in large numbers of lactic cultures that are in actual use in dairy plants. In this work the medium of Galesloot *et al.* (3) was modified to contain 51g tomato juice agar and 5g calcium lactate per liter and was used with the aroma bacteria indicator of 0.6% calcium citrate sol stabilized with carboxymethyl cellulose (8). Herein is reported the numbers of citrate-fermenting bacteria in lactic cultures in current use.

PROCEDURES

Forty-one dairies submitted lactic cultures for examination in sterile 2-oz. bottles containing approximately 1g of calcium carbonate. In addition, a completed questionnaire with each culture furnished information as to the length of time the culture had been in use in the plant (age), frequency of transfer, carrying medium and its heat treatment,

incubation time and temperature, and the products made with the culture.

Each culture was transferred on the day of arrival into Matrix Mother Culture Media¹ and incubated at 21 C for at least 16 hours or until coagulation occurred. The cultures were then cooled and stored at 4 C until the second subculture was made (about 8 to 10 hr). From the second subculture the bacterial populations were determined within 0.5 to 2 hr after the incubation period. Bacterial populations in dilutions of the second subcultures were enumerated by the agar plate method on M-PH medium (MPHM), Tomato Juice Agar (TJA) and TJA containing 0.5% calcium lactate and 0.6% colloidal calcium citrate (TJAC%). The diluent for the cultures was 0.1% aqueous peptone. Dilutions at 10^{-6} and 10^{-7} were plated on MPHM and TJA. Dilutions at 10^{-4} , 10^{-5} , 10^{-6} , and 10^{-7} were plated on TJAC%. Each dilution was plated in triplicate. The plates were incubated at 25 ± 1 C for 72 ± 2 hr. Colonies were counted with the aid of a Quebec Colony Counter. When possible, plates were selected for counting and counted according to standard methods (1).

RESULTS AND DISCUSSION

Data for the 72 lactic cultures are presented in Table 1. Higher counts were obtained on the TJA than on the MPHM. However, 20 of the 72 cultures had a higher count on the latter. Colony counts per ml on TJA ranged from 3 million to 2 billion with a mean of 540 million. Colony counts on the MPHM ranged from 11 million to 1.4 billion with a mean of 410 million. Analysis by t-test (9) indicated the difference between the means of the colony counts on TJA and MPHM to be significant at $P < 0.10$ but not at $P < 0.05$. Colony counts of the citrate-fermenting bacteria on the TJAC% ranged from fewer than 10,000 to 2.1 billion with a mean of 140 million per ml. Citrate-fermenting bacteria per ml expressed as per cent of each corresponding count on TJA ranged from 1 to 733% with a median of 13%. Culture number 69 (Table 1), used in the plant for 5 yr for making of buttermilk and cottage

¹Obtained from the Galloway-West Co., Fond du Lac, Wis.

TABLE 1. SOURCE, AGE, USE, TOTAL COUNT AND COUNT OF CITRATE FERMENTERS IN STARTER CULTURES

Culture number	Dairy	Original source ^a	Age - Time main- tained in the dairy	Use in dairy ^b	Colony count ^c per ml of culture x 10 ⁻⁶			Colony count on TJAC½% as % of colony count on TJA
					(MPHM)	(TJA)	(TJAC½%)	
2	2	1	5 yr	ChC	220	150	1.3	1
3	2	1	5 yr	ChC	69	68	0.97	1
4	4	1	15 da	BM,CoC	49	340	43	13
7	5	1	10.75 yr	ChC	880	580	37	6
34	19	1	1 yr	ChC	420	650	170	3
46	35	1	1.5 yr	ChC	90	27	42	155
69	41	1	5 yr	BM,CoC	1200	1300	0	0
70	41	1	5 yr	BM,CoC	81	120	1	1
71	41	1	5 yr	BM,CoC	150	160	40	25
72	41	1	3 mo	BM	52	46	22	48
1	1	2	15 da	BM,CoC	420	480	85	18
16	3	2	35 da	BM	560	770	730	95
18	3	2	30 da	BM	580	950	3.6	1
30	20	2	14 da	BM	500	470	19	4
31	20	2	2 da	BM	165	420	24	6
54	28	2	14 da	BM,CoC	110	57	23	40
66	34	2	7 da	BM	380	390	310	79
67	34	2	7 da	CoC	380	350	20	6
15	3	3	20 da	BM	590	450	30	7
17	3	3	20 da	BM	310	430	54	13
19	12	3	14 da	CoC	160	850	5.6	1
21	14	3	10 da	CoC	400	570	59	10
22	14	3	14 da	BM,CoC,SrCm	520	750	74	10
25	15	3	3 da	BM,CoC,SrCm	700	960	440	46
28	21	3	42 da	BM	250	270	740	274
38	18	3	--	StCd	80	610	73	12
52	33	3	7 da	BM,CoC	11	24	36	150
53	33	3	7 da	CoC	13	25	33	132
58	30	3	--		44	66	63	95
59	30	3	1.5 yr	BM,CoC	640	24	42	175
5	6	3a	12 da	ChC	880	980	16	1
10	8	3a	14 da	BM,CoC	740	1000	28	3
13	11	3a	21 da	BM	270	700	54	8
33	19	3a	2 yr	ChC,CmC	640	960	470	49
36	24	3a	21 da	BM,CoC	150	460	13	3
40	26	3a	2 da	BM	520	830	62	7
42	26	3a	40 da	BM	370	860	0.23	1
49	27	3a	2 da	BM,CoC,SrCm	130	17	26	153
68	23	3a	7 da	ChC	1200	1100	73	7
6	6	3b	12 da	ChC	380	390	9	2
12	11	3b	7 da	BM	600	1100	37	3
50	27	3c	2 da	BM,SrCm	22	28	42	150
37	24	3d	21 da	BM,CoC	340	430	27	6
39	23	3d	30 da	ChC	330	600	32	5
61	19	3e	6 mo	ChC	83	1500	87	6
23	14	4	14 da	BM,SrCm	28	42	29	69
43	39	4	15 da	ChC	28	2000	2100	105
48	27	4	2 da	BM,CoC	1000	56	41	73
51	33	4	28 da	BM,CoC	86	11	21	191
8	6	4a	5 da	ChC	1200	1300	96	7
55	28	4a	14 da	BM,CoC	480	74	18	24
57	28	4a	14 da	BM,CoC	74	19	53	28
11	11	4b	7 da	BM	710	860	55	6
41	26	4b	15 da	BM	370	650	31	5
45	38	4c	6 da	BM,SrCm	91	3	22	733
9	8	5	5 da	BM,CoC	25	210	27	13
24	14	5	10 da	BM,CoC,SrCm	50	100	86	86
47	27	5	2 da	BM,SrCm	27	4	24	600
56	28	5	14 da	BM,CoC	53	39	0.76	2
14	13	6	11 mo	ChC,CoC	1300	1600	38	2
26	13	6	7 mo	ChC	610	930	280	30
27	13	6	8 mo	ChC	1400	1600	280	18
60	40	6	7 da	BM	1200	1200	490	41
32	19	6a	3 mo	CmC	320	440	91	21
44	31	6a	28 da	ChC	560	160	340	213
62	19	6a	3 mo	ChC	17	280	110	39
20	12	7	5 mo	CoC	35	320	4.1	1
63	37	8a	2 mo	ChC	1100	1200	710	59
64	37	8b	8 da	ChC	760	820	640	78
65	37	8c	--	ChC	320	520	5	1
29	16	9	4 yr	BM	490	590	120	20
35	17	10	42 da	SwC	340	560	43	8

^aNumber refers to supplier; letter refers to supplier's designation.

^bChC = Cheddar cheese, CoC = Cottage cheese, BM = buttermilk, SrCm = Sour cream, StCd = Stirred curd, CmC = Cream cheese, SwC = Swiss cheese.

^cCounts are rounded to 2 significant figures.

cheese, had less than 10,000 citrate-fermenting bacteria but had one of the higher lactic acid organism counts (1.3 billion). Conversely, the cultures that had the high percentages of citrate-fermenting bacteria had low lactic acid organism counts as indicated by the low counts on the TJA.

The 72 cultures received originated from 9 different sources and the origin of 10 cultures was unknown. Most of the unknown group had been in the dairy for a long period. Culture 7 had been used day after day in the same Cheddar cheese plant for over 10 yrs. Large enough numbers of samples were available from six of the sources for statistical treatment. Analysis of variance by the method of Snedecor (9) indicated no significant differences ($F = 0.855$, $F_{0.05} = 2.41$) among the mean percentages of citrate-fermenting bacteria in cultures from the six sources.

Some interesting comparisons can be made regarding the ages of the cultures. When the three cultures that had no age specified are omitted, it will be noted that of the remaining 69 cultures, 84% had been in the plant for less than 1 yr, 78% for <6 mo, 62% for <30 days, 48% for <15 days and 26% for <8 days. These data imply a high turnover of lactic cultures in the dairy plants participating in this study. Sixty-eight cultures containing citrate-fermenting bacteria were grouped according to the time they had been in the dairy plant. These groups were: less than 8 days, 8-15 days, 16-30 days, 31 days to 6 mo and over 6 mo. An analysis of variance showed no significant differences ($F = 1.69$, $F_{0.05} = 2.51$) among the mean percentages of citrate-fermenting bacteria in the cultures of the five age groups. These data do not support the idea that one of the reasons for changing cultures is that the citrate-fermenting bacteria tend to disappear with repeated transfer in the dairy plant.

Cultures containing citrate-fermenting bacteria were grouped on the basis of their use in the dairy plant. Of these, 59% were used in the making of buttermilk, 36% in Cottage cheese, 30% in Cheddar

cheese and 11% in sour cream. Also, two cultures were used in the making of Cream cheese and one in Swiss cheese. An analysis of variance showed no significant differences ($F = 1.26$, $F_{0.05} = 3.11$) among the mean percentages of citrate-fermenting bacteria in the lactic cultures for these three purposes. Presumably some cultures have been classified for buttermilk, cottage cheese, Cheddar cheese, etc. on the basis of the flavor producing organisms but this work shows no significant relationship between the bacterial make-up of the cultures and their use by the dairy plant.

ACKNOWLEDGMENT

We wish to thank Galloway-West Co., Fond du Lac, Wis. for the Matrix Mother Culture Media.

REFERENCES

1. American Public Health Association. Standard Methods for the Examination of Dairy Products. 11th ed. Am. Public Health Assoc., New York, N. Y. 1960.
2. Benchetrit, Issac. Thesis. M. S. Iowa State College. 1933.
3. Galeslot, Th. E., Hassing, F., and Stadhouders, J. Agar Media for the Isolation and Enumeration of Aromabacteria in Starters. *Neth. Milk and Dairy J.*, 15:145. 1961.
4. Lundstedt, Erik. The Symbiosis Between Lactic Acid Bacteria and Aroma Bacteria in Starters. *The Milk Dealer*. April, 1959.
5. Mayeux, J. V., Sandine, W. E., and Elliker, P. R. A Selective Medium for Detecting *Leuconostoc* Organisms in Mixed-strain Starter Cultures. *J. Dairy Sci.*, 45:655. 1962.
6. McDonough, F. E., Hargrove, R. E., and Tittler, R. P. A Selective Plating Medium for *Leuconostoc* in Mixed Lactic Cultures. *J. Dairy Sci.*, 45:656. 1962.
7. Prouty, C. C. A Plate Culture Technique for the Quantitative Determination of *Leuconostoc citrovorum* in Cultured Buttermilk with Observations on the Progressive Changes in Numbers during the Fermentation Process. *J. Dairy Sci.*, 36:564. 1953.
8. Skean, J. D. and Overcast, W. W. Another Medium for Enumerating Citrate-Fermenting Bacteria in Lactic Cultures. *J. Dairy Sci.*, 45:1530. 1962.
9. Snedecor, G. W. Statistical Methods. 5th ed. Iowa State College Press, Ames, Iowa. 1956.

A STUDY OF THE MICROBIOLOGICAL QUALITY OF HADDOCK FILLETS AND SHUCKED, SOFT-SHELLED CLAMS PROCESSED AND MARKETED IN THE GREATER BOSTON AREA¹

J. T. R. NICKERSON AND S. A. GOLDBLITH

Department of Nutrition and Food Science,
Massachusetts Institute of Technology,
Cambridge, Massachusetts

SUMMARY

Data obtained during the months of July and August of 1961 on the microbiological quality of haddock fillets and shucked, soft-shelled clams processed and marketed in the greater Boston area have been compiled and critically evaluated for commercial and sanitary significance. Differences were observed in the aerobic-facultative microbial counts of haddock fillets processed at different times of day in a given company. Soft-shelled clams dug from unpolluted beds in the vicinity of Boston, when shucked in a commercial plant, were found to have counts which were about one hundred times lower than clams shipped in from the Maryland area and subsequently shucked in the local marketing area. This points out the desirability of processing shellfish (by radiation treatment or otherwise) at a point close to the source of supply. Anaerobic (clostridia) counts were somewhat higher in shucked clams than in haddock fillets although high counts (clostridia) were not encountered with either product.

