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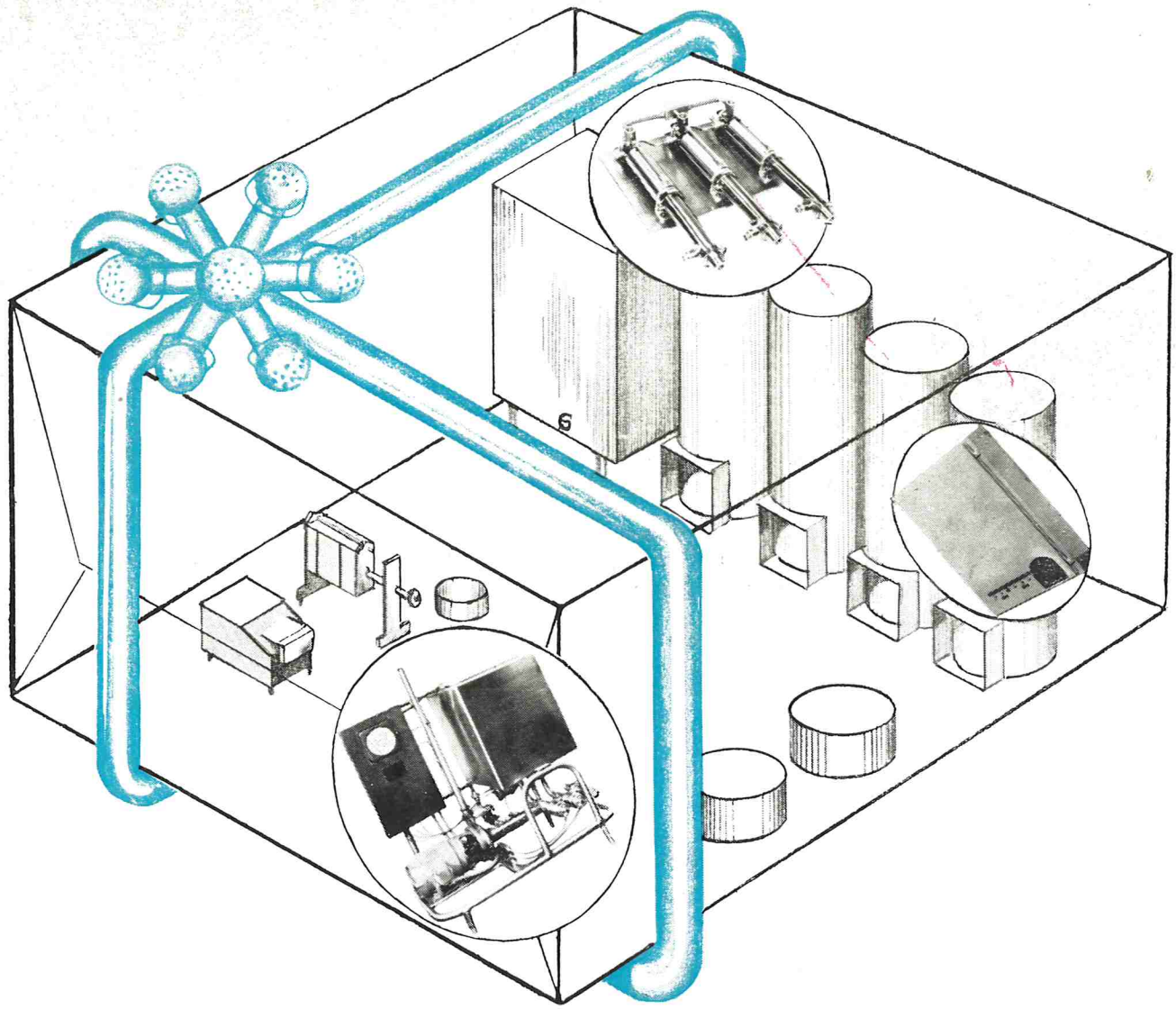

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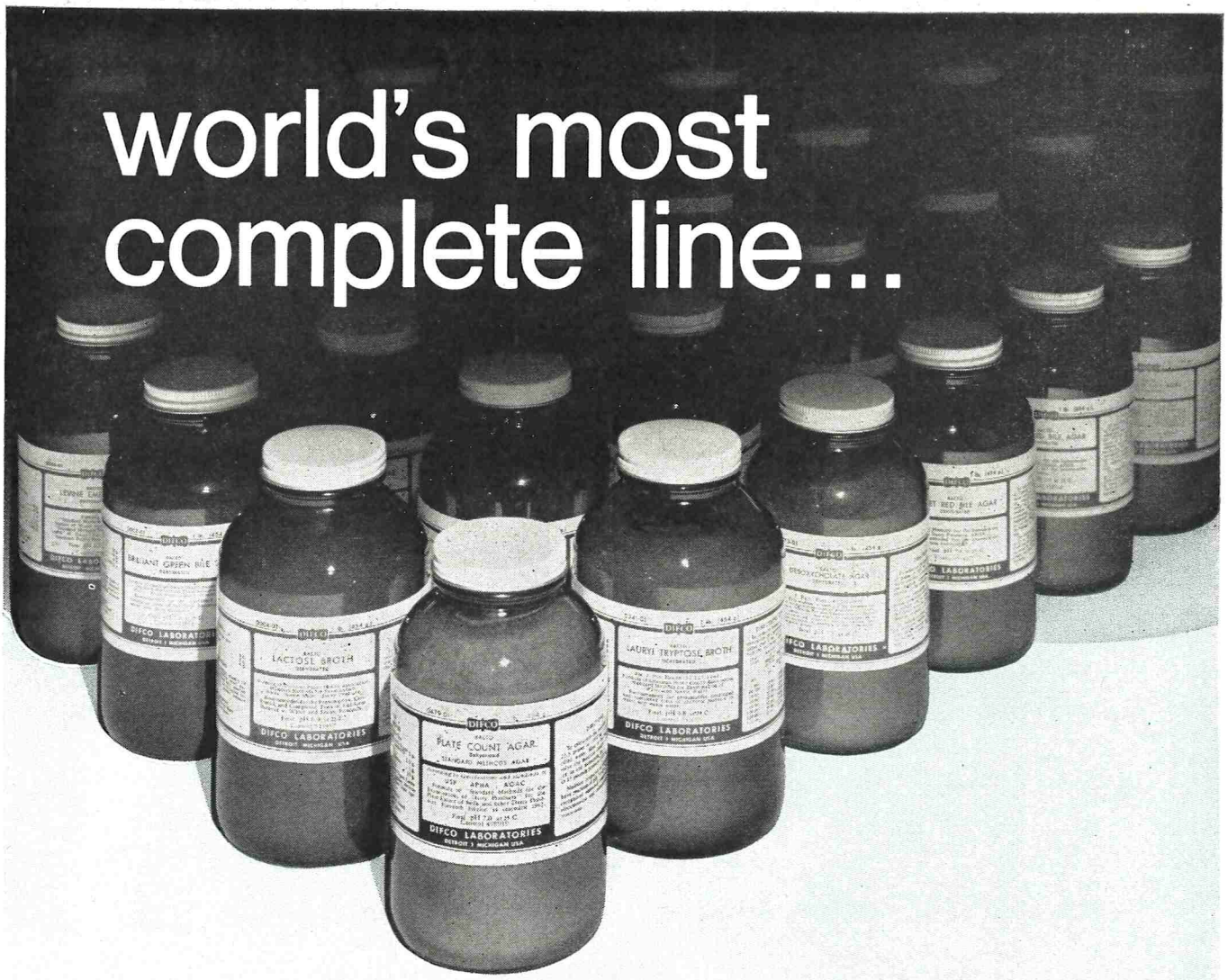

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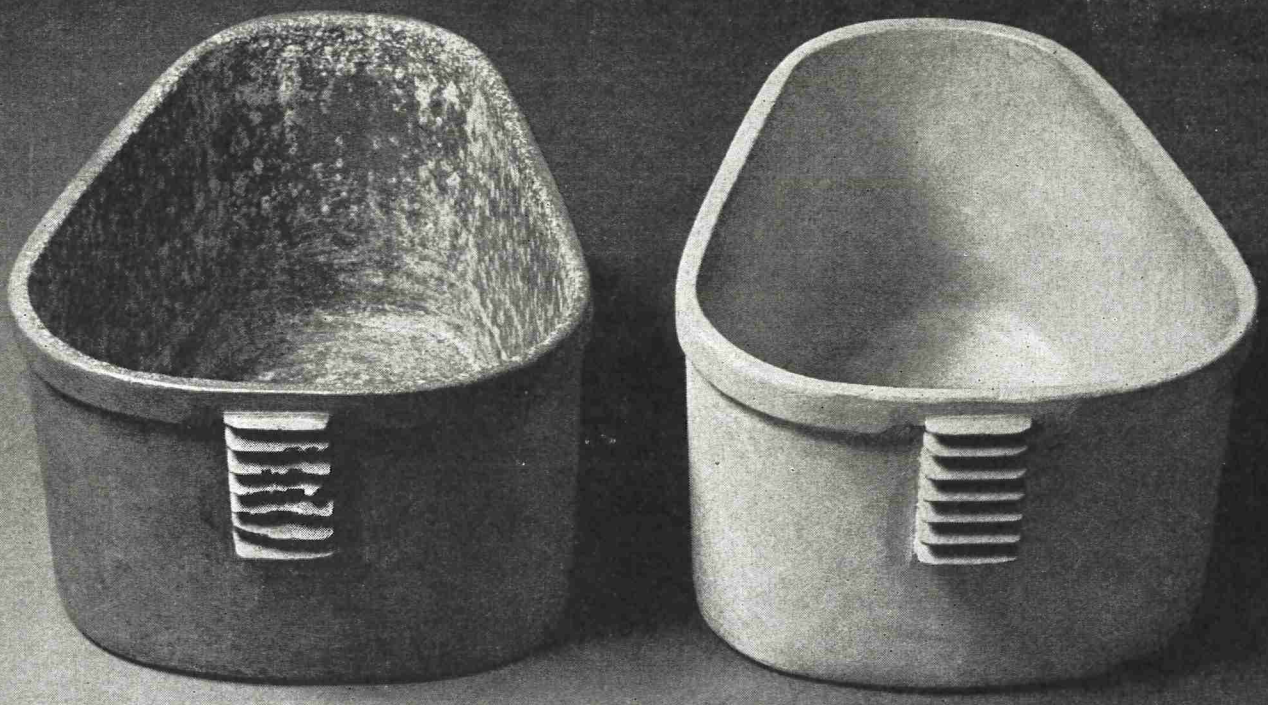

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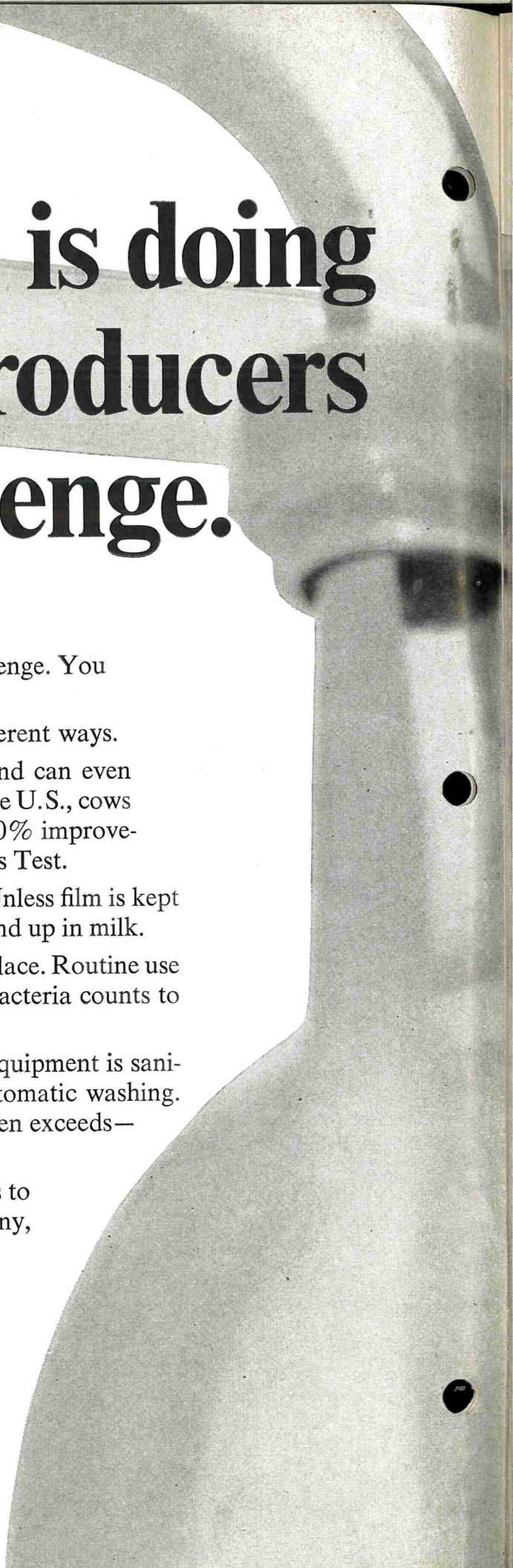

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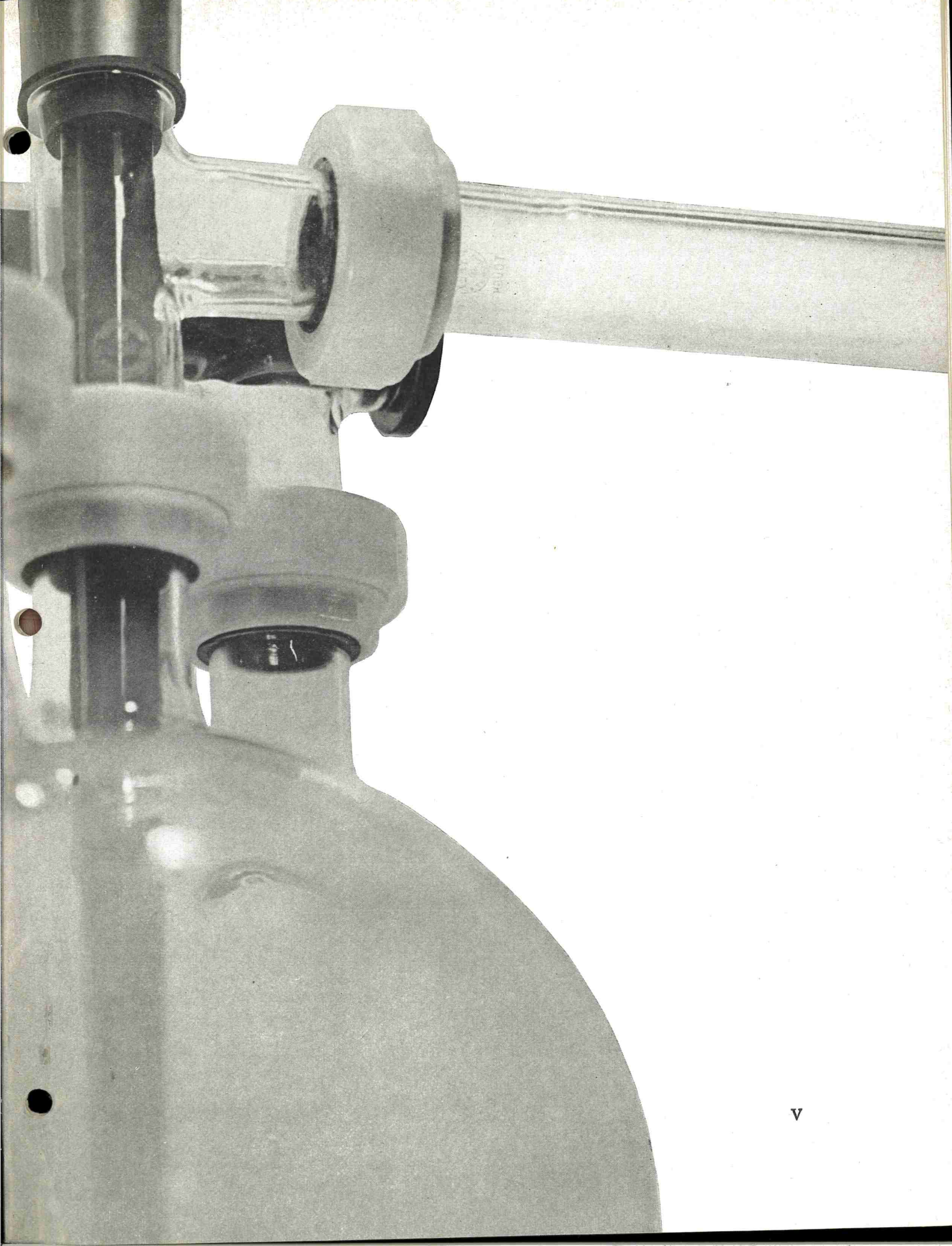