As part of a comprehensive program of research being conducted by the Department of Nutrition and Food Science of the Massachusetts Institute of Technology, Cambridge, Massachusetts, for the advancement of the fisheries industries of the northeastern Atlantic states, a study was initiated to evaluate the microbiological quality of haddock fillets and shucked, soft-shelled clams processed and marketed in the greater Boston area. The objective of this study was two-fold. First, to obtain a current, representative picture of the levels of microbial populations in these commercially important sea foods at the point of processing and distribution for a variety of recommendational purposes; and, second, to obtain the best possible sources of supply of these sea foods for a program of radiation-pasteurization intended to indicate the feasibility of expanding the inland markets for these sea foods by significantly extending their storage life at refrigeration temperatures above freezing. The sanitation implications of the findings from this survey are discussed in this paper.

METHODS

Sampling Procedure

Haddock Fillets. Three representative haddock

fillets were taken from the end of the processing line in each of three plants three times daily. The fillets were placed in clean polyethylene film envelopes which were carefully sealed and placed in crushed ice in an insulated container for transportation back to the laboratory. The three plants participating in the survey were typical of large-, medium-, and small-scale fish-filleting establishments in the greater Boston area.

Shucked, Soft-Shelled Clams. Half-pint samples of shucked, soft-shelled clams, packaged in plastic-lined cardboard containers, were obtained each day from three clam-shucking establishments in the general vicinity of Boston. These samples were drawn from the shucking line three times daily, and the containers placed in polyethylene film envelopes which were sealed and packed in ice for storage until called for the following morning. The concerns selected for the survey were typical of shucking establishments in this general area.

Sample Preparation

Haddock Fillets. The sealed polyethylene film envelopes containing the three haddock fillets were carefully opened and the fillets placed on sterile aluminum foil sheets. Sections were aseptically cut with sterile surgical scissors from the three fillets, and weighed out to a total of 50 g in the covers of sterile, refrigerated, stainless steel Oster Blendor cups. These sections were then aseptically transferred into the body of the blender cup. The cover and cutting-transfer utensils were rinsed three times with sterile, refrigerated diluent into the body of the blender cup. A total of 450 ml of diluent was added to the 50 g of diced haddock fillets.

Shucked, Soft-Shelled Clams. The containers of clams were removed from the polyethylene envelopes, and the contents of each (clams and liquor) thoroughly mixed with sterile spoons. Fifty grams of clams plus liquor were aseptically weighed out in blender cup covers, as previously described, and the contents transferred and rinsed three times into the body of the cups with sterile, refrigerated diluent. A total of 450 ml of diluent was added to the 50 g of clams and liquor.

Both haddock fillet and shucked, soft-shelled clam

¹Contribution number 495 from the Department of Nutrition and Food Science, Massachusetts Institute of Technology, Cambridge, Massachusetts.

samples were blended for three minutes at 15,000 rpm, and then allowed to stand for ten minutes at 5 C to permit the foam to break and the emulsion to become more homogeneous in consistency.

Aerobic-Facultative Pour Plate Procedure

1. Ten ml of the blended, emulsified samples were aseptically pipetted from the blender cups into 90-ml refrigerated dilution blanks; and, thereafter, diluted further for plating. Three decimal dilutions were employed for both haddock fillets and shucked, soft-shelled clams to insure obtaining plates which would yield statistically desirable microbial colony populations. Generally, 10^3 , 10^4 and 10^5 dilutions were used for haddock fillets, and 10^4 , 10^5 and 10^6 dilutions for shucked clams. These three sample dilutions were plated out in triplicate.

2. Approximately 10 ml of agar Medium B (DW)¹, tempered to 45 C, was aseptically poured into the Petri dishes containing the sample inocula, and thoroughly mixed. This medium was determined, by a previous investigation (4), to yield maximum recovery of microorganisms from both sea foods.

3. The cooled, solidified cultures were incubated for five days at 20 C and the macrocolonies which developed were counted and tabulated.

Anaerobic (clostridia) Tube Preparation

1. One ml of the 10^2 dilution of both haddock fillet and shucked, soft-shelled clam samples were aseptically transferred, in duplicate, into sterile oval culture tubes (Corning No. 9200) containing sterile solutions of sodium sulfite, Polymixin B sulfate, and sodium sulfadiazine in the concentrations recommended by Angelotti and Hall (2).

2. Seven ml of the basal SPS agar², tempered to 45 C, was immediately aseptically pipetted into the tubes; mixing the inocula, reagents, and agar thoroughly. The tubes were then quickly placed in a 20 C water bath to rapidly solidify the agar mixture.

3. Following solidification, 5 ml of BBL thioglycollate supplement plus 1.5% agar was aseptically pipetted over the first agar to help establish and maintain anaerobic conditions in that medium.

¹Medium B (DW)

Ingredients	g per liter
BBL Trypticase	15.0
BBL Phytone	5.0
Bacto-Yeast Extract	5.0
NaCl	4.0
Na ₂ SO ₃	0.2
l-Cystine	0.7
Bacto-Dextrose	5.5
Bacto-Agar	15.0
Distilled Water	1.0 liter
Final pH 7.0 ± 0.1	

4. The cooled, solidified tubes were incubated for 40 hours at 30 C, and the black macrocolony zones that developed were counted and tabulated (presumptive count for clostridia).

5. Confirmation of the black colonies as clostridia was accomplished by removing the agar from the tubes, picking the black colonies, performing morphological tests to determine shape and spore formation and analyzing for the presence of catalase.

RESULTS AND DISCUSSION

Data from the microbiological survey (aerobic and anaerobic clostridia counts) of products from haddock and clam processing plants were analyzed statistically by the analysis of variance method (three periods considered, AM, M, PM) and by Duncan's multiple range test (two periods considered, AM vs. M, AM vs. PM, M vs. PM).

Aerobic-Facultative Macrocolony Counts

Haddock-Fillets. It is a well known fact that prior to filleting only small numbers of bacteria, if any, are present in the flesh of fish such as haddock (3, 5). Contamination of such products with bacteria occurs, therefore, mostly during filleting and subsequent handling prior to packaging.

An examination of Tables 1 and 3 indicates that in any of the three plants A, B or C the average contamination of fillets with aerobic-facultative bacteria at any time of day would provide counts near 400,000 per g or higher. This may be contrasted with the Canadian requirement of 250,000 per g for freshly frozen fillets and the statement that in inspected plants in Canada average contamination of freshly frozen fillets has been lowered to about 70,000 per g (1).

Statistical analyses of aerobic-facultative counts on products from haddock filleting plants indicated that in plants A and B there was a gradual build-up of contamination on equipment, subsequently transferred to the product, as the day progressed. This eventually resulted in significantly higher counts in product produced in the afternoon as compared to

²Medium SPS

Ingredients	g per liter
Bacto-tryptone	15.0
Bacto-Yeast Extract	10.0
Iron Citrate	0.5
Bacto-Agar	15.0
Final pH 7.0 ± 0.1	

Add the following millipore-filtered solutions:

<i>Final concentration in medium</i>	
Fresh Sodium Sulfite	0.05%
Polymixin B Sulfate	10 PPM
Sodium Sulfadiazine	0.12 mg per ml sodium

TABLE I. AEROBIC-FACULTATIVE MACROCOLONY COUNTS FROM HADDOCK FILLET AND SHUCKED, SOFT-SHELLED CLAM SAMPLES OBTAINED FROM COMMERCIAL PROCESSING ESTABLISHMENTS IN THE GREATER BOSTON AREA (INCUBATION-5 DAYS AT 20 C -AVERAGE OF THREE REPLICATE PLATES-AGAR B(DW))

	Haddock fillets (X 10 ⁻⁴ /gram)									Shucked, soft-shelled clams (X 10 ⁻⁵ /gram)								
	Company A			Company B			Company C			Company D			Company E			Company F (X 10 ⁻³ /gram)		
	AM	12N	PM	AM	12N	PM	AM	12N	PM	AM	12N	PM	AM	12N	PM	AM	12N	PM
20	13	200	10	18	4	38	28	22	59	28	65	55	10	5	49	25	22	
9	19	24	4	5	36	18	13	130	39	47	9	47	30	55	55	35	13	
41	110	74	40	43	160	420	61	190	15	13	16	31	4	7	79	110	40	
53	24	24	77	16	67	430	83	61	31	13	27	16	8	1	80	74	37	
18	17	200	17	48	44	58	220	90	37	55	250	5	42	64	8	210	35	
26	60	21	39	38	13	150	120	76	34	59	210	24	10	11	39	82	120	
73	53	140	36	88	100	330	63	270	27	98	38	26	14	11	54	170	78	
15	56	210	46	33	77	100	34	150	9	35	43	11	90	110	92	24	81	
24	32	20	21	68	2	48	33	45	65	38	12	3	10	6	43	11	42	
110	69	3	15	73	37	120	72	69	32	46	9	45	130	110	64	100	51	
27	21	200	45	21	53	200	140	10	52	25	25	83	170	230	71	26	29	
79	36	27	22	14	53	150	83	170	26	13	200	56	69	74	59	56	74	
31	58	87	44	55	140	74	110	170	8	22	27	50	43	41	47	10	53	
43	57	18	27	35	29	34	26	34	52	38	65	3	80	160	38	140	150	
23	42	370	45	29	70	320	53	90	23	9	16	84	14	43	50	26	44	
90	33	200	35	36	45	170	35	120	43	43	46	86	11	6	41	110	22	
25	50	67	40	23	67	190	40	78	12	25	12	28	22	15	69	36	55	
54	26	28	30	73	20	130	330	270	28	9	12	34	7	5	11	17	13	
46	41	44	30	40	37	360	32	36	23	14	25	11	5	4	16	16	32	
23	23	58	35	35	59	98	53	88	65	35	7	15	24	6	64	42	43	
62	100	120	80	52	57	81	62	140	39	16	27	32	6	5	39	48	38	
40	98	64	82	36	60	60	70	280	10	14	180	11	6	6	73	45	47	
20	21	26	41	45	100	220	97	38	11	32	34	6	10	25	78	20	57	
21	31	21	27	50	340	44	45	69	67	12	17	10	18	10	26	69	75	
27	31	44	24	28	170	71	100	120	9	30	10	44	7	97	70	21	19	
55	34	43	49	16	41	140	45	77	71	6	26	10	9	7	68	83	76	
39	79	54	52	33	42	59	94	49	5	33	7	88	21	8	120	64	76	
49	21	50	62	92	74	63	110	130	7	9	86	8	59	6	110	39	20	
Mean count																		
Std. deviation	40.8	44.8	87.0	38.4	40.8	71.3	149.1	80.4	109.7	32.1	29.2	53.6	32.9	33.2	40.3	57.6	61.0	51.5
95% confidence limits	24.4	25.8	86.9	19.6	22.1	67.1	119.7	65.3	74.4	27.0	41.1	289.7	26.4	50.3	31.6	26.3	50.1	31.6
	9.4	10.0	32.6	7.6	8.6	26.2	46.3	25.2	28.7	10.4	20.1	112.0	10.2	19.5	12.3	10.6	20.5	12.9

MICROBIOLOGICAL QUALITY

TABLE 2. MACROCOLONY COUNTS OF CLOSTRIDIA FROM HADDOCK FILLET AND SHUCKED, SOFT-SHELLED CLAM SAMPLES OBTAINED FROM COMMERCIAL PROCESSING ESTABLISHMENTS IN THE GREATER BOSTON AREA (INCUBATION-40 HOURS AT 30 C — AVERAGE OF DUPLICATE ANAEROBIC TUBES-SPS AGAR)

	Haddock fillets (X 10 ⁻² per gram)									Shucked, soft-shelled clams (X 10 ⁻² per gram)								
	Company A			Company B			Company C			Company D			Company E			Company F		
	AM	12N	PM	AM	12N	PM	AM	12N	PM	AM	12N	PM	AM	12N	PM	AM	12N	PM
1	0	1	0	0	1	1	1	0	4	0	4	2	3	2	0	1	0	
3	4	3	0	0	0	1	1	1	0	5	2	0	1	0	2	1	1	
3	3	3	2	0	0	0	0	1	0	3	3	0	1	1	1	1	1	
3	2	2	1	1	0	1	2	0	5	4	1	1	0	0	2	3	0	
3	2	4	0	0	0	0	4	0	6	1	0	0	1	1	1	1	1	
1	2	1	1	1	0	1	0	0	4	6	1	0	1	0	1	1	2	
2	1	1	1	0	1	0	2	0	2	4	2	2	0	1	1	1	0	
0	0	1	1	0	1	1	1	0	3	2	2	3	0	0	0	2	1	
1	0	0	0	1	0	1	0	0	0	2	1	0	0	2	2	1	0	
1	2	0	0	0	3	2	0	1	0	7	4	2	2	3	1	0	0	
1	0	1	0	0	1	1	0	1	0	0	2	2	4	7	0	1	0	
0	1	3	0	1	0	1	0	1	2	1	1	2	2	2	3	0	0	
1	1	2	0	1	0	3	0	3	3	1	2	2	0	0	0	3	2	
4	2	0	0	0	1	0	1	1	1	0	4	6	2	0	2	0	0	
1	1	2	1	3	2	3	2	3	7	3	1	3	1	1	2	0	1	
1	3	1	0	1	0	2	0	0	2	1	1	0	0	2	0	2	1	
1	0	1	0	2	0	1	0	1	2	3	1	4	0	0	0	2	1	
1	1	1	0	0	0	3	0	3	1	2	3	2	2	0	2	0	0	
1	0	0	0	1	0	1	1	4	2	1	1	2	2	1	0	1	3	
0	0	2	0	1	0	0	1	2	1	0	1	1	3	3	2	1	2	
2	2	2	0	0	1	2	2	3	2	1	0	2	0	0	1	2	1	
0	2	3	0	1	0	3	2	0	3	1	0	1	0	1	1	0	1	
0	1	1	0	0	0	1	0	1	3	0	1	2	0	0	2	0	0	
0	1	0	1	1	2	1	1	2	8	4	3	0	6	4	0	2	2	
0	0	2	2	7	0	0	1	0	7	8	3	5	2	2	2	2	0	
2	0	2	1	6	5	2	3	5	2	1	1	4	2	4	1	2	3	
3	2	5	0	3	4	1	1	0	2	0	1	6	5	1	1	1	1	
1	1	2	1	1	0	0	2	0	1	0	0	4	1	2	2	0	3	
Mean count	1.32	1.21	1.64	0.43	1.14	0.79	1.18	1.00	1.18	2.60	2.18	1.64	2.07	1.46	1.73	1.14	1.10	0.96 = \bar{x}