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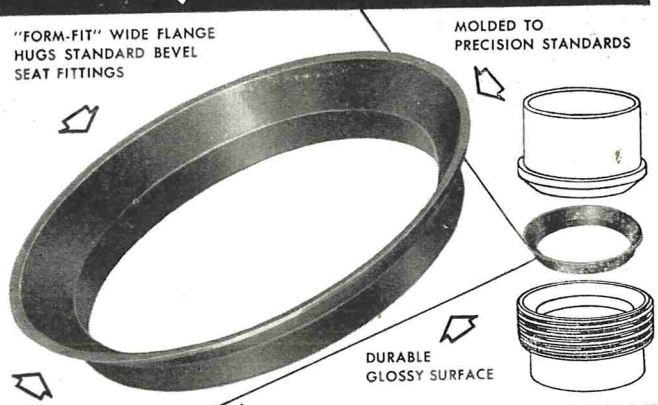

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IMPROVING THE BACTERIOLOGICAL QUALITY OF CHICKEN FRYERS[1, 2]

J. E. KEEL[3] AND C. E. PARMELEE

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(Received for publication July 24, 1968)

ABSTRACT

Two commercial fryer processing operations were investigated to determine the bacteriological quality of the fryers during and after evisceration. Alterations of washing, rinsing, and chilling methods were made to reduce bacterial numbers on skin surfaces of fryers. Swab samples were collected from fryer skin surfaces at various points in the processes and from table surfaces. Total plate counts, psychrophile counts, and coliform counts were determined.

Total plate counts provided the greatest amount of useful information. Coliform counts were not suitable indicators of bacteriological conditions in the evisceration process.

The major sources of bacteria on the skin surface of chilled fryers were the skin of freshly picked fryers and contamination added during the transfer of carcasses from the picker to the evisceration line. Evisceration of the fryers did not add significant numbers of bacteria to the skin surface. Bacteria on the skin of freshly picked fryers were firmly affixed to the surface. They could be removed in increased numbers by combining increased volumes of wash water with the scrubbing action of flexible rubber fingers in the washer.

The bacteriological quality of chicken fryers has been studied by many investigators. Gunderson et al. *(4)* reported lower bacterial counts on poultry eviscerated immediately after dressing, while still warm, than on carcasses eviscerated later. Manual handling of carcasses during evisceration contributed to total bacterial numbers and especially to the numbers of intestinal type bacteria on the skin of fryers.

Drewniak et al. *(2)* studied sanitation methods in poultry processing and reported bacterial counts from the skin of birds at 12 stations on the evisceration line. They concluded that bacterial counts increased where manual handling and manipulation of carcasses or viscera were required and counts decreased during washing operations. The overall effect of the evisceration process was reduction in the total bacterial count of the skin of the fryers.

After investigating the pattern of bacterial contamination of fryers in 13 commercial eviscerating operations, May *(7)* concluded that the variation in bacterial numbers among birds was greater than that of different areas of the skin surface of a single bird. To estimate the true mean bacterial population on the skin surface of fryers within 10%, a sample of at least 10 birds was necessary. In the 13 operations studied, the bacterial count of fryers increased most consistently at the point where carcasses were transferred from the picker to the evisceration line. Lack of hand washing facilities for the worker and laying of carcasses on a table were important factors contributing to the increase in bacterial count. Washing carcasses after evisceration reduced total bacterial counts by 36 to 96% in different plants. May concluded that washing of carcasses was not a substitute for good sanitation during evisceration, and that frequency of hand washing was the primary factor affecting bacterial counts of birds at other stations on the evisceration line.

Fromm *(3)* studied techniques used to quantify bacteria on chicken carcasses and observed that a scrubbing action was needed for effective removal of bacteria from the skin. He found that fat on the skin surface hindered the action of rinse water in removing bacteria.

Kotula *(5)*, using the swab technique, found that bacterial numbers on the thigh of the dressed chicken were consistently larger than the numbers on the breast and leg. He found no difference in aerobic bacterial count from side to side on the same bird and from several birds within a lot as long as the same part of the bird was sampled. Significant differences were found in the counts of birds from different lots and from day to day.

Casale et al. *(1)* found that agitated ice and water significantly reduced the total counts on the skin of fryers chilled by that method when compared with fryers chilled by air or agitated chilled water. Kotula et al. *(6)* found that the use of a counterflow, tumbler type, high agitation continuous chiller significantly reduced total bacterial counts of fryers.

EXPERIMENTAL METHODS

Two commercial poultry evisceration processes, plants A and B, were investigated. Neither plant operated under any form of regular governmental inspection for sanitation or wholesomeness of product. The manager of each plant expressed his willingness to make alterations in the evisceration process during the course of the investigation if the data in-

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[1]Journal Paper No. 3225 of the Purdue Agricultural Experiment Station, Lafayette, Indiana.

[2]Taken from the M. S. Thesis submitted to the faculty of Purdue University by the senior author.

[3]Presently at Fort Lee, Virginia.

dicated that a change would improve the bacteriological quality of the eviscerated fryers from that plant.

In both plants the evisceration process included all steps, subsequent to the picking of birds, which were necessary to produce a ready-to-cook product. The evisceration operation included the following steps: opening the abdominal cavity; removal of abdominal and thoracic viscera; and removal of the head, esophagus, crop, and trachea.

During the second stage of the investigation at plant A, the function of the washer was examined. This unit contained 8 jets directing sprays of water on carcasses as they passed through the unit on a conveyor line. At the same time two revolving drums bearing sets of flexible rubber fingers (FRF) exerted a scrubbing action on the carcasses.

The process in plant B was altered during the second stage of the investigation by installing additional water jets in the spray rinse cabinet, and by adding a counterflow, tumbler type, high agitation continuous chiller.

The sampling sequence for fryers began with carcasses in the chill vats and proceeded backward along the evisceration line to the point at which birds emerged from the picker. This order was chosen so that no bird would be sampled more than once.

Swab samples were collected from the left main pectoral feather tract. This location was chosen for the convenience of the investigators and to allow swabbing of the same area at each sampling station in both plants. Swab samples were taken also from the surface of the transfer table between the picker and the evisceration line conveyor.

A modification of the technique of Ayres et al., 1950, was used in collecting swab samples. Sterile absorbent cotton tipped swabs in sterile plastic tubes[4] were used. Ten milliliters of sterile, phosphate buffered distilled water were added to each swab tube. The tubes were chilled before use. Sterile stainless steel templates were used. A separate template was used to define the area to be swabbed each time. The hole in the template was 3.568 cm in diameter which provided an area of 10 cm^2 for swabbing. The area was swabbed by firmly scrubbing the surface with a moistened cotton swab for 5 sec. After swabbing, the cotton swabs were immediately returned to the tubes containing the buffered water.

Dilution and plating of samples and counting of bacteria were conducted according to *Standard Methods for the Examination of Dairy Products* (1960) with the following exceptions. Total plate counts and psychrophile counts were made with tryptone glucose extract agar. Plates for total plate count were incubated for 72 hr at 21 C and those for the psychrophile count for 10 days at 5 to 6 C.

Samples were plated with violet red bile agar for enumeration of coliform bacteria. Those plates were incubated for either 24 hr at 35 C or 20 hr at 37 C. Colonies were picked from violet red bile agar plates and inoculated into 3 tubes of brilliant green bile broth. When one or more tubes failed to show gas production after incubation for 48 hr at 37 C, the final coliform counts were adjusted accordingly.

A logarithmic transformation was used for all data on total plate counts. A transformation of the natural $\log_{10}(x+100)$ was used for psychrophile and coliform counts.

One way analyses of variance were made on total, psychrophile and coliform counts from the initial stage of the investigation of each plant.

When the analysis of variance indicated significant differences ($P<.05$), a Newman-Kuels Sequential Range Test was applied according to Steel and Torrie *(8)*. The sequential range test identified the sampling stations between which significant differences in bacterial counts existed.

One way analyses of variance of total plate count data were made also to compare the effect of initial and altered rinsing and chilling procedures at plant B.

The washer at plant A presented two variables, water flow rate and FRF action. A two-way analysis of variance was made on the total plate count data from the investigation of that unit. When interaction was found between the action of the FRF and water flow rate, the data were reanalyzed as two separate components to study the effect of water flow rate and FRF action separately. The Newman-Kuels Sequential Range Test was employed to identify the points of significant difference in total plate counts when water flow rate was varied.

RESULTS AND DISCUSSION

In plant A the complete evisceration process resulted in no apparent net final change in average total plate counts. Birds sampled after evisceration in the chill vats had an average total plate count that was not significantly different from that of freshly picked carcasses as shown in Table 1. Significant increases in average total plate counts from surfaces of fryers occurred at two points in the evisceration process, namely: the transfer station and the washer.

The average total plate count of the surface of the transfer table was 5.5×10^6 bacteria per cm^2. The increase in total plate count from fryers passing the transfer station averaged 27,000 bacteria per cm^2. Most of this increase resulted from scald water and fecal material present on the surface of the transfer table where carcasses were piled prior to being placed on the eviscerating line conveyor. Manual handling of carcasses at this point undoubtedly contributed to the spread of contamination. Drainage of the transfer table was inadequate and no handwashing facility was available to the worker at this point.

The average total plate count of the skin of fryers increased by 120,000 per cm^2 as the birds passed through the washer. Investigation of the bacteriological condition of the water and equipment indicated these bacteria were from the skin of the fryers and had been loosened by the scrubbing action of the FRF.

Data collected in a separate study of the washer effect during the second stage of the investigation are given in Table 2. A water flow rate of 500 ml per min per jet accompanied by FRF action represented the initial conditions. During passage through the washer, birds were hung by a two point suspension. The water flow rate per jet was increased in increments of 500 ml per min with the FRF operating and not operating.

Significantly greater numbers of bacteria were re-

[4]No. 2009 Swube by Falcon Plastics Division of B-D Laboratories, 550 W. 83rd Street, Los Angles, California.

TABLE 1. AVERAGE BACTERIAL COUNTS (NO./CM²) OF FRYERS FROM THE EVISCERATION PROCESS, PLANT A[1]

Sampling station	Total plate count	Significance	Psychrophile count	Significance
After picker	5,500	fghij[2]	720	efghi
Placed on shackle, 2 point	32,000	fgh	930	efg
After washer	150,000	abcde	2,500	a
Abdomen incised	240,000	a	2,500	ab
Viscera removed	190,000	ab	2,300	abc
Lungs removed	170,000	abcd	2,000	abcde
Head, trachea esophagus	180,000	abc	2,100	abcd
After spray rinse	36,000	f	900	abcdef
Giblets inserted	28,000	fg	980	efgh
Carcass in chill vat	16,000	fghi	480	efghij

[1]Each bacterial count represents an average of 10 samples.
[2]Average bacterial counts followed by the same letter or letters did not differ from each other at ($P<.05$) after analysis of variance and application of the Newman-Kuels Sequential Range Test.

moved from the carcasses, as evidenced by lower plate counts, when the water flow rate was increased to 1,500 ml per min or more with the FRF in operation.

Lower total plate counts were obtained from fryers passing through the washer when the FRF were not operating. Those counts represented a failure of the washer to loosen bacteria sufficiently to collect them by the swabbing technique used.

The results of this study revealed that bacteria initially present on the skin of freshly dressed fryers were firmly affixed to the surface and could be removed in significantly greater numbers with FRF action accompanied by increased amounts of water to flush away the loosened bacteria and debris.

The evisceration operations caused no significant changes in average total plate counts from fryers. Care in handling of viscera to prevent leakage of intestinal contents and frequent handwashing aided in controlling the contamination of carcasses during removal of viscera in plant A.

An average reduction of 76% in total plate counts was observed after the carcasses passed through the spray rinse chamber. Since no significant numbers of bacteria were added to the carcasses in preceeding steps, many of those washed away during the rinse must have been on the carcass during the entire sequence of operations from placement on the evisceration line conveyor. This suggests that the first washing step was not as efficient initially as it could have been.

The average total plate count did not change significantly during removal of the neck and insertion of the giblet package. No handling of the carcasses was required for those operations.

The average total plate count decreased significantly after carcasses were dropped into the chill vats. Some of this decrease resulted from continued drainage of rinse water after the spray rinse chamber. Most of the decrease appeared to result from washing action by the ice and water chilling mixture. The fact that such washing action could reduce the total plate count further indicated the inadequacy of the earlier washing and rinsing.

Psychrophile counts from skin surfaces of fryers at plant A followed the same general pattern of increases and decreases as the average total plate counts. The significant increase in the average psychrophile count during passage of the fryers through the washer coupled with the lack of any significant increase during the transfer operation from the picker to the evisceration line indicated that psychrophilic organisms were firmly affixed to the skin of fryers. No appreciable increase in the average psychrophile count on the skin of fryers occurred during the piling of birds on the transfer table despite the fact that

TABLE 2. TOTAL PLATE COUNTS (NO./CM²) OF FRYERS FROM THE WASHER WHEN WATER FLOW RATE AND FLEXIBLE RUBBER FINGER (FRF) ACTION WERE VARIED, PLANT A

FRF operation	Water flow rate (ml/min/jet) 0	500	1000	1500	2000
On	190,000	120,000	92,000	10,000	8,100
On	190,000	85,000	39,000	10,000	5,000
On	140,000	38,000	61,000	9,100	10,000
On	210,000	79,000	73,000	13,000	12,000
On	160,000	61,000	37,000	17,000	14,000
Off	72,000	71,000	1,200	1,300	2,500
Off	29,000	18,000	1,500	1,000	2,700
Off	93,000	44,000	3,100	6,900	7,800
Off	87,000	55,000	5,800	5,600	2,400
Off	67,000	34,000	3,500	1,100	4,900

the average psychrophile count from that table surface was significantly higher than psychrophile counts from the skin of freshly dressed fryers. The count from the table surface averaged 9,900 psychrophiles per cm² compared with 720 per cm² from the freshly dressed birds. The average psychrophile count of the skin of fryers was not changed by any step in the evisceration operation.

A significant decrease in average psychrophile count from skin surfaces was observed after the final rinse and dropping of carcasses into the chill vats. Most of this decrease was caused by the spray rinse. Many of the organisms removed by the spray rinse had been loosened by the FRF action in the washer. Although the average psychrophile count of fryers in the chill vats was not significantly different from that of freshly picked birds, a net decrease in actual numbers must have occurred. The numbers of psychrophiles remaining on the carcasses in the chill vats was sufficient to affect the storage life of those carcasses.

Coliform counts were not suitable indicators of bacteriological conditions in the evisceration process. The numbers of coliforms isolated from fryers at various points in the evisceration process varied between 0 and 500 per cm². The wide variation in numbers of coliforms among birds made impossible the detection of any significant changes in coliform counts caused by evisceration procedures at plant A.

TABLE 3. AVERAGE BACTERIAL COUNTS (NO./CM²) OF FRYERS FROM THE EVISCERATION PROCESS, PLANT B[1]

Sampling station	Total plate count	Significance	Psychrophile count	Significance
After picker	8,800	gh[2]	84	i
Placed on shackle, 3 point	37,000	adcdef	380	abcd
Oil gland off	88,000	a	520	a
Abdomen incised	41,000	abc	500	ab
Viscera removed	36,000	abcde	410	abc
Lungs removed	51,000	ab	380	abcde
Head, trachea, esophagus removed	29,000	abcdefg	260	abcdefg
Legs off	39,000	abcd	310	abcdef
After spray rinse	6,400	hi	250	abcdefgh
Carcass in chill vat	2,800	j	57	ij

[1]Each bacterial count represents an average of 9 samples.
[2]Average bacterial counts followed by the same letter or letters did not differ from each other at ($P<.05$) after analysis of variance and application of the Newman-Kuels Sequential Range Test.

TABLE 4. TOTAL PLATE COUNTS OF FRYERS (NO./CM²) AFTER 2 DIFFERENT SPRAY RINSE TREATMENTS

Type of rinse	Total plate count of fryers (9 replications)					Average total plate count
4 spray jets	1,200	13,000	8,700	5,100	5,200	
	4,500	9,200	4,500	7,100		6,400
10 spray jets	2,500	4,400	3,700	2,800	2,500	
	4,200	2,900	1,900	3,700		3,200

TABLE 5. TOTAL PLATE COUNTS (NO./CM²) OF FRYERS AFTER 2 DIFFERENT CHILLING METHODS

Type of chiller	Total plate count of fryers (9 replications)					Average total plate count
Ice-water slush, no agitation	4,300	6,300	1,500	2,400	3,800	
	2,100	2,000	1,500	1,100		2,800
Counterflow, tumbler type	1,100	1,900	2,100	1,300	1,700	
	1,500	1,800	1,200	1,400		1,600

The average total plate counts from fryers at plant B were lower at every sampling station that the corresponding values at plant A except for freshly picked birds. The data are presented in Table 3. The reason for the lower values at plant B appeared to be the lack of a washer placed near the beginning of the evisceration line. With no washing and scrubbing action on the skin of the fryers, loosening of firmly affixed bacteria from the skin did not occur. In plant A, an average of 3×10^5 bacteria per cm² were loosened from the skin by washing and scrubbing. This many bacteria, if left on the surface would have an effect on the keeping quality of the finished product.