MICROBIOLOGICAL QUALITY

TABLE 3. SUMMARY OF RESULTS OF STATISTICAL ANALYSES — AEROBIC COUNTS ON HADDOCK AND CLAMS — WITHIN PLANT

Plant	Product	Period compared	Value of <i>F</i>	Level of significance ^a
A	haddock	AM, M, PM	27.3	1%
"	"	AM vs. M	—	>5%
"	"	AM vs. PM	—	1%
"	"	M vs. PM	—	1%
B	haddock	AM, M, PM	5.3	1%
"	"	AM vs. M	—	>5%
"	"	AM vs. PM	—	1%
"	"	M vs. PM	—	1%
C	haddock	AM, M, PM	4.1	5%
"	"	AM vs. M	—	1%
"	"	AM vs. PM	—	>5%
"	"	M vs. PM	—	>5%
D	clams	AM, M, PM	2.7	>5%
E	clams	AM, M, PM	0.27	>5%
F	clams	AM, M, PM	0.46	>5%

^aWhen three periods compared (AM, M, PM) analyses made by analysis of variance. When two periods compared Duncan's multiple range test used.

TABLE 4. SUMMARY OF RESULTS OF STATISTICAL ANALYSES — ANAEROBIC (CLOSTRIDIA) COUNTS ON HADDOCK AND CLAMS WITHIN PLANT

Plant	Product	Period compared	Value of <i>F</i>	Level of significance ^a
A	haddock	AM, M, PM	0.92	>5%
B	haddock	AM, M, PM	2.6	>5%
C	haddock	AM, M, PM	0.31	>5%
D	clams	AM, M, PM	1.5	>5%
E	clams	AM, M, PM	1.4	>5%
F	clams	AM, M, PM	0.64	>5%

product filleted prior to the luncheon recess. The implication is that in these plants the noonday cleanup was inadequate, allowing bacterial contamination to build up on equipment especially during afternoon periods. In plant C the highest aerobic-facultative counts were obtained in the morning, the counts gradually diminishing to the noontime period and building up again in the afternoon. Obviously the night-time cleanup in this plant was totally inadequate, resulting in highly contaminated equipment when production was started in the morning. As the day wore on the equipment was actually being cleaned by the product until noontime. Thereafter bacterial increases on equipment again caught up, apparently because of poor noontime cleanup, and the counts on the product again increased.

No attempt has been made to compare the level of aerobic-facultative counts obtained on products produced in different haddock filleting plants. However, the 95% confidence limits have been listed for these counts and some evaluation of such differences may be made from these data.

Shucked, Soft-Shell Clams. Tables 1 and 3 show that there were no significant differences between

aerobic-facultative counts made on clams at any period of the day (AM, M, PM) in any particular plant (D, E and F). This is to be expected since the only implement used for removing clams from the shell is a small knife and the product is shucked directly into the final container. Plant sanitation did not, therefore, provide a problem in any of the three plants.

When aerobic-facultative counts of shucked clams produced in the three plants are compared, one plant to another (see Table 1), there is an obvious highly significant difference between the count on product produced in plants D and E (2,900,000 to 5,400,000 per g) and product produced in plant F (52,000 to 61,000 per g). Plants D and E were shucking clams transported from Maryland, in the shell, by truck. Plant F shucked only locally dug clams. Since there were no significant differences in the counts within plants, morning through afternoon, no plant sanitation problems are indicated and the obvious conclusion is that high or low counts are related to the condition of the raw material. It is possible that clams removed from Maryland waters might be more highly contaminated but it would not be expected that the aerobic-facultative count of such waters would be as high as 2.9 to 5.4 x 10⁶ per g. It is probable that some increase in bacterial count is taking place during transportation of the clams in the "in the shell" condition. Regardless of where the increase in bacteria count occurs, shucked clams having the higher counts indicated can be expected to have a relatively short storage life at refrigerator temperatures above freezing. Some method of processing such as radiation-pasteurization, carried out after shucking the product near the source, should facilitate distribution of such products and provide for extended storage life at refrigerator temperatures above freezing.

Anaerobic (clostridia) Counts

Anaerobic clostridia counts and the summary of the statistical analyses of data are reported in Tables 2 and 4. No build-up of clostridial types during the day's production was indicated for any plant processing either haddock or clams. The total anaerobic clostridia counts for both products was also comparatively low.

CONCLUSIONS

1. A survey of the bacterial contamination of haddock fillets produced in three different plants has indicated the need for better cleaning and sanitizing of equipment. A better noonday cleanup was indicated as requisite in all plants.

2. Aerobic-facultative counts in shucked clams were

found to be approximately one hundred times higher in clams transported in the shell from Maryland and shucked in the Boston area as compared to clams dug locally and shucked in the Boston area.

3. Anaerobic clostridia counts made on both haddock fillets and shucked clams produced in the Boston area indicated low concentrations of organisms of this type.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the technical assistance of Leonard Coris, Mohamed Noaman, and Rene Lagasse in the procurement, preparation, and microbiological assay of the haddock fillets and shucked, soft-shelled clams evaluated in this investigation. We also wish to cite the splendid cooperation of the fishery establishments in the greater Boston area who participated in this industry survey. Our special gratitude and thanks go to the Office of Isotope Development of the United States Atomic Energy Commission under whose Contract Number AT (30-1)-2329, Task XII this work was carried out.

REFERENCES

1. Anderson, G. G. Department of Fisheries, Ottawa, Canada. Personal communication to G. J. Silverman, M.I.T. 1962.
2. Angelotti, R. and Hall, H. E. Rapid Procedure for the Detection and Quantitation of *Clostridium perfringens* in Foods. Bacteriol. Proc., Soc. Am. Bacteriologists, p 68. 1961. (Abst.)
3. Castell, C. H. and Greenough, Maxine F. The Action of *Pseudomonas* on Fish Muscle. I. Organisms Responsible for Odors Produced During Incipient Spoilage of Chilled Fish Muscle. J. Fish. Res. Bd. Canada 14: 617-625. 1957.
4. Nickerson, J. T. R., Goldblith, S. A., and Masurovsky, E. B. A Study of the Effects of Sub-sterilization Doses of Radiation on the Storage Life Extension of Soft-Shelled Clams and Haddock Fillets. Quarterly Progress Report for the period May - July, 1961. Prepared by the Department of Nutrition, Food Science and Technology, Massachusetts Institute of Technology, Cambridge, Massachusetts, for the United States Atomic Energy Commission under Contract Number AT (30-1)-2329, Task XII. No. NYO 9572. 1961.
5. Proctor, B. E. and Nickerson, J. T. R. An investigation of the sterility of fish tissues. J. Bacteriol., 30:377-382. 1935.

BACTERIOLOGICAL SURVEY OF FILLETING PROCESSES IN THE PACIFIC NORTHWEST

III. BACTERIAL AND PHYSICAL EFFECTS OF PUGHING FISH INCORRECTLY

WAYNE I. TRETSVEN

*Bureau of Commercial Fisheries, Technological Laboratory,
Seattle, Washington*

SUMMARY

Pughing of various species of bottom fish was quantitatively evaluated with regard to the incidence of pugh marks, the percentage weight loss in trimming away pugh-damaged area, the rate of spoilage of pugh-damaged areas, the predisposition toward discoloration of these areas, and the bacterial effects of pughing before and after iced storage.

Pughs are used to facilitate the handling of fish, as it has long been considered good practice to lift a fish by inserting the tine of the pugh into its head. By use of this technique, the fish handler avoids piercing the body of the fish, and since the head is not used for human food, the edible flesh is not damaged.

Lack of knowledge by a handler, however, as to the need to pugh only the head, often results in unnecessary damage to the flesh and quickens subsequent spoilage. In fact, some workers make little or no effort to avoid mutilating the body of the fish. To speed handling, these workers frequently use forks, which are multi-tined and which therefore can hardly be employed without piercing the body.

When pughs or forks are thus misused (see Figures 1 and 2), the tines not only pierce, tear or bruise the flesh but also convey foreign material into it, often including that from the viscera. Penetration of bacteria and enzymes introduced by the tines, leachings of body fluids, and exposure of the flesh at the opening of the wound result in rapid deterioration.

Ellison (1), Pottinger and Puncochar (7), Reay and Shewan (8), Harvey (2) and Heen (1) have considered the detrimental effects of incorrect pughing as have also the National Fisheries Institute (5, 6), Federal Specifications (11), and the National Canners Association (12, 13, 14).

A high incidence of pugh marks (holes) in the body of the fish has been noted in filleting operations at plants in the Pacific Northwest. From these observations, it appears that the holes resulting from pughing are not recognized as being significant sources of spoilage by fish handlers. The purpose of this paper therefore is to furnish quantitative information on the extent of damage caused by improper pughing.

Our first step in this survey was to determine

precisely how extensive was the pughing of the fish and what exactly was the resulting loss, in short, was it really as serious as our offhand observations had indicated. Next, we were concerned as to the bacterial counts at the pugh marks and the effect of pughing on the deterioration of the quality of the fish during storage. We also were concerned about discoloration, as it is one of the most evident effects of pughing. Pughing, however, does not invariably result in discoloration, which raises the question as to why. Another question that occurs is the effect of the time of pughing, since the fish are repeatedly pughed from the time they are caught to the time they are filleted. Accordingly, we performed five experiments to determine the following: (a) incidence of pugh marks and resulting loss, (b) bacterial counts at pugh marks, (c) relation of pughing to deterioration during storage, (d) discoloration resulting from pughing, and (e) bacterial counts as affected by time of pughing.

INCIDENCE OF PUGH DAMAGE

The purpose of the first experiment was to ascertain the incidence of pugh damage in commercial fish and in the fillets cut therefrom by determining the following: (a) the average number of pugh marks in the body per fish, (b) the average number of pugh marks in the fillets, (c) the incidence of discoloration of the pugh marks in the fillets, and (d) the loss of material due to the trimming of flesh damaged by pughing.

Procedure

Every 10th fish on a conveyor leading to the filletting line from a commercial landing of flounder (*Atheresthes stomias*) was removed for examination, which resulted in a sample totaling 614 fish. Each of these fish was examined, and the number of pugh marks in the head and in the body were counted. In this count, the pugh marks on both sides of the body were included.

In order that the trimming loss caused by pughing could be determined, the plant's filleters were requested to leave the pugh holes undisturbed. Each of the whole, unwashed fillets was examined, and every hole and tear was counted. The discolored holes were itemized separately. Opposing holes ap-

TABLE 1. PUGH MARKS AND TRIMMING LOSS IN A SAMPLE OF COMMERCIAL FLOUNDER AND FILLETS

Fish examined	614
Pugh marks in heads of fish	495
Pugh marks in bodies of fish	2360
Total pugh marks in fish	2855
Fillets examined	1228
Pugh marks in fillets	1774
Discolored pugh marks	164
Trimmed fillets (A)	596 lb.
Trimmings (B)	22 lb.
Trimming loss = $\frac{(B)}{A + B} \times 100$	3 %

pearing on opposite sides of a fillet were counted as one. After the pugh-damaged fillets were examined and weighed, they were trimmed of pugh marks (discolored areas and loose torn flesh). The trimmed fillets and trimmings were weighed to ascertain the trimming loss.

Results

The results are reported in Table 1. In the 614 fish examined, there were two to eight pugh marks per whole fish. Some of these fish had more than one pugh mark on the head; it was difficult, however, to determine the number when more than one was present. Although no pugh marks were found in the bodies of some fish, as many as six were found in the bodies of others. Altogether there were 2360 pugh marks in the bodies of the fish (average 3.8 per fish) and 1774 in the fillets cut therefrom (average 1.4 per fillet). Of the pugh marks in the fillets, 164 (9%) were discolored.