The transfer station in plant B was arranged in the same manner as that in plant A. A similar significant increase in average total plate count from the skin of fryers was observed as they passed this point.

Two significant decreases in average total plate counts were observed in fryers in plant B, after the spray rinse and after dropping of carcasses into the chill vats. The average total plate count on carcasses from chill vats was significantly lower than the count from freshly picked birds. Thus, the evisceration process appeared to result in a net reduction

in average total plate count. All of the bacteria added to the surface of the carcasses during the transfer operation and subsequent operation plus some of the original population from the freshly dressed birds appeared to have been removed. Additional bacteria might have been removed had there been equipment available for the washing and scrubbing of carcasses.

None of the changes in average total plate count associated with the evisceration operations was significant.

The average psychrophile count of fryers at plant B was increased significantly by the transfer operation. Most of the decrease in average psychrophile count occurred after dropping carcasses into chill vats. The average psychrophile count of fryers in chill vats was not significantly different from that of freshly dressed birds.

Data from both plants indicated that the major source of psychrophile organisms on eviscerated fryers was the freshly dressed birds. Psychrophiles equivalent to those added to the carcass during the evisceration process were removed by rinsing and placing the carcasses in chill vats. Additional psychrophiles could be removed from carcasses by washing and scrubbing, indicating that the organisms were present on carcasses as firmly affixed contaminants.

Coliform counts from the evisceration process at plant B were no more suitable as indicators of bacterial contamination of fryers than at plant A because of the wide variation in numbers among birds.

The spray rinse chamber of plant B was altered by installing 6 additional water jets. Data on total plate counts from fryers rinsed in the altered unit were compared with corresponding data from the initial process. The data are presented in Table 4. The average total plate count from fryers rinsed by the altered unit decreased by 50%. This suggests the usefulness of additional rinse water in reducing the total plate count from skin surfaces.

A comparison of average total plate counts of fryers chilled by immersion in ice-water slush with those chilled in a counterflow, tumbler type, high agitation continuous chiller, revealed a decrease in total plate counts from the fryers chilled by the latter method. The data appear in Table 5. Some washing action appeared to take place.

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NEW MICHIGAN FOOD SERVICE SANITATION LAW

An act passed by the 1968 Michigan Legislature provides for a coordinated state health department–local health department licensing and inspection program for all food service establishments, temporary food service establishments and vending machines dispensing perishable foods and beverages in the State.

This act, No. 269, P.A. of 1968, was supported by both industry and public health interests. Both the U. S. Public Health Service Food Service Sanitation Ordinance and Code and the U. S. Public Health Service Vending Ordinance and Code were adopted by reference.

The Michigan Department of Public Health has set up a new Section of Food Service Sanitation within the Division of Engineering to carry out its responsibilities as provided for by the Act. Robert R. Dalton, who has been employed by the Michigan Department of Public Health since July 1, 1954, has been designated Chief of the Section. Mr. Dalton was employed by the Minnesota Department of Health for several years before moving to Michigan.

STORAGE STABILITY OF COMMERCIAL MILK[1]

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Abstract

Storage of fluid milk for extended times at low temperature appears feasible. The extended shelf life is long enough to allow a 100-fold decay of Iodine-131 under emergency conditions. This theoretical decay period may be 4 to 8 weeks depending on degree of contamination and extent of depositions on pasturage.

Commercially produced summer milk stored at 32 F, averaged 4.4 weeks or 5 times its life at 45 F. Summer milks possessed twice the shelf life of winter milks.

Shelf life was materially affected by pasteurization temperature, storage temperature, and season as determined by taste panel and bacteriological tests. Marked increases in shelf life were observed with reduced storage temperatures. Criteria for product acceptability were flavor score (35.0 or higher), total plate count, and psychrophilic plate count (less than 1 million per ml).

UHT processing at 200 to 220 F for 0.5 to 16 sec yielded as much as 20 weeks acceptable shelf life at 32 F. A combination of UHT pasteurization, 32 F storage to the end of microbial lag phase, and repasteurization followed by refrigerated holding extended storage life to as much as 23 weeks, depending on storage temperature.

The contamination of pastures and feedstuffs by radioactive fallout with consequent contamination of milk is a serious problem that has received much attention by the Atomic Energy Commission, U. S. Public Health Service, U. S. Department of Agriculture and the general public. Iodine-131, one of the important radionuclides that may occur in significant amounts in milk, is known to concentrate in the thyroid gland, thus posing a serious threat to human health. Currently, radioactive fallout does not constitute a serious threat to human health; however, in the event of an accident or emergency, sufficient information and means should be available for safeguarding our milk supply.

To reduce exposure to Iodine-131, the Federal Radiation Council *(6)* has recommended removal of dairy cattle from contaminated pastures and the diversion of contaminated milk to processed dairy products that permit storage.

The relatively short decay period (half life = 8 days) for radioactive Iodine-131 suggests the possibility of process and storage modifications for market milk which would extend storage life sufficiently long to render it safe for use. The safe storage time would depend on the severity of the situation, i.e., the degree of contamination and the extent of depositions on pasturage. Theoretically the radioactive Iodine content would be reduced to 1/16 its original activity after 32 days storage. Russell *(14)* has reported that two months of storage would result in a reduction factor greater than 100. It can then be deduced that storage of milk for 4 to 5 weeks after a single Iodine-131 emmission probably would result in milk with a safe Iodine-131 level.

The storage stability from present pasteurizing and storage procedures strongly indicates that fluid milk might be processed and stored to maintain flavor stability for several weeks; however, practical information is lacking concerning the necessary conditions. Storage temperature is known to materially affect the keeping quality of milk. Over the years numerous reports have appeared in the literature on the keeping quality of milk and the effects of pasteurization on the bacterial flora. Considerable investigative effort has dealt with retail distribution and household storage and their effects on keeping quality *(2, 4, 7, 8, 9, 11, 13)*. Many of the early studies on keeping quality dealt with milk which was pasteurized at minimum temperatures, non-homogenized, and subsequently stored at 40 F. More recently the trend has been toward higher pasteurizing temperatures and somewhat lower storage temperature. The effects of storage below 40 F have been less conclusively evaluated. Sherman et al. *(15)* reported keeping

[1]The study was carried out under contract with the Agricultural Research Service, U. S. Department of Agriculture, administered by the Eastern Utilization Research and Development Division, Washington, D. C. 20250.

quality of 8 and sometimes 12 weeks for milks stored at 0 C. Boyd and coworkers *(3)* observed good flavor retention up to 42 days in milk stored at 33 F. Ashton *(2)* used strict hygienic precautions in pasteurized milk production and during storage at 36 to 38 F. Maximum keeping quality ranged from 9 to 170 days.

Undoubtedly, the advent of ultra high temperature pasteurization (UHT) has increased the capability for prolonging the keeping quality of milk. Evans et al. *(5)* reported that milk processed at 220 F for 0.6 sec hold retained bacteriological quality for 4 weeks at 40 F. Milk pasteurized at 250 to 260 F stored satisfactorily for 8 weeks at 40 F. Speck *(16)* advised that one company, using 220 F for 1 to 2 sec hold, experienced faster spoilage than when 195 F had been used. Olson *(12)* has stated bacterial types were more important than numbers in determing shelf life.

The present study was undertaken to determine whether flavor and bacterial acceptability of commercial milks or specially processed milk could be maintained long enough for Iodine-131 to decay to a safe level. It was anticipated that the study would provide the dairy industry with a standby procedure that could be used in the event of radioactive contamination of pasturage. In addition, it should provide vital information relating to the storage stability of present-day commercial fluid milk.