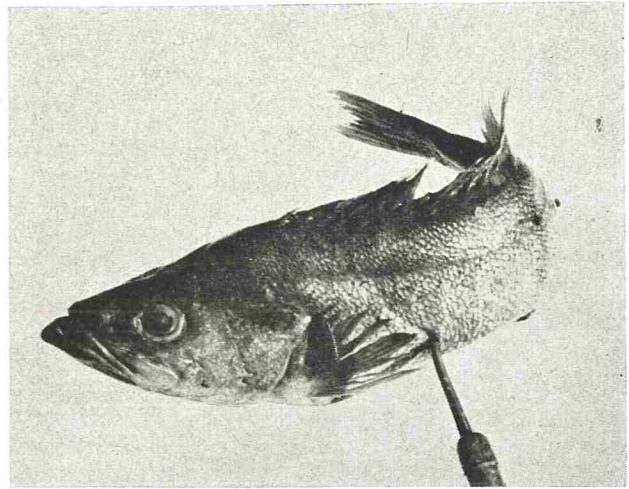


Figure 1. Improper pughing — pugh-piercing the body of a rockfish.

The results of the examination indicated that this load of fish had been subjected to a number of handlings from the time it was brought aboard the trawler to the time of filleting. As is evident from the data, the handlers had failed to pugh the fish in the head only. The trimmings appeared to consist primarily of discolored and torn flesh, and represented 3% of the weight of the fillets.

BACTERIAL COUNTS AT PUGH MARKS

The purpose of the second experiment was to determine the bacterial counts at the pugh mark and at a control area 5 cm distant on both the whole fish and on a fillet cut therefrom.

Procedure

Rockfish (*Sebastes alutus*) that had been pughed in the body during commercial handling and had been spray-washed on a washing conveyor were sampled by swabbing 2 cm² areas at the pugh mark (location I, Figure 3) and at a location approximately 5 cm away (location II). Fillets were obtained

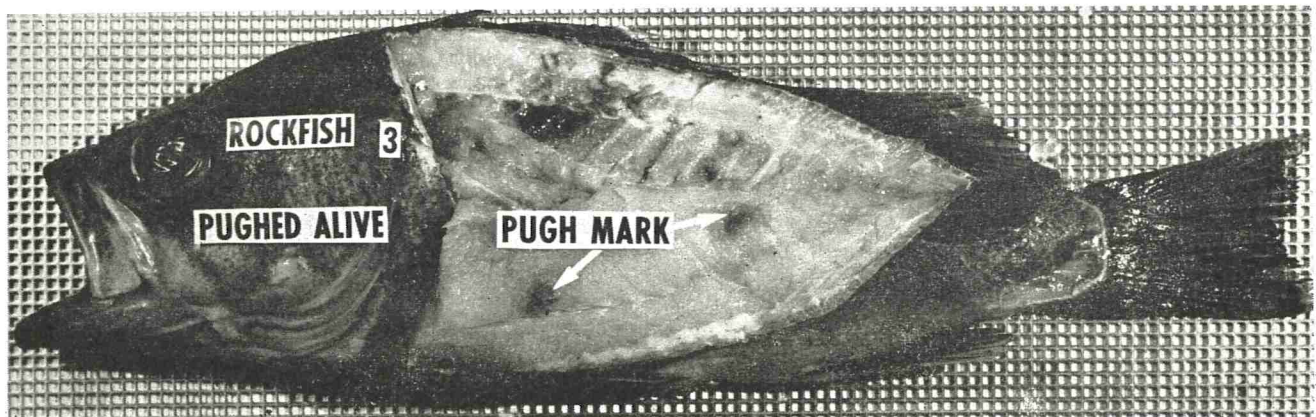


Figure 2. Rockfish, showing two discolored pugh marks in the flesh cutaway from backbone.

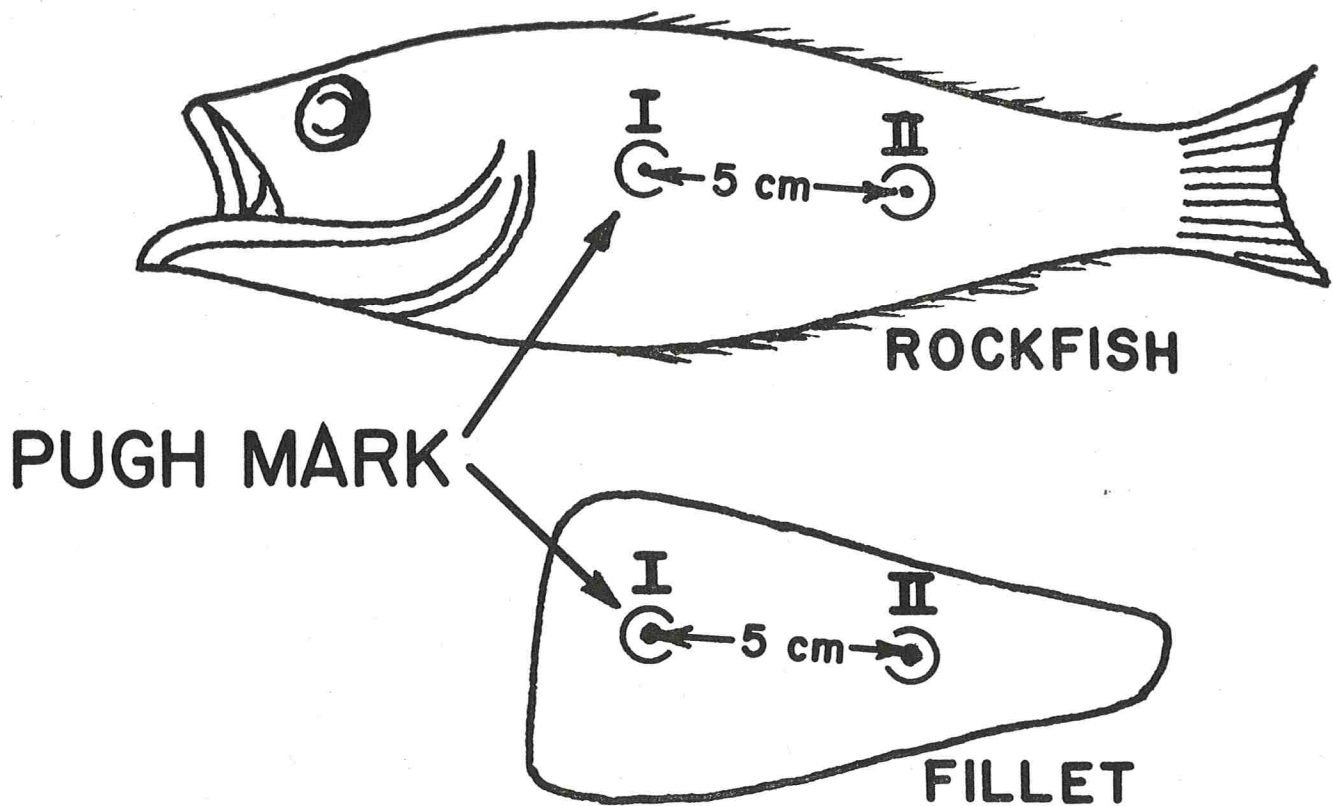


Figure 3. Rockfish and fillet cut thereof illustrating pugh mark (location I) and sampling area (location II) approximately 5 cm distant.

from the same side of the fish that had been sampled whole, and the skin side of the skinned fillets were similarly swabbed at the pugh mark and at 5 cm distant (See Figure 3). Aerobic plate counts of the samples were determined by the procedure of Tretsven (9, 10).

Results

Bacterial counts from the whole fish at the pugh marks were distinctly higher than were those obtained at the control area 5 cm distant. This observation was also true for the bacterial counts for the fillets; however, the counts for the fillets were much lower than were those for the whole fish (Table 2).

PUGHING AND DETERIORATION OF QUALITY DURING STORAGE

The purpose of the third experiment was to obtain an estimate of the rate of spoilage of pugh-damaged flesh relative to the rate of spoilage of undamaged flesh in the same fillet.

Procedure

Approximately 10-g portions of the flesh at locations I and II (Figure 3) were excised from rockfish fillets using an aseptic technique. Each of the portions was placed into a separate, clean, sterile, covered petri dish. The samples were coded, placed in a

dark room at 1 C, and evaluated for odor initially, and after 7 and 15 days. The cover of the petri dish was merely tilted to allow the investigator to smell the sample. Inasmuch as some of the samples from location II were not spoiled on the 15th day, they were kept in storage and examined on the 22nd day. Subjective evaluations of odor were expressed by two critics, according to the following numerical scale:

5	-	fresh
4	-	slightly stale
3	-	stale
2	-	spoiled
1	-	putrid

Results

In the comparison of the odors of portions of flesh from locations I and II, the odors (average numerical scores) at the various examinations were as follows:

Location	Initial	7th day	15th day
I (pugh mark)	4.6	1.1	1.0
II (control)	4.9	3.4	2.0

The samples examined on the 22nd day scored "4" and had an average bacterial count of 44,000 per g

TABLE 2. BACTERIAL COUNTS OBTAINED BY SWABBING 2 CM² AT THE PUGH MARK (LOCATION I) AND 5 CM DISTANT (LOCATION II) ON ROCKFISH AND FILLETS

Sample (No.)	Log of bacterial count			
	Whole fish at		Fillet at	
	I	II	I	II
	(log. per 2 cm ²)			
1	5.86	5.74	5.56	5.00
2	5.90	5.81	5.38	5.34
3	6.20	5.64	5.81	5.26
4	7.72	5.68	5.56	5.34
5	5.76	5.56	5.45	5.42
6	6.15	5.79	5.65	5.73
7	5.87	5.76	5.61	5.34
8	5.74	5.72	5.48	5.00
9	5.95	5.80	5.62	5.42
10	5.86	5.82	5.58	5.59
Average	5.90	5.73	5.57	5.34
Bacterial count	800,000	540,000	370,000	220,000

at that time.

It is significant to note that the flesh in the control area 5 cm from the pugh mark kept considerably longer than did that at the pugh mark.

DISCOLORATION EFFECTS OF PUGHING

The purpose of the fourth experiment was to determine if there was any correlation between (a) discoloration at pugh marks, and (b) whether the fish were alive or dead when pughed.

Procedure

Fillets were cut from fish that had been pughed in the body while the fish were still alive; the following kinds of fish were represented: cod (*Gadus macrocephalus*), lingcod (*Ophiodon elongatus*), rockfishes (*Sebastes* sp), sole (*Microstomus pacificus*), and flounder (*Atheresthes stomias*). These fillets were compared with fillets obtained from similar fish that were pughed after death.

Results

Of the fillets cut from the fish that had been pughed in the body after death, less than 3% were discolored at the pugh mark. Of the similar species of fish that were pughed in the body while the fish were alive, approximately 10% of the fillets were discolored at the pugh mark. Both the intensity and the incidence of discoloration were most apparent when the pugh pierced the body in the proximity

of the backbone and when the fish were handled roughly.

BACTERIAL COUNTS AS AFFECTED BY TIME OF PUGHING

The purpose of the fifth experiment was to determine if there is any significant difference in the bacterial counts of fish pughed and then held in ice for several days compared with fish held in ice for the same period and then pughed.

Procedure

Bacterial counts of the flesh at the pugh marks and at a distance 5 cm away in a control area were determined on rockfishes pughed and grouped as follows:

A. Six rockfish were obtained that had been pughed in the body while they were alive.

B. Six other were obtained that had been pughed approximately 20 minutes after being landed.

C. Three others were obtained that had been pughed after they had been stored in ice for 5 days.

For use as a control, three rockfish of group A and three of group B were frozen rapidly with solid CO₂ within 5 hr after being pughed on the boat. The three others of group A and three of group B were stored in ice.

The fish were sampled 5 days after they had been caught. Using aseptic technique, we excised 5 g of the flesh at the pugh mark of each fish. The excised flesh from the three fish in each group was blended with 9 parts (by weight) of cold, sterile phosphate diluent at 22,000 rpm for 30 seconds, and total bacterial counts were determined.

Results

Table 3 reports the results. The counts were similar in the flesh of fish that had been pughed in the body while alive (group A) and after death (group B). The pugh-damaged flesh (groups A and B) that had been held in ice 5 days had counts that were quite similar but considerably higher than

TABLE 3. BACTERIAL COUNTS OF PUGH-DAMAGED FLESH OF ROCKFISH PUGHED WHILE ALIVE (GROUP A), PUGHED IMMEDIATELY AFTER DEATH (GROUP B), AND PUGHED AFTER 5 DAYS OF STORAGE IN ICE (GROUP C)

Group	Bacterial count ^a	
	Frozen after pughing	In ice 5 days
	No./g	No./g
A	48,000	900,000,000
B	55,000	800,000,000
C		16,000,000

^aComposite sample consists of 5 g of pugh-damaged flesh from each of three fish.

those of the same groups that had been frozen as a control (see Table 3). The bacterial counts of the pugh-damaged flesh of fish that had been in ice 5 days before being pughed (group C) were higher than for those in groups A and B that had been pughed at landing and frozen, yet were very markedly lower than were those for groups A and B that had been in ice 5 days after being pughed.

Although freezing destroys some bacteria, we may assume that the counts of the frozen samples of groups A and B indicate the approximate number of bacteria contaminating the flesh at the time of pughing. The higher counts after 5 days of storage in ice represent contamination with higher-count material from the visceral cavity and surface and growth of the contaminants in the pughed flesh.

CONCLUSIONS

Specific

In 614 fish examined, the bodies average 3.4 pugh marks per fish, and the fillets cut therefrom averaged 1.4 pugh marks per fillet. Of the pugh marks in the fillets, 9% were discolored. Loss due to the trimming away of pugh-damaged flesh represented 3% of the weight of the fillets.

Bacterial counts from the whole fish at the pugh marks were distinctly higher than were those obtained at a control area 5 cm distant. Though the counts were lower on the fillets, the same pattern of counts was observed.

Pugh-damaged flesh spoiled markedly faster than did the flesh in the control area of the same fillets. On the 7th day, the pugh-damaged flesh was putrid, whereas the control, though stale, was still edible.

Less than 3% of the fillets of commercial fish were discolored at the pugh marks when the fish were pughed after death, whereas 10% were discolored when the fish had been pughed when alive.

Bacterial counts at the pugh marks were markedly less in fish that had been held 5 days in ice and then pughed as compared with the counts at the pugh marks in fish that had been pughed and then held 5 days in ice.

RECOMMENDATIONS

Workers handling fish should be made aware of the contamination, spoilage, and loss of flesh due to pughing fish in the body.

The number of pugh marks per fish (two to eight) indicates that much hand labor is involved in moving fish and that use of mechanical methods might well result not only in fish of higher quality but also in economies as well.

REFERENCES

1. Ellison, W. A. Prevention of spoilage at sea. II. The hold. *Fishing Gazette*, pp. 17-19, April, 1934.
2. Harvey, E. W. Good handling helps to keep competitive. *Pacific Fisherman*, 51: p. 40, September, 1953.
3. Heen, E. Importance of quality control of fresh fish. Improved quality and packing of fresh fish as a means of stimulating consumption. FAO report on workshop held in Norway, 11-16.
4. Jones, N. R. Fish muscle enzymes and their technological significance. *Recent Advances in Food Science*, 151-166. 1962.
5. National Fisheries Institute. Fish and Seafood Judging Forms. Set 9A, Sheet 1, 9/61; Set 10A, Sheet 1, 9/61; Set 11B, Sheet 1, 9/61; Set 12C, Sheet 1, 9/61; Set 21, Sheet 1, 9/61; Set 7B, Sheet 1, 9/61; Set 8B, Sheet 1, 9/61. 1961.
6. National Fisheries Institute, Guide-liner.
7. Pottinger, S. R. and J. F. Puncochar. *Boston Fish Pier*. 1949.
8. Reay, G. A. and J. M. Shewan. The care of the trawler's fish. Department of Science & Industrial Research, Food Investigation, Leaflet No. 3, Torry Research Station. 1949.
9. Tretsven, W. I. Bacteriological Survey of Filletting Processes in the Pacific Northwest. I. Comparison of methods of sampling fish for bacteria counts. *J. Milk and Food Technol.*, 26:302-306. 1963.
10. Tretsven, W. I. Bacteriological Survey of Filletting Processes in the Pacific Northwest. II. Swab technique for bacteriological sampling. In Press. *J. Milk and Food Technol.*
11. U. S. Federal Specification. Salmon, Canned. 3.2 Description of the canned product. PP-S-31c, p. 2, February 3, 1954.
12. Yonker, W. V. Summary of the cleaning in the 1960 canned salmon pack. Memo to all Salmon Cannery, National Cannery Association, Northwest Research Laboratory. 1961.
13. Yonker, W. V. Summary of the cleaning in the 1961 canned salmon pack. Memo to all Salmon Cannery, National Cannery Association, Northwest Research Laboratory. 1962.
14. Yonker, W. V. Summary of the cleaning in the 1962 canned salmon pack. Memo to all Salmon Cannery, National Cannery Association, Northwest Research Laboratory. 1963.

RETAIL MISBRANDING OF FOODS¹

FRANK E. FISHER, *Director*

*Division of Food and Drugs
Indiana State Board of Health*

I am sure that most of you are familiar with the provisions of the Indiana Food, Drug and Cosmetic Act. The labeling provisions of that act refer to foods in package form ready for sale to the consumer at the retail level. Since most of our foods are prepackaged and ready for the customer to place in the shopping cart, the labeling requirements relate to practically all foods sold in retail groceries.

In general, any food in package form must bear a label containing the name and place of business of the manufacturer, packer, or distributor; an accurate statement of the quantity of contents in terms of weight, measure or numerical count; the common or usual name of the food and in case it is fabricated from two or more ingredients, the common or usual name of each such ingredient. The labeling of food must not be false or misleading in any particular and, if it is an imitation of other food, the label must bear, in type of uniform size and prominence the word "imitation" and immediately thereafter the name of the food imitated. The law provides that the food shall be misbranded if its container is so made, formed, or filled as to be misleading. If the food bears or contains any artificial flavoring, artificial coloring, or chemical preservative, it must bear a label stating that fact. All words, statements or information required by the act to appear on the label of the food must be prominently placed thereon with such conspicuousness and in such terms as to render it likely to be read and understood by the ordinary individual, under customary conditions of purchase and use.

Several problems have arisen in the field of the statement of the quantity of contents. Regulations promulgated under authority of the act provide that the statement of the quantity of the contents shall be expressed in terms of weight, measure or numerical count, or any combination thereof which are generally used by consumers to express quantity of such food and which gives accurate information as to the quantity thereof. As you know, it is customary to purchase doughnuts by the dozen rather than the pound. However, there is no standard for the size of doughnuts and a dozen of one baker's doughnuts may weigh only one half as much as a

second baker's. Usually, if such items are packaged so that the consumer can readily determine the size of the individual units, a statement of the numerical count would be satisfactory. However, unless an unqualified statement of the numerical count gives accurate information as to the quantity of the food in the package, it must be supplemented by such statement of weight as will give such information. In cases where the numerical count is so large or such that it cannot be verified by the customer at the time of purchase, then the quantity must also be expressed in terms of weight. For example, a package containing and labeled "100 cookies" must also bear a conspicuous statement of the quantity of the contents in terms of weight since a count of 100 cookies cannot be confirmed by the purchaser without opening the package. Statements of quantity should contain only such fractions as are generally used in expressing the quantity of food and the statement should be reduced to its lowest term. The weight of a product should be expressed as "one pound", not "16 ounces", and rather than "20 ounces", the label should state "1 1/4 pounds" or "1 pound 4 ounces."

A food is misbranded if any or all of the mandatory labeling is difficult for the customer to read and understand under ordinary conditions of purchase and use. We have found examples such as licorice candy wrapped in clear cellophane on which all mandatory labeling information was printed in black ink. At the point of sale while all labeling was present, it was completely invisible. Many times, ingredient statements are printed in such small size type as to render it almost impossible to read without a magnifying glass. I am sure that you have observed similar instances of misbranding in many classes of food.

Labeling of products must not be false or misleading in any particular. Recently, a product labeled "Blueberry Pancake Mix" was the subject of regulatory action. The manufacturer had mixed blueberry preserves with cornstarch, powdered sugar, artificial flavor and artificial color to the consistency of a paste, then molded small pellets about the size of the end of your little finger. In the extremely fine print of the ingredient statement, these were listed as "stabilized blueberries". However, the

¹Reprinted from Indiana Association of Sanitarians Newsletter.

words, "Blueberry Pancake Mix", were extremely prominent on the face of the label. In addition, the illustration of the product showed large quantities of blueberries. Since there were no blueberries in the product, the name of the product was false and misleading, and the illustration of the blueberries would also tend to mislead the consumer.

So far, we have discussed a few instances of products which were misbranded by labeling as we commonly understand labeling. However, a number of court decisions have held that any representation, disseminated in any manner or by any means other than by labeling for the purpose of inducing — directly or indirectly — the purchase of a food, becomes labeling of the food product. This, then, means that a table menu or wall placard in a restaurant becomes labeling of the food products being sold. Likewise, any oral representation made to induce the sale of a food is also labeling of the product.

Recently, a large shipment of meat patties destined for restaurant use was seized because of false and misleading labeling. This product, which had been shipped in from Chicago, Illinois, was labeled on the shipping container as a "deluxe meat patty". The ingredient statement listed "ground beef, soy bean meal, water, spices, dextrose, and monosodium glutamate". In the carton containing the beef patties, manufacturer had placed a number of menu clip-on cards, table tents, and wall streamers giving the name of the product as "Chopped Sirloin Steak". It was our contention that the advertising materials which accompanied the product were to be used in the restaurant to induce the customer to buy this product. Therefore, the advertising materials became labeling and served to misbrand the product by providing false and misleading information to the customer. Certainly, an adulterated hamburger is not a "Chopped Sirloin Steak".

As you know, the product "Orange Juice Drink" enjoys a rather large sale in this state, and the product certainly lends itself to misbranding. This product consists approximately of 20% orange juice, water and sugar, citric acid to provide tartness, and artificial cloud to simulate orange pulp. The product is being sold house to house and in many instances, the driver salesman ask the housewife, "Do you need any orange juice today?", or some similar statement which implies that the product is orange juice. The company's name will always be "----- Juice Company" and the company name is very prominent on the side of the container (a half-gallon glass jug), whereas the true name of the product "Orange Juice Drink" appears in smaller letters on the screw cap. We are reasonably sure that many housewives are buying this product for their children under the

mistaken assumption that the product is orange juice. They believe that they are providing their children with the vitamins and minerals normally present in orange juice, whereas the product in fact only contains 20% orange juice and 80% colored, flavored water. Certainly, this practice is false, misleading, and fraudulent, and if we can prove these driver salesmen are making such statements, we would be most anxious to take any necessary regulatory action to stop this practice. We also suspect that this product is being used in some restaurants where orange juice appears on the menu or wall streamer and when the customer orders orange juice, he is given the orange juice drink product.

A similar type of misbranding, not so important nutritionally but equally false and misleading, is the advertising of pure maple syrup on the menu or wall streamer and serving the customer an imitation maple flavored syrup instead. Other similar misbrandings would include the use of milk or cream substitutes and indicating on the menu that cereals are served with cream, or serving the substitute product when the patron asks for cream with his coffee.

For many years, both federal and state regulations provided that the weight of finished smoked products, such as hams and pork shoulder picnics, could not exceed the weight of the fresh uncured article. For example, approximately two pounds of curing solution is pumped into a 20-pound fresh ham. Some of this solution drains out during the curing period and the remainder evaporates in the smokehouse so that the final weight of the cured smoked ham does not exceed 20 pounds. Early in 1962, the federal regulations were changed to permit the weight of the finished product to be increased as much as 10% over the weight of the fresh uncured article. This means that approximately four pounds of curing solution can be pumped into a 20-pound ham, two pounds are lost in draining and evaporation during smoking, and the finished ham can weigh as much as 22 pounds. These "wet hams" must be labeled "Water Added". This is done by attaching a rice paper strip label or by branding the ham with a purple ink statement "Water Added". We have found several instances where the retail butcher stripped the paper label from the ham or trimmed off the inked statement and sold the ham as a regular ham. This practice is misbranding since the customer is being misled as to what he is buying and he is being defrauded. In the above example, the customer would pay ham price for two pounds of water.

Although we have not changed the state meat regulations to legalize this deception, we are faced with the fact that it is permitted under federal regulations and our only means of attacking the problem is at the retail level. We solicit your help in com-

batting this problem.

It is our opinion that the use of nonnutritive artificial sweeteners (such as sodium or calcium cyclamate or saccharine) in ordinary foods is prohibited by the Indiana Food, Drug and Cosmetic Act. However, it is recognized that the use of such substances has a place in bona fide foods for special dietary uses. The act provides that such products are required to bear distinctive and informative labeling, informing the customer as to the amount of fat, protein, and carbohydrates in a given portion of the food, in addition to the mandatory labeling required on all food containers. Also, when a non-nutritive artificial sweetener is used, the words "Artificially Sweetened" must appear immediately before or immediately after the name of the particular product, and the label should also bear wording similar to "Contains ---- per cent cyclamate sodium (or cyclamate potassium or saccharine, as the case may be), a nonnutritive artificial sweetener which should be used only by persons who must restrict their intake of ordinary sweets."