EXPERIMENTAL PROCEDURE

Commercial milks

Commercial HTST pasteurized milk samples were secured from 6 bottling plants in six different states in the south-southeast during the summer of 1966 and again in January of 1967. HTST pasteurizing equipment included plate-vacuum and plate, steam injection, and vacuum units. Pint samples were taken directly from the paper bottle filler in each plant and immediately immersed in ice and salt until cooled to 32 F. The time required for cooling ranged from 50 to 90 min. When milk temperature, as determined by a thermistor probe inserted in a typical package reached 32 F, samples were surrounded by crushed ice in styrofoam packers for air transport to Greenville, Illinois for storage and analysis.

In-transmit time did not exceed 12 hr and temperature rise in milk samples did not exceed 0.5 F. Individual plant milk lots were divided on arrival into 4 sub-lots of 27 packages each for storage at 32, 35, 40, and 45 F. and storage temperatures were controlled to ± 1 F.

Standard plate counts (SPC) were made at each plant on the raw and pasteurized milk. Standard plate and psychrophilic counts (PPC) and flavor evaluations were made 24 hr after pick-up to establish "zero" time data for the storage samples. At weekly or more frequent intervals, duplicate samples from each plant and storage condition were examined for total and psychrophilic counts and flavor score. All bacteriological work was performed according to *Standard Methods for the Examination of Dairy Products,* 11th Edition *(1).* Standard plates were incubated 48 hr at 32 C while psychrophilic plates were held for 7 to 10 days at 5 to 7 C before counting.

Flavor scoring followed the ADSA score card, described by Nelson and Trout *(10),* as to numerical rating and criticism. No less than three trained flavor panelists judged each group of samples. Milk quality was considered unacceptable and analyses were discontinued when two successive stored samples showed either a bacterial count of 1 million/ml or a flavor score of less than 35.

UHT milk

UHT pasteurized milks for storage tests were processed in pilot-plant facilities at the Research and Development Division of Pet Incorporated, Greenville, Illinois. Processing equipment consisted of a modified De Laval Vacu-Therm* HTST pasteurizing system. The modification comprised installation of a spiral coil, high-velocity heater with interchangeable 0.5 and 16 sec holder tubes and an accessory high pressure pump. These units followed the heater section of the plate unit and discharged directly into the second vacuum chamber.

The system was sanitized by circulating hot water until all product contact surfaces were heated to 160 to 170 F. Thereafter 50 ppm of iodine sanitizer was added to the water and circulated 10 to 15 min. Sanitizer residue was exhausted while the system was being adjusted to the most rigorous time-temperature conditions.

Processing times and temperatures were employed in the following order: 220 F–16 sec, 200 F–16 sec, 220 F 0.5 sec, 210 F–0.5 sec.

One lot of Grade A milk was used for all conditions. Sanitizer residue was flushed with the first milk through the system and discarded.

Samples were collected in sterile 0.5–pint glass bottles from the process line partially protected from air contamination by a plastic enclosure. Process conditions were reduced to progressively less rigorous times and temperatures until samples had been collected for each of the four conditions. These lots were examined immediately for total and psychrophilic counts and flavor. They were divided into 4 sub-lots for storage at 32, 35, 40, and 45 F. Subsequent examinations of stored samples followed the plan previously outlined for the commercial samples. A total of two complete trials each comprising all four process conditions were made using summer milk and then winter milk.

Reprocessed milk

The effects of repasteurizing bulk stored milks on storage stability were determined in pilot plant facilities. Frequent plate counts indicated that the bacterial lag phase ended after 24 days at 32 F. Following the 24 day bulk storage period, milks originally processed at 220 F–16 sec, and 200 F –16 sec, were divided and each lot reprocessed at 220 F–16 sec and 175 F–16 sec. Samples of each reprocessed milk were collected in sterile 0.5–pint glass bottles for storage at 45, 40, 35 and 32 F. Analyses for total count, psychrophilic count and flavor score were made initially and at weekly intervals until samples were exhausted or exceeded criteria limits.

*Mention of brand or firm names does not constitute an endorsement by the Department of Agriculture over others of a similar nature not mentioned.

TABLE 1. RELATIONSHIP OF SEASON, PASTEURIZING CONDITIONS AND STORAGE TEMPERATURE TO STORAGE STABILITY OF COMMERCIAL MILK

Plant	Pasteurization Temp.	Pasteurization Time	Storage Life (weeks[1]) 32 F Summer	32 F Winter	35 F Summer	35 F Winter	40 F Summer	40 F Winter	45 F Summer	45 F Winter
A	169 F	16 sec	4[2]		2		2		<1	
	172 F	16 sec		4		1-3		2-3		<1
B	170 F	16 sec	4		3		2		<1	
	169.5 F	16 sec		3		2-3		2-4		<1
C	169 F	16 sec	4		3		2		<1	
	170 F	16 sec		3-5		3		1-3		1-2
D	170 F	16 sec	<1		3		3		<1-2	
	170.5 F	16 sec		1		1		1		<1
E	171 F	16 sec	7		4		2		1	
	172 F	16 sec		3		1		1		<1
F	172 F	16 sec	7		6		1-3		1	
	170 F	16 sec		1-3		1-3		1-2		<1-2
G[3]	165 F	17 sec		4		3-5		3-4		1-2
(Mean)			(4.42)	(2.83)	(3.5)	(1.92)	(2.17)	(1.83)	(0.79)	(0.79)
Std. Dev.			2.30	1.27	1.31	1.00	0.53	1.03	0.45	0.58

[1]Acceptability determined by flavor score 35.0 or higher and SPC and PPC less than 1,000,000/ml.

[2]Single number shows duplicate samples had same stability, whereas range shows difference in stability of duplicates. Value of 0.5 week assigned to <1 to permit statistical analysis.

[3]G—Plant sampled in winter only, thus not included in statistical analysis.

TABLE 2. COMPARISON OF STORAGE STABILITY CRITERIA IN EVALUATING EFFECTS OF STORAGE TEMPERATURE AND SEASON ON STABILITY OF COMMERCIAL MILK

Storage Temp.	Stability Criteria[1]	Winter Weeks Range	Winter Weeks Mean	Summer Weeks Range	Summer Weeks Mean
32 F	PPC	1-3	2.07	2-9	4.09
	SPC	1-4	2.36	2-9	4.64
	Flavor	3-5	3.36	<1-7[2]	4.42
35 F	PPC	1-3	1.36	2-5	3.17
	SPC	1-5	2.00	2-5	3.25
	Flavor	1-4	2.57	2-6	3.50
40 F	PPC	1-4	1.57	1-3	1.83
	SPC	1-4	1.71	1-3	1.83
	Flavor	1-4	2.21	2-3	2.08
45 F	PPC	<1-2	0.75	<1-1	0.75
	SPC	<1-2	0.86	<1-1	0.67
	Flavor	<1-2	1.00	<1-1	0.92

[1]Acceptability determined by flavor score 35.0 or higher and SPC and PPC less than 1,000,000/ml.

[2]Value 0.5 week was arbitrarily assigned to <1 to facilitate calculations.

TABLE 3. RELATIONSHIP OF INITIAL COUNTS, PASTEURIZING CONDITIONS AND STORAGE TEMPERATURES TO STORAGE LIFE OF UHT PASTEURIZED MILK

Milk Lot	Raw SPC/ml.	Raw PPC/ml.	Pasteurization Condition	Bacteria SPC/ml.	Bacteria PPC/ml.	Storage Life-Weeks[1] 32 F	35 F	40 F	45 F
A	150,000	3,200	220 F-16 sec	<30 (22)	<30	13+	13+	9+	3
			200 F-16 sec	120	<30	7	4	3	1
			220 F-0.5 sec	110	<30	10	6	4	1
			210 F-0.5 sec	130	<30	9	4	3	1
E	87,000	4,700	220 F-16 sec	80	<30	13+	13+	11+	4+
			200 F-16 sec	100	<30	8	5	5	1
			220 F-0.5 sec	130	<30	12+	4	4	1
			210 F-0.5 sec	120	<30	6	6	4	1
I	14,000	7,600	220 F-16 sec	120	<30	15	14	7	3
			200 F-16 sec	130	<30	10	7	4	2
			220 F-0.5 sec	120	<30	13	7	4	2
			210 F-0.5 sec	140	<30	11	3	3	2
M	35,000	1,600	220 F-16 sec	<30 (9)	<30	20[2]	20[2]	20[2]	18[2]
			200 F-16 sec	32	<30	12	7	6	4
			220 F-0.5 sec	39	<30	12	10	6	5
			210 F-0.5 sec	31	<30	10	7	5	4

[1]Acceptability determined by flavor score 35.0 or higher and SPC and PPC less than 1,000,000/ml.