In our opinion, however, the labeling of these products may not prevent consumer deception, and

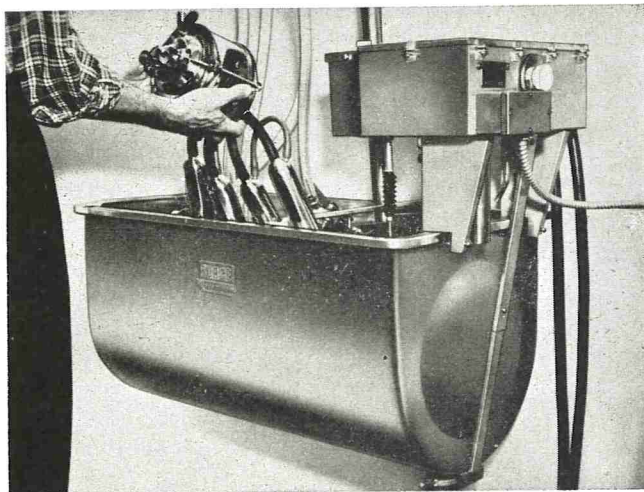
we believe that the distribution of such products should be so controlled as to insure that the special dietary foods are not confused with ordinary foods. We feel that it is important that these special foods be segregated from ordinary foods, especially at the retail level, by displaying all such foods in a special section of the establishment devoted to special dietary foods. Display material should emphasize the special dietary properties of these products to further insure that the prospective consumer is fully aware of the special dietary nature of the product.

In the past, the sanitarians in the local health departments in Indiana have done an outstanding job in securing the cooperation of the retail establishments in providing special dietary departments for these products. The recent upsurge in "low calorie soft drinks" will create a similar problem which, I am sure, will be handled just as efficiently.

In this limited discussion, we have only scratched the surface of the subject of misbranding. However, I hope that this has provided you with information on some basic types of misbranding which will be of some assistance to you in your inspectional activities.

NEWS AND EVENTS

NEW SEAMLESS WASH TANK HELPS DAIRY SANITATION



Of interest to sanitarians and milk technologists is a new SEAMLESS wash tank for the dairy farm which comes in a variety of sizes to fit different size milking installations, according to the builder, Babson, Bros. Co., Chicago.

Made of genuine 18/8 stainless steel, the new Surge SEAMLESS wash tank has done away with

soldered seams. Taking their place are smooth, tough welded joints with not a single sharp corner or rough spot for bacteria to hide in. Re-inforced corners are smooth and provide added strength.

The tanks may be wall-mounted or floor-mounted, according to preference. For floor-mounted models, sturdy stainless steel legs with welded bracing can be ordered separately. For wall-mounted models, wall brackets are provided.

All new Surge SEAMLESS wash tanks have big 2-inch drains. Rubber stoppers are included. All this sanitary equipment can be obtained from Surge Service Dealers throughout the U. S., Canada, Central and South America.

NOTICE TO MEMBERS

We have a vacancy on our Food Equipment Committee. If you have a real interest in developing standards for the evaluation and installation of food equipment and food beverage vending machines, please let me know.

Karl K. Jones, Chairman
IAMFES Committee On
Food Equipment Sanitary Standards

"HERITAGE OF SPLENDOR," NEW NATURAL RESOURCES-OUTDOOR RECREATION FILM, HAS ANTI-LITTER THEME

America's beautiful scenery and outdoor recreation areas — and their desecration by the thoughtless "litterbug" — are highlighted in a new 18-minute color film titled "Heritage of Splendor."

The film, produced in the interests of good citizenship by Richfield Oil Corporation of Los Angeles, is narrated by screen star Ronald Reagan. It presents outstanding color photography, with scenes of forests, mountains, lakes, rivers, beaches and parks. It stresses America's scenic and recreation areas as an important natural resource "worthy of devoted care and protection," and calls for both individual and group effort in turning back the blight of litter.

Keep America Beautiful, Inc., the national litter-prevention organization, recommends "Heritage of Splendor" for showing to both youth and adult groups. KAB suggests it especially for schools, young people's organizations, civic and service clubs, garden and women's clubs, church organizations, and recreation, conservation and sportsmen's groups.

Prints — 16mm, sound and color — may be ordered from Alfred Higgins Productions, 9100 Sunset Boulevard, Hollywood 69, California. The price is \$101. Preview prints may be requested from the same source.

ANNOUNCEMENT OF PUBLIC HEALTH SERVICE TRAINING COURSE

The Public Health Service through the Division of Environmental Engineering and Food Protection, will present the training course, Methods and Practices for State Milk Laboratory Survey Officers, March 9-13, 1964, to be conducted by the Training Program of the Robert A. Taft Sanitary Engineering Center in Cincinnati, Ohio. Survey officers responsible for certification of laboratories examining milk supplies for interstate shipment are the eligible trainees. They should, preferably, have completed the course, Laboratory Examination of Milk or Microbiological Examination of Milk and Milk Products. Instruction in lectures, discussions, demonstrations, and laboratory, covers the control methods employed in examining interstate milk supplies.

A more complete description of the course is given in the new *Training Program Bulletin* which is available on request. Applications or requests for information should be addressed to the Director, Training Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Ohio, or to an appropriate PHS Regional Office. No tuition or registration fee is required.

PENNSALT CHEMICALS ANNOUNCES TWO NEW APPOINTMENTS

Pennsalt Chemicals Corporation announces two new appointments in its Chemical Specialties Division. C. E. Brooker, for nine years Sales Manager of the B-K/Pennswim Department, is assigned to the staff of the Chemical Specialties Division. In this newly created assignment, Brooker will be responsible for implementing divisional plans for expansion.

In making the announcement, J. Stanley Hall, Director of Sales for the Division, pointed out that Brooker has over 30 years' experience working with wholesalers and jobbers in the chemical industry. "Mr. Brooker's knowledge of the needs of the market coupled with our own manufacturing capabilities will prove invaluable in the implementation of our expansion plans," Hall said.

Succeeding Brooker as B-K/Pennswim Sales Manager is L. C. Dormuth, who moves from the position of Assistant to the General Manager of the Specialties Division. Dormuth joined Pennsalt as a research chemist in 1942. After serving in the U. S. Army, he was assigned various responsibilities in technical and sales services, specializing in the development, testing of sanitizing chemicals and installation of sanitizing systems. In 1960, he was assigned to the Office of the General Manager.

In his new capacity, Mr. Dormuth will be responsible for sales of the B-K line of sanitizers and cleaners to the dairy, bottling and food processing industries. He assumes the post at a time when the company is accelerating its development of new and improved products to meet the changing needs of industry. These products are being developed at Pennsalt's new \$9-million Technological Center near Valley Forge, Pa.

Dormuth holds a B.S. degree from the Philadelphia College of Pharmacy and Science. He is a member of a number of professional organizations such as American Chemical Society and the International Association of Milk, Food and Environmental Sanitarians. He has authored numerous articles on water and food sanitation.

KENTUCKY DAIRY MANUFACTURING CONFERENCE HELD AT LEXINGTON

"It is important to know and keep in mind the desires of the consuming public regarding ice cream flavors, rather than to depend on one person's opinion," Professor L. R. Dowd, University of Connecticut, Storrs, Connecticut said at one of the opening meetings of the recent Dairy Manufacturing Conference held in Lexington, Kentucky.

This conference, sponsored by the Department of

Dairy Science, University of Kentucky and the Dairy Products Association of Kentucky, is one of several held for the dairy industry at the University.

Professor Dowd went on to say that customer satisfying flavor in ice cream was one of the most important matters the industry has to consider. In addition to this talk, Professor Dowd was in charge of an ice cream clinic and gave another talk on milk flavors.

Dr. J. J. Jezeski pointed out the importance of the problem of rancidity in milk. He traced the sources of the defect and gave precautions on how it may be avoided. Dr. Jezeski, Dairy Department, University of Minnesota, Mr. Ellis Green, Dean Milk Company and Dr. H. E. Randolph, University of Kentucky, conducted a cottage cheese and butter-milk clinic and Dr. Jezeski also gave a talk on staphylococcus aureus and its importance in dairy products.

Mr. W. G. Meeder, Vendo Company, Kansas City, Mo., challenged those in attendance to make use of modern merchandising methods. He pointed out advantages in using automatic sales equipment and also told the people that they had far from reached the limits in merchandising of milk.

In pointing out the costs occurring due to accidents, Mr. N. E. Thiel, Sealtest Foods, Charlotte, N. C., said that the dairy industry had one of the poorest safety records of any industry. He advised those in attendance that it would save money in the long run to put in sound safety programs.

Other speakers on the two day program were Mr. R. D. Finley, Pet Milk Co., Greenville, Ill.; Dr. R. E. Freeman, Economics Research Service, U. S. D. A., Washington, D. C., Mr. G. A. Houran, The DeLaval Separator Company, Poughkeepsie, N. Y., Mr. Shelby Johnson, State Department of Health, Frankfort, Kentucky, Mr. R. W. Peterson, and Dr. H. E. Randolph, Department of Dairy Science, University of Kentucky, Lexington, Ky., and Mr. R. L. Smith, Votator Division, Chemetron Corp., Louisville, Ky.

Presiding at the various sessions of the meeting were members of the Kentucky Dairy Industry. These included Mr. R. D. Johnson, Oscar Ewing Co., Louisville, Mr. A. B. Snazelle, Brown's Dairy Foods, Inc., Bowling Green, and Mr. Jack Petty, Swift and Company, Lebanon, Ky.

A near record attendance was set at the banquet held on the first evening of the two day conference. Dr. W. J. Tyznik, Ohio State University, Columbus, Ohio was the speaker on this program and kept the members well informed and entertained with his comments on "Foods, Facts and Fallacies." This was a joint session with the various Kentucky Dairy Technology Societies and Manufacturing Milk Organizations.

RHODE ISLAND ASSOCIATION SCHOLARSHIP AWARD



At the recent fall meeting of the Rhode Island Association of Dairy and Food Sanitarians, the annual Scotty Ross Memorial Scholarship was presented to Steven Brown, son of Mr. and Mrs. Russell B. Brown of 53 Nickerson Street, Cranston, R. I. The Browns are owners of the W. B. Brown Dairy Company, located in Cranston. Left to Right: Prof. Clifford J. Cosgrove, Robert C. Armstrong, President, Steven Brown, Recipient, and Sidney Shepard, Secretary-Treasurer.

CONFERENCE ON METROPOLITAN PLANNING FOR ENVIRONMENTAL HEALTH

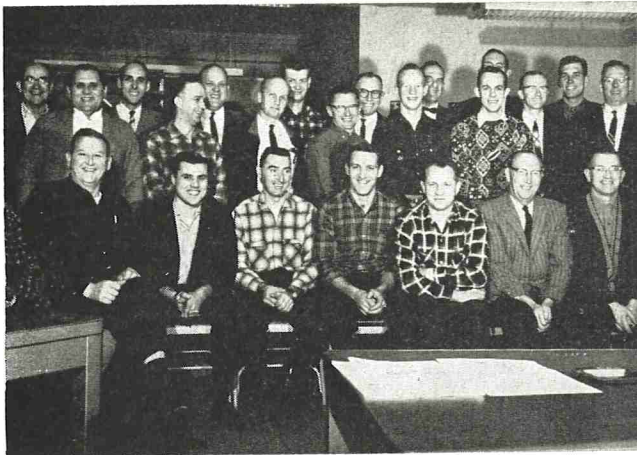
The Georgia Department of Public Health, with the co-operation of the University of Georgia and the U. S. Public Health Service, will conduct a conference on Metropolitan Planning for Environmental Health. This southeastern conference, to be held at the University of Georgia, February 10-14, 1964, has three specific goals: to examine environmental health problems in communities; to increase public awareness of these problems; and to promote inter-governmental co-operation between planning and health agencies in attacking the problems.

Following this conference, a series of training seminars will be held throughout Georgia. These seminars will include an intensive survey of community environmental health services and facilities. The survey findings will then be evaluated from an environmental health standpoint.

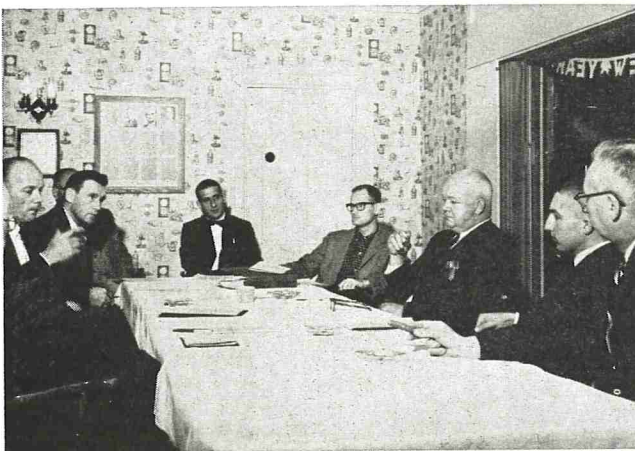
Trainees attending the initial conference and the seminars will represent state and local health agencies, city planning departments, municipal and county governments and civic groups from Georgia and the southeast.

For additional information contact the Conference Coordinator: Mr. Ted Hammock, Georgia Center for Continuing Education, Athens, Georgia.

CONNECTICUT ASSOCIATION SPONSORS SHORT COURSE



Class of students who participated in a ten weeks course on dairy sanitation sponsored by the Connecticut Association of Dairy and Food Sanitarians and the Dairy Department of the University of Connecticut.



Laboratory Committee of the Connecticut Association of Dairy and Food Sanitarians hold important meeting on December 6.