[2]Storage samples exhausted.

TABLE 4. EVALUATION OF BULK STORAGE AND RE-PROCESSING OF PASTEURIZED MILK

Initial Process	Storage Time Before Re-Past. Days @ 32 F	Bact. Pop./ml. Before Re-Past. SPC	Bact. Pop./ml. Before Re-Past. PPC	Re-Past. Conditions	Bact. Pop./ml. After Re-Past. SPC	Bact. Pop./ml. After Re-Past. PPC	Storage Stab.[1] Temp. F	Storage Stab.[1] Weeks
11-1 220 F-16 sec	24	10,000	17,000	220 F-16 sec	39	<30	45	14+
							40	19+
							35	23+
							32	23+
11-2 220 F-16 sec	24	10,000	17,000	175 F-16 sec	99	<30	45	10
							40	16+
							35	21+
							32	22+
JJ-1 200 F-16 sec	24	360,000	970,000	220 F-16 sec	77	<30	45	15+
							40	17+
							35	23+
							32	23+
JJ--2 200 F-16 sec	24	360,000	970,000	175 F-16 sec	120	<30	45	5
							40	10
							35	10
							32	19

[1]Acceptability determined by flavor score 35.0 or higher and SPC and PPC less than 1,000,000/ml.

RESULTS AND DISCUSSION

The influence of storage temperature on the keeping quality of commercial pasteurized milk is illustrated in Table 1. At 32 F, 81% of the samples were judged acceptable for 3 weeks or longer while 57% kept for 4 or more weeks. Only 15% of the samples stored at 45 F were satisfactory for more than one week.

Summer milk exhibited significantly longer storage stability than winter milk in most instances. These seasonal differences were more pronounced at 32 and 35 F than at 40 and 45 F as evidenced both by individual and by mean storage values.

Analysis of variance revealed highly significant variations at the 99% confidence level for season and storage temperature, when using average values for stability of duplicate samples.

Variations in pasteurizing temperatures from 169 to 172 F did not affect shelf life appreciably.

A further illustration of the effect of season and storage temperature on storage stability is shown in Table 2. The storage data for all commercial milk samples are grouped as to storage temperature and season. The stability evaluation criteria, flavor, SPC, and PPC are compared in each group and generally show good agreement.

PPC was the most stringent criterion of storage life, while SPC reflected somewhat longer keeping quality. Flavor remained acceptable longest.

During the course of storage some packages became soft and were suspected of moisture wicking. To eliminate this factor as a variable, special moisture resistant, foil and polyethylene laminated packages were used to obtain additional samples from each plant during the winter phase of collection. No significant difference was noted between the two types of cartons with respect to storage stability.

The effects of storage temperature on stability of fluid milk was much more dramatic with UHT processing.

The relationships of initial bacterial populations, pasteurizing conditions, and storage temperatures to storage stability of UHT processed milk are shown in Table 3. Neither raw nor pasteurized SPC and PPC data were indicative of the ultimate storage stability. Increasing the intensity of the pasteurizing conditions materially increased storage stability. The maximum exposure of 220 –16 sec hold resulted in substantially longer storage life than obtainable from other processing conditions.

A comparison in Fig. 1 of mean storage life of UHT milk reveals the significance of process conditions and storage temperature. The beneficial effect of reducing storage temperature to prolong storage stability is shown by the curves for the lower process conditions. The curve for 220 F–16 sec is not a true representation of storage life because samples were exhausted before shelf life could be determined. Storage stability appeared to vary inversely with the storage temperature. The increase in storage stability is non-linear in that it was greater between 35 and 32 F than between 45 and 35 F.

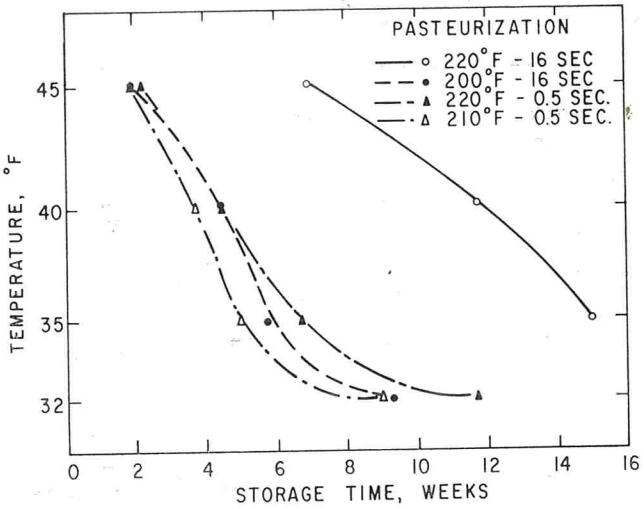

Figure 1. Storage life of UHT milk as influenced by pasteurizing temperature and time and storage temperature.

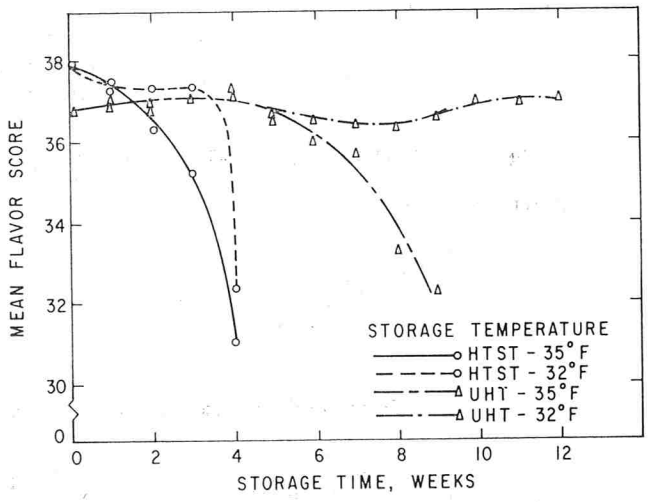

Figure 2. Comparison of HTST and UHT pasteurization as they affect flavor score and storage time.

The main flavor effects recorded for UHT samples were "cooked" during the early weeks and "stale" in the later weeks.

A comparison of mean flavor scores for commercial and UHT pasteurized milk is shown in Fig. 2. Initially, HTST pasteurized milks resulted in higher flavor score than UHT. Depending on storage temperature, the commercial milk flavor scores dropped rather rapidly, falling below 35.0 in 1 to 4 weeks. By contrast UHT flavor score was slightly lower initially, increased to a maximum of 37.5 in 4 weeks,

and remained at the 36 to 37.5 range during 12 weeks of 32 F storage and 7 weeks at 35 F.

Storage of conventional packaged milk to allow for Iodine-131 decay poses problems of package leakage, refrigeration failures, and vast refrigerated space requirements. A partial solution would be UHT pasteurization followed by bulk storage in large refrigerated tanks. With this process, milk would be held after pasteurization until initiation of the bacterial logarithmic growth phase was detected, after which it would be repasteurized, packaged, and stored under refrigeration.

Representative data for reprocessed bulk stored milks are shown in Table 4. Storage stability was longer for those milk lots receiving the most intense heat treatment.

Except for the lowest pasteurizing conditions, storage stability exceeded the number of stored samples in every instance, totaling as high as 23 weeks for several conditions.

Flavor evaluations did not indicate that repasteurization intensified cooked flavor. Staleness was the major flavor defect after 12 to 15 weeks storage.

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NATIONAL SURVEY OF SOLID WASTES PRACTICES

A Federal official has estimated that it will take an additional 750 million dollars per year over the next five years to provide Americans with satisfactory collection and disposal of household refuse, garbage, and other solid wastes.

These services already are costing the public more than 4.5 billion a year, said Richard D. Vaughan, Chief of the Solid Wastes Program, Environmental Control Administration, Department of Health, Education, and Welfare.

These figures were among the preliminary results of a national survey of solid waste practices, announced by Mr. Vaughan at the 1968 Annual Meeting of the Institute for Solid Wastes of the American Public Works Association in Miami Beach, Florida.

The survey, for the first time, provides an accurate look at the cost and adequacy of solid waste handling and disposal in the United States. This service is one of the largest items on the budget of any U. S. city.

Mr. Vaughan listed the additional funds needed anually for improved solid wastes handling and disposal as follows: to upgrade collection systems, 550 million; to increase incinerator capacity, 45 million; to upgrade land disposal operations 60 million. In addition over 100 million will be required each year for five years to cover open dumps or convert them to sanitary landfills.