FOURTH NATIONAL FOOD ENGINEERING CONFERENCE AT MICHIGAN STATE UNIVERSITY

The Fourth National Food Engineering Conference will be held at Michigan State University, April 8 and 9, 1964. This Conference will cover refrigeration as it applies to the preservation of foods. Topics to be discussed will deal with refrigeration in three functions of food handling. The first will be pre-cooling, regarding the engineering and design principles for optimum produce cooling. The second phase will be concerned with refrigeration during transportation of food. This phase will evaluate the various merits of several available truck refrigeration systems. The third phase will be directed to refrigeration problems at the retail level. These dis-

cussions will involve some of the engineering limitations of retail refrigerated food display cases. These would be the display cases normally used for vegetables, meats, dairy products, and frozen foods.

Anyone interested in receiving a copy of the program or information pertaining to the Conference should write to Continuing Education Services, Michigan State University, East Lansing, Michigan.

DAIRY AND FOOD INDUSTRIAL EXPOSITION TO OCCUR IN CHICAGO, OCTOBER 4-9, 1964

The Dairy and Food Industrial Exposition, with displays by more than 350 exhibitors, will occur October 4-9, 1964, at McCormick Place in Chicago, Illinois.

Exhibits will include every necessary item of supply or equipment, or service, required in the dairy processing industries, as well as in many other major food industries. Among the exhibits will be displays featuring dairy and food processing equipment and components, automated systems, refrigeration equipment and supplies, transportation equipment, sanitation products, ingredients, flavors, additives, all types of containers, filling and packaging equipment, materials handling equipment, and specialized service such as industrial financing, advertising campaigns, architectural services, etc.

The Exposition will be the first ever to be sponsored under this name by Dairy and Food Industries Supply Association, formerly called Dairy Industries Supply Association, or DISA. As DISA, the Association originated the Dairy Industries Expositions, starting in 1926, which grew into the largest regularly-held industrial shows for any field of the food processing industry.

The last Dairy Industries Exposition was held in 1962. The forthcoming Dairy and Food Industrial Exposition will be in the direct tradition of these earlier Dairy Industries Expositions, and thus, largely the same rules which governed the earlier Expositions will be observed.

Only persons with a direct vocational interest in the displays will be admitted to the Dairy and Food Industrial Exposition. The general public will be excluded. Admission will be by badge only. Badges will be issued, without charge, to registrants from the dairy and food processing fields, as well as to educators, government officials, scientific and technological personnel, and, in general, all users or regulators of the supplies, equipment, and services on display.

Admission badges will not be free for personnel from companies manufacturing products or offering services which are sold to the dairy and food industrial markets and are not on display. For these

persons, admission is granted only after payment of a fee.

For the overwhelming number of registrants, however, admission is free and registration procedures are speedy.

Further to facilitate registration, the regular convention badges of at least four associations which will be holding their annual meetings during the week of the Exposition will be honored for admission at McCormick Place, so their wearers need not re-register. These four associations are Dairy Society International, International Association of Ice Cream Manufacturers, Milk Industry Foundation and National Ice Cream Retailers Association. Possibly other associations which may decide to meet concurrently will also have their badges honored for admission, but this is a matter for later decision.

As at past Dairy Industries Expositions, some hotels in Chicago will be considered the exclusive property of certain of the convening associations. Persons not affiliated with these associations will not have reservations honored in these hotels. For this reason, persons who plan to attend the autumn 1964 event are advised *not* to make their hotel reservations until the spring of 1964, at which time hotel allocations will be announced.

Chicago's major hotels are already agreed that they will not accept reservations for the week of the Exposition until after a spring 1964 date yet to be announced by the convening associations, thus assuring everyone of equal opportunity for first class hotel accommodations. Full details on securing hotel accommodations will be announced probably no later than April 1964.

As at past Expositions, Dairy Society International will maintain an "International Lounge" at which guests from abroad may receive interpretive assistance and aid in planning tours.

A booklet describing the Dairy and Food Industrial Exposition will be available in April 1964. Until then, questions about the forthcoming Exposition may be addressed to its sponsor, Dairy and Food Industries Supply Association, 1145 - 19th Street, N.W., Washington, D. C. 20036.

NEW LAB FOR DAIRY INSPECTION AND GRADING

Dairy manufacturing plants in Northeastern States are receiving U. S. Department of Agriculture grading reports on their products much faster since the opening in September of a new dairy products inspection and grading laboratory in Syracuse, N. Y.

The improved service by the centrally located laboratory, a unit of the Dairy Division of USDA's

Agricultural Marketing Service, is permitting earlier release of dairy products for domestic or export movement. In the past, samples of products from the Northeastern area were shipped to the USDA laboratory in Chicago.

Some 130 dairy manufacturers; local, State, and Federal officials; and food and dairy publications editors were given a first-hand look at the modern testing facilities during an open house held at the laboratory on September 18. Special guests, who spoke at the opening ceremony, included the New York State Commissioner of Agriculture, Don J. Wickham, and the Mayor of Syracuse, William F. Walsh.

Commissioner Wickham, in welcoming the new laboratory, noted that "Any quality program for dairy products is dependent upon good laboratory facilities and constant checking and controls. We welcome the new laboratory — on behalf of the Eastern States — where both industry and government can continue to work for improved dairy products."

Dr. Alexander Swantz, Acting Director of AMS's Dairy Division, explained the role of the new laboratory, and Harold E. Meister, Acting Deputy Director, reviewed Federal-State programs for the dairy industry. Others on the program were J. L. Dizikes, Dairy Division's chief chemist, who outlined the scope and techniques of the laboratory services, and George W. Fry, supervisory chemist at the Syracuse laboratory, who conducted a tour of the new facilities.

The new laboratory supports the Dairy Division in its inspection and grading service, by testing various dairy products for compliance with U. S. quality or grade standards and with contract specifications. This Federal-State service is performed on a voluntary basis, with the users paying all costs under a fee system.

In explaining the role of the new laboratory, Dr. Swantz said:

"There are many users of our joint Federal-State services in the Northeast. This is an important milk producing area and has the largest concentration of consumers in the country. Many people benefit from the services that will be performed by this laboratory — the dairy industry, consumers, exporters and importers, institutions, and the school lunch and direct distribution programs — in fact, just about everyone who deals in or uses manufactured dairy products."

With 2,450 square feet of floor space in Syracuse's Midtown Plaza Building, the new facility has rooms for bacteriological testing, fat analysis, compositing and sample preparation, as well as reception and clerical areas. Laboratory personnel include two analytical chemists, a bacteriologist, a dairy manu-

facturing technologist, and two clerical employees.

Plants receiving the service are located primarily in New York, Vermont, Massachusetts, Pennsylvania, Maryland, and Virginia. They are now receiving grading results as much as three days earlier than before.

A wide range of dairy products are tested: dry whole milk, instant nonfat dry milk, evaporated and sweetened condensed milk, anhydrous milk fat, natural and processed cheese, and miscellaneous products such as sterilized canned milk, butteroil, casein, and malted milk.

In his talk at the opening ceremony, Dr. Swantz recalled that:

"During the last few years, many industry users and cooperating State agencies have asked that we locate a laboratory here in the Northeast region of the United States. We reviewed the need for a laboratory several times.

"Our study showed that the volume of samples moving to our Chicago laboratory from users in this region was increasing steadily. Last year, for example, about 15 percent of all tests performed by the Chicago laboratory was on products from plants in this area. Then too, there were delays and other disadvantages when samples of products had to be shipped to Chicago for final analysis and quality evaluation."

Last year, the Dairy Division graded more than 200 million pounds of dry milk produced in the six major States that the lab will serve. That was enough to fill more than 3,500 railroad cars. About 17,000 samples were tested, all at the Chicago laboratory, which is continuing to serve the Midwestern and Plains States. Other Dairy Division Laboratories are a Federal-State unit in Seattle and a Federal unit in San Francisco.

"Many States, including most of the States in this Northeastern region," Dr. Swantz said in his address, "have programs that help producers and plants maintain high quality products of the variety and composition the consumer wants. These include quality tests on producers' milk, and checks on condition of plant and equipment, processing procedures, effectiveness of their sanitary practices, and protection of products during storage and distribution to consumers."

Dr. Swantz further stated, "We are pleased to recall the close and friendly working relationships we have had down through the years with the States in this area. In the State of New York, we carry out our dairy product inspection, grading, and quality control work with the splendid cooperation of the New York State Department of Agriculture and Markets. We rely on their State employees for drawing samples of products and to check on plant operations

QUALITY

YOUR PROFITS AND REPUTATION DEPEND ON IT

Dairy quality is no better than dairy sanitation. No question. But we do question the cost: Are you getting your money's worth?

Lazarus offers you a full range of money-saving programs that cope with every dairy sanitation problem. A well-known example: Iosan — the four-way detergent/germicide that cleans and sanitizes equipment, removes and prevents milkstone buildup, helps control mastitis. And that's just one of our complete line of proven and accepted sanitation products. So if you're a plant operator, a bulk tank, can or pipeline shipper — and profit-minded, too—



LOOK TO LAZARUS

Write: Lazarus Laboratories, Inc., Div., West Chemical Products, Inc. 42-16 West St., Long Island City 1, N. Y. Branches in principal cities.

that may affect quality or condition of the products. When they finish their work, they pass the samples on to our laboratory for the kind of bacteriological and chemical composition tests that will be carried on right here in Syracuse from today on."

HELPFUL INFORMATION

Editorial Note: Listed below are sources of information on a variety of subjects. Requests for any of the material listed should be sent by letter or postcard to the source indicated.

The Meat Handbook. Albert Levie. 326 pages. \$14.50. The AVI Publishing Company, Westport, Connecticut.

Changing Techniques for Platform Grading of Milk. C. B. Reeves, Jr. Dairy Sci. 46, 484, 1962.

Current concepts of bovine mastitis. \$1.00. The National Mastitis Council, Inc., 440 E. Ogden Avenue, Hinsdale, Illinois. (A bulletin prepared by a committee of six engaged in mastitis research).

Food Processing Operations, Vol. 2, J. L. Heid & M. A. Joslyn, AVI Publishing Company, Westport, Connecticut. 594 pages, \$19.75. 1963.

Effect of Changes in Milking Machine Design On Milking Rate, Machine Stripping, and Mastitis. N. Y. (Cornell) Ag. Exp. Sta. Bul. 983. Ithaca, N. Y.

Effects of Pesticides on Human Health. W. J. Hayes, Jr. Public Health Service. National Agric. Chemical Assoc. News 22, No. 1 pg. 3. Octo. 1963.

USDA and Pesticide Safety. M. R. Clarkson. ARS, USDA, National Agric. Chem. Assoc. News 22, No. 1. pg. 9, Oct. 1963.

Engineering for Dairy and Food Products. A. W. Farrall. John Wiley & Sons, Inc. 440 Park Ave. South, New York City. 1963. 674 pp.

Microwave Heating. David Copson. The AVI Publishing Co., Westport, Conn. 1962. 433 pp. \$13.00.

Cereal Millers Handbook. Vol. 1. Assoc. of Operative Millers. 639 Board of Trade Building, Kansas City 5, Mo. 1963. 446 pp. \$12.50.

Food Composition and Analysis. H. O. Tribold and L. W. Aurand. D. Van Nostrand Co., 120 Alexander St., Princeton, N. J. 460 pp. \$14.00.

Packaging and Processing of Foods in Flexible Pouches. MRD Division, General American Transportation Co., 7501 No. Natchez Ave., Niles 48, Ill. 1963. \$12.50.

THIRD ANNUAL MEETING NATIONAL MASTITIS COUNCIL, INC.

The third annual meeting of the National Mastitis Council will be held on Thursday and Friday, February 13-14, 1964 at The Holiday Inn — O'Hare, Shiller Park, a modern well equipped motel near O'Hare Airport, Chicago, Illinois. The Motel will provide free transportation to and from O'Hare Airport.

This meeting will provide a spring-board for an intensive drive against mastitis during the current year.

Thursday morning registration from 8 - 10 A.M. Several educational films on mastitis will be shown for the "early-birds".

Then Dr. Robert W. Metzger, president, will present his welcome address, to be followed by reports of the standing committees concerned with: 1) Research, 2) Programs and Procedures, 3) Education, 4) Membership and Finance.

At noon everyone who has registered will have an opportunity to participate in special workshops concerned with one of these four subject areas, each workshop to have a separate luncheon and discussion period.

In the afternoon general session, outstanding authorities will speak on important development, problem and opportunities related to the basic goal of reducing the impact of mastitis on the dairy industry.

The evening banquet will feature an address by a distinguished guest speaker.

Friday morning will be devoted to: 1) general discussions of the four subject areas, for which committees have been established, 2) presentation of important papers, and 3) the business affairs of the Council and election of officers.

A registration fee of \$12.00 will cover participation in all sessions, including Thursday luncheon and banquet, and a copy of the 1964 annual report. Registration form is enclosed. To be sure accommodations are reserved for you, return completed form by return mail. Single rooms, \$10.50 plus tax, Double

rooms, \$14.50 plus tax.

This will be a highly significant meeting for anyone in or associated with the dairy industry who is concerned with mastitis. It is open to members of the Council and to other interested persons.

R. A. CROSBY

R. A. Crosby, Floyd-Harrison County Health Department, passed away December 2. Russ was an authority on small water supplies and sewage disposal systems and was noted for his ability to solve seemingly unsolvable sewage disposal problems.

At the time of his death, Russ was a member of the membership committee of the Indiana Association of Sanitarians. His contributions to public health and to the I.A.S. over the years have been legion. His passing is a loss felt keenly by everyone who knew him.

NATIONAL LABELING COMMITTEE SELECTS NEW EXECUTIVE SECRETARY

The National Labeling Committee meeting in Washington, D. C., re-elected officers for the coming year and additionally elected Mr. H. L. Thomasson as its Executive Secretary. The two-day meeting, held January 14 and 15, was attended by thirteen members representing associations on the NLC with a number of important issues and procedures resolved.

The officers re-elected for the coming year will be: Chairman, M. W. Jefferson, Virginia Department of Agriculture; Vice Chairman, Shelby Johnson, Kentucky Department of Health; Treasurer, Ervin L. Peterson, Milk Industry Foundation; Executive Secretary, H. L. Thomasson, International Association of Milk, Food and Environmental Sanitarians, Inc.

The selection of Mr. H. L. Thomasson to succeed Harold Barnum as Executive Secretary means that the office of the National Labeling Committee will be located in Shelbyville, Indiana. Mr. Thomasson will continue his present responsibilities as Executive Secretary of the International Association of Milk, Food and Environmental Sanitarians in addition to his new duties with the NLC. The NLC headquarters will share the office space now housing the IAMFES.

Tentative approval was given to new operating procedures for the NLC which would closely resemble those followed by the 3-A Sanitary Standards Committee.

The NLC through its Regulatory, Industry and Advisory Sections is giving immediate attention to

the forthcoming revision of the USPHS Milk Code and Ordinance. High on the list of items being considered are the questions of accurate and informative definitions for the fluid products of milk containing less butterfat than standard whole milk. Associated questions receiving the Committee's attention are the labeling requirements to apply to these products so as to fully inform consumers as to the composition and characteristics of these products.

Additionally the committee hopes to provide a means by which differences and problems arising in the regulations applied to milk and dairy products may be resolved.

TRANSPORT TANK DEVICE TO GET 3-A AMENDMENT IN MAY OF 1964

The final validating signature was added to a new amendment to the 3-A Sanitary Standard for Stainless Steel Automotive Milk Transportation Tanks for Bulk Delivery and/or Farm Pick-up Service on January 15, 1964.

This amendment, which was formulated at the October meeting of the 3-A Sanitary Standards Committees in Cincinnati, provides for the optional installation in transportation tanks of a permanently mounted device serving the dual purpose of air agitation and in-place or mechanical cleaning.

The new amendment will become effective four months after the signing, or May 15, 1964. It will be published in the earliest possible issue of the Journal of Milk and Food Technology.

3-A Standards for dairy equipment are the result of cooperation among three groups: (1) dairy processors, the users of dairy equipment; (2) dairy industrial suppliers and equippers, the manufacturers and sellers of dairy equipment; and (3) public health officials and sanitarians, the regulatory officials under whose jurisdiction the equipment is installed and used.

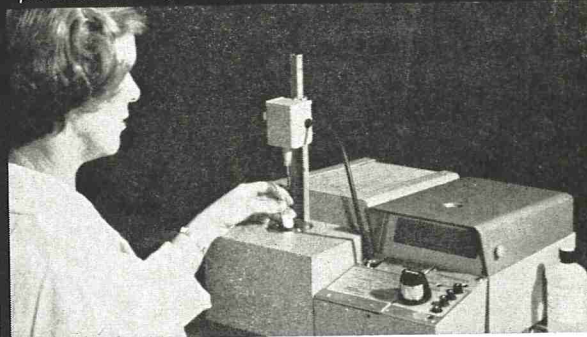
The 3-A program, which is supported by every national dairy trade association, is an entirely voluntary undertaking which has resulted in standards being issued for 23 items of dairy industrial supplies or equipment.

BAKING INDUSTRY SANITATION STANDARDS COMMITTEE FURNISHES FREE COPY OF STANDARDS

BISSC has an established policy to furnish a complimentary copy of each published standard to any federal, state, county, or local health department requesting such standards. These may be obtained from: Raymond J. Walters, Executive Secretary, 521 5th Ave., New York 17, N. Y.

TODAY... You will probably pay
for watered milk*

* Surveys by states, municipalities, associations, and universities prove that from 5% to 30% of all milk is watered.



unless you own the

ADVANCED MILK CRYSCOPE

Used for routine screening of added water it can save you from \$5,000 to \$25,000 a year. This simple, inexpensive instrument follows the official AOAC, Standard APHA, and MIF methods more closely than any other equipment. Run a 100 sample water survey of your milk today. Request details, call collect if you like—or write for literature and prices.



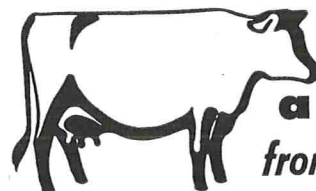
**ADVANCED
INSTRUMENTS, INC.**

45 KENNETH STREET - 617-DEcatur 2-8200
NEWTON HIGHLANDS 61, MASSACHUSETTS

Classified Ad

FOR SALE

Single Service milk sample tubes. For further information and a catalogue please write, Dairy Technology, Inc., P. O. Box 101, Eugene, Oregon.



**CLEAN
and SAFE**
from Herd to Bottle!

Britex
SANITATION PROGRAM

BRITEX CORP. Manufacturing Chemists
BOSTON, MASSACHUSETTS



Application for Membership

**INTERNATIONAL ASSOCIATION OF MILK, FOOD & ENVIRONMENTAL
SANITARIANS, INC.**

Box 437, Shelbyville, Indiana

Name ----- Date -----
Please Print

Address ----- Renewal

----- New

Business Affiliation ----- Re-instatement

Annual Dues \$7.00 Check Cash
(Membership Includes Subscription to Journal of Milk & Food Technology.)
Please Print

Recommended by -----

Shelbyville, Ind.
Box 437

Subscription Order

JOURNAL OF MILK & FOOD TECHNOLOGY
(Monthly Publication)

Name ----- Date -----
Please Print

Address ----- New

----- Renewal

Educational Institution & Public Libraries (Annually) \$6.00 Check Cash
(Please Print) Individual Non-Member Subscription (Annually) \$8.00
Governmental Agencies, Commercial Organizations

I. A. M. F. E. S. & J. M. F. T.
Box 437, Shelbyville, Ind.

Change of Address

FROM

Name ----- Date -----
Please Print

Address -----

TO

Name -----
Please Print

Address -----
Please Print

I. A. M. F. E. S. & J. M. F. T.
Box 437, Shelbyville, Ind.

Order for 3A Standards

Name ----- Date -----
Please Print

Address -----
() Complete Set @ \$3.00 = ----- () Complet set bound (durable cover) @ \$4.75 = -----
() HTST Std—with cover = .50
() HTST Std—without cover = .45
5 Year Service on Standards as Published = 2.50 additional

Order for Reprints of Articles

Amt. ----- Title -----
Schedule of prices for reprints F. O. B. Shelbyville, Indiana

	1 Page	2 Pages	3 & 4 Pages	6 & 8 Pages	12 P.	Cover
100 or less	\$12.50	\$15.00	\$21.00	\$30.00	\$50.00	\$21.67
Add'l. 100's	1.60	1.60	3.00	4.20	7.00	3.37

THE ONLY Approved
SANITARY METHOD OF APPLYING
A U. S. P. LUBRICANT
TO DAIRY & FOOD
PROCESSING EQUIPMENT

*Haynes
Spray*

U. S. P. LIQUID PETROLATUM SPRAY

U.S.P. UNITED STATES PHARMACEUTICAL STANDARDS

CONTAINS NO ANIMAL OR VEGETABLE FATS. ABSOLUTELY NEUTRAL. WILL NOT TURN RANCID—CONTAMINATE OR TAIN WHEN IN CONTACT WITH FOOD PRODUCTS.

SANITARY—PURE

ODORLESS—TASTELESS

NON-TOXIC



This Fine
Mist-like
HAYNES-SPRAY
should be used to lubricate:

SANITARY VALVES
HOMOGENIZER PISTONS — RING
SANITARY SEALS & PARTS
CAPPER SLIDES & PARTS
POSITIVE PUMP PARTS
GLASS & PAPER FILLING
MACHINE PARTS
and for ALL OTHER SANITARY
MACHINE PARTS which are
cleaned daily.

The Modern HAYNES-SPRAY Method of Lubrication
Conforms with the Milk Ordinance and Code
Recommended by the U. S. Public Health Service

The Haynes-Spray eliminates the danger of contamination which is possible by old fashioned lubricating methods. Spreading lubricants by the use of the finger method may entirely destroy previous bactericidal treatment of equipment.

PACKED 6-12 oz. CANS PER CARTON
SHIPPING WEIGHT—7 LBS.

THE HAYNES MANUFACTURING CO.
4180 Lorain Avenue • Cleveland 13, Ohio

HAYNES-SPRAY INGREDIENTS CONFORM WITH FDA REGULATIONS AND CAN BE SAFELY USED AS A SANITARY LUBRICANT FOR FOOD PROCESSING EQUIPMENT WHEN USED IN COMPLIANCE WITH AN EXISTING FOOD ADDITIVES REGULATION.

Reprint Of Ten-Year
Annual Index

Journal Of Milk And Food
Technology

VOLUMES 15 (1952)
THROUGH 25 (1962)

Price — \$2.50

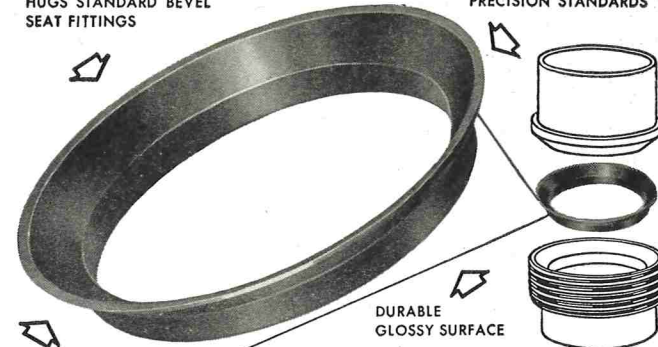
BOUND IN DURA-PRONG BINDER
ADDITIONAL 5 YEAR SERVICE — \$2.50

Write: IAMFES, Inc.
Box 437, Shelbyville, Ind.

HAYNES SNAP-TITE GASKETS

"FORM-FIT" WIDE FLANGE
HUGS STANDARD BEVEL
SEAT FITTINGS

MOLDED TO
PRECISION STANDARDS



DESIGNED TO
SNAP INTO
FITTINGS

DURABLE
GLOSSY SURFACE

▶ **LOW COST...RE-USABLE**

▶ **LEAK-PREVENTING**

NEOPRENE GASKET for Sanitary Fittings

Check these **SNAP-TITE** Advantages

- | | |
|---|-------------------------------|
| Tight joints, no leaks, no shrinkage | Time-saving, easy to assemble |
| Sanitary, unaffected by heat or fats | Self-centering |
| Non-porous, no seams or crevices | No sticking to fittings |
| Odorless, polished surfaces, easily cleaned | Eliminate line blocks |
| Withstand sterilization | Help overcome line vibrations |
| | Long life, use over and over |

Available for 1", 1½", 2", 2½" and 3" fittings.
Packed 100 to the box. Order through your dairy supply house.

THE HAYNES MANUFACTURING CO.
4180 Lorain Avenue • Cleveland 13, Ohio

A HEAVY DUTY SANITARY LUBRICANT



Available in both
SPRAY AND TUBE

All Lubri-Film ingredients are approved by F.D.A. and can be safely utilized as a lubricant for food processing equipment when used in compliance with an existing food additive regulation.

ESPECIALLY DEVELOPED FOR LUBRICATION OF FOOD
PROCESSING AND PACKAGING EQUIPMENT

For Use in Dairies — Ice Cream Plants — Breweries —
Beverage Plants — Bakeries — Canneries — Packing Plants

SANITARY • NON TOXIC • ODORLESS • TASTELESS

SPRAY — PACKED 6 — 16 OZ. CANS PER CARTON
TUBES — PACKED 12 — 4 OZ. TUBES PER CARTON

THE HAYNES MANUFACTURING CO.
CLEVELAND 13, OHIO

TO HELP YOU TEACH



BETTER COW MILKING AND CLEANER MILK...

Here! . . . Now! . . . and available for your use—a wide variety of booklets, leaflets, bulletins, construction plans, motion pictures and sound-slide films specifically designed and produced to help Dairymen do their jobs better.

Babson Bros. Co., too, has a stake in the future of this dairy business. Good cow milking and increased production of

better and better quality milk are subjects we have employed every skill, technique and medium to promote. This wealth of information material for reference, distribution or program use is available through your local SURGE DEALER . . . or by writing directly to our Chicago Office.

SURGE is a Babson Bros. Co. trademark
© Babson Bros. Co., 1964

BABSON BROS. CO.
2843 WEST 19TH STREET
CHICAGO, ILLINOIS 60623

SURGE