The most common solid waste disposal practice, Mr. Vaughan said, is the open burning dump. This method, he said, is unacceptable, since it contributes to air, ground, and water pollution. Other information gained from the new solid wastes survey, cited by Mr. Vaughan, included:

The fact that 180 million tons of solid wastes are being collected by municipal and private agencies annually, while a total of 360 million tons of household, commercial and industrial solid wastes are being generated annually in this country. In addition 2 billion tons per year of agricultural solid wastes and 1 billion tons per year of mineral solid wastes must be added to the household, commercial and industrial total. 94% of land disposal operations are unsatisfactory. 75% of incinerator facilities are inadequate.

The national solid wastes survey was developed by the staff of the Federal Solid Wastes Program in cooperation with state officials.

BACTERIAL TEST RESULTS OF GRADE-A RAW MILK SAMPLES AS A MEASURE OF FARM PRODUCTION CONDITIONS[1]

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Abstract

Milk from 30 grade-A farms was subjected to bacteriological tests including the Standard Plate, total, coliform, psychrophilic, thermoduric, and enterococcus count, resazurin reduction time, and leucocyte count to determine the correlation between these tests and farm production conditions. Farm conditions were evaluated at sample collection time by a farm score, which was based mainly on sanitation.

After collection and immediate transportation to the laboratory, half of each sample was stored at 3.3 C for 72 hr, the remainder was preincubated at 12.8 C for 18 hr after storage at 3.3 C for 54 hr; determinations were then performed. The leucocyte count was determined on the fresh sample.

The psychrophilic count was the only bacterial test that showed significant correlation with the farm score. For samples stored at 3.3 C for 72 hr, all comparisons among bacterial counts showed significant correlation except: psychrophilic count vs. resazurin reduction time; coliform count vs. resazurin reduction time; and, coliform count vs. enterococcus count. For preincubated samples, all comparisons among bacterial counts showed significant correlation except: psychrophilic count vs. resazurin reduction time; coliform count vs. resazurin reduction time; and, coliform count vs. thermoduric count. Higher correlations were obtained on the preincubated samples for all bacterial tests except the thermoduric count. Within this experimental design, preliminary incubation did not improve the ability of the bacterial tests to show statistically significant correlation with the farm score. The leucocyte count showed significant correlation with the farm score, but not with the bacterial test results.

Evaluation of data shows that the bacterial test results are not highly correlated with farm production conditions as measured by farm score. Milking-time inspections are necessary to assure that recommended practices are used in grade-A milk production.

In view of the changes in the production of grade-A milk during the last 10 to 15 years, it is necessary to evaluate testing methods and determine how closely they correlate with farm-production conditions. Dilution of microorganisms, resulting from increased milk production per farm, and modern refrigeration systems have limited the reliability of the Standard Plate Count. Present methods of bacterial testing, with lenient maximum limits and frequent lack of milking-time inspections, may permit many undesirable sanitary violations to go undetected.

Emphasis on esthetically acceptable production conditions makes it mandatory to check on production practices. Milking-time inspections provide an ideal method because they can serve an educational as well as a regulatory purpose. Also, they detect undesirable practices that otherwise might go unnoticed. Since only a few milking-time inspections are made, it would be desirable to designate a species or group of microorganisms to serve as a sanitary indicator that could supplement farm inspection, but no such indicator organism has yet been recognized.

Much past work has attempted to correlate results of bacterial tests with each other by using samples of unknown history without regard to age and previous storage temperature. Often, production conditions were not known. Consequently, the significance of a count could not be ascertained. In this study, there was complete control over the sample beginning at the farm. The senior author, a former fieldman, inspected the farms at milking time, collected the samples, and analyzed them personally. During his visits, scores were also assigned for production conditions. After analysis, the results of seven bacterial tests and the leucocyte count were correlated with the farm inspection score to determine the ability of each to evaluate production conditions. The results of the bacterial tests and the leucocyte count were also correlated.

Methods

Milk produced on 30 grade-A dairy farms located within 50 miles of Ames, Iowa, was sampled during a 20-month period. Each farm was visited at least 30 min before milking began on a day when the bulk tank was empty. The individual farms were numerically rated using the score card shown in Fig. 1; the card emphasized cleanliness and sanitization of milk-contact surfaces. The highest possible score was 100 points, and violations were scored according to their seriousness. For example, the penalty was more severe for moisture remaining in equipment if the equipment was not sanitized before it was used. If no violation was observed for an item, the maximum possible score was assigned. The maximum score was six for all items except use of the strip cup and cleanliness of the cows, for which the maximum score was five. If there was a serious violation of an item, the minimum score of 1 was assigned. Each farm received

[1]Journal Paper No. J-6017 of the Iowa Agriculture and Home Economics Experiment Station, Ames, Iowa. Project 1050.

[2]Present address: American Dry Milk Institute, Inc., Chicago, Ill. 60606.

DAIRYMAN _____ SAMPLE NUMBER _____

	Very Poor 1	2	3	4	5	Excellent 6
Bulk Tank						
Solids	—	—	—	—	—	—
Milking Machines						
Solids	—	—	—	—	—	—
Moisture	—	—	—	—	—	—
Inflations	—	—	—	—	—	—
Milk hoses	—	—	—	—	—	—
Pipeline (tote pails)						
Solids	—	—	—	—	—	—
Moisture	—	—	—	—	—	—
Sanitation						
Bulk tank	—	—	—	—	—	—
Pipeline (tote pails)	—	—	—	—	—	—
Milking machines	—	—	—	—	—	—
Udders	—	—	—	—	—	—
Inflations between cows	—	—	—	—	—	—
Udders						
Use strip cup	—	—	—	—	—	
Individual udder towels	—	—	—	—	—	—
Clean cows	—	—	—	—	—	
Clean udders	—	—	—	—	—	—
Miscellaneous	—	—	—	—	—	—

TOTAL POINTS _____

Figure 1. Example of score card used in determining numerical rating of grade-A dairy farm milking facilities and procedures.

a score of six for the miscellaneous item, unless a sanitary violation, not represented elsewhere on the score card, was observed.

Sample collection and dispensing

After milking was completed, a sample was aseptically collected from the bulk tank and placed in a sterile quart fruit jar for prompt refrigerated transportation to the laboratory. At the laboratory, the sample was immediately dispensed by a 10-ml manual continuous syringe into four sterile 15 x 125 mm rubber-stoppered test tubes and seven sterile 20 x 125 mm screw-capped test tubes. After each test tube was filled, it was immediately placed in an ice-water bath. After all test tubes were filled, they were placed in a 3.3 C air incubator, except for one screw-capped tube used for a leucocyte count. The tubes were divided into two equal sets. One set was stored at 3.3 C for 72 hr, and the other set was stored at 3.3 C for 54 hr and then at 12.8 C for 18 hr. The latter treatment constituted preliminary incubation (PI). The storage at 3.3 C simulated the storage treatment that milk would be subjected to in industry before being analyzed.

Analysis of samples

After the 72-hr storage period, the milk samples were removed from the air incubators and analyzed. Procedures given in the 11th edition of *Standard Methods for the Examination of Dairy Products (1)* were followed unless a different procedure is specified. The bacterial tests performed were: thermoduric (TdBC), coliform (CC), enterococcus (EC), psychrophilic (PBC), Standard Plate (SPC), and total (TC) counts. The resazurin reduction time (RRT) also was determined. The bacterial counts were made on duplicate tubes of milk, and the RRT was determined on a single tube of milk. Leucocyte numbers were determined on the fresh milk sample using the Levowitz-Weber method *(1)*.

Thermoduric count. Milk for the TdBC was laboratory pasteurized as recommended by Anderson and Meanwell *(2)*.

Coliform count. Violet Red Bile Agar (VRBA) was used. Plates were incubated at 32 ± 1 C for 18-24 hr.

Enterococcus count. Citrate Azide Agar (CAA) of Saraswat, Clark, and Reinbold *(20)* was used.

Psychrophilic count. The PBC plates were incubated at 7 ± 1 C for 10 days.

Total count. The TC was determined by using Eugonagar (EA) *(6)*. Plates were incubated at 21 ± 1 C for 7 days.

Statistical analysis

For statistical analysis, counts of <1 were recorded as 0. The counts were transformed by taking $\log_{10}$ (count + 1). The PI test was not conducted on the first six samples, and leucocyte counts were not determined on the first five samples because of a change of plans after the experiment was started. This was taken into account in the data comparisons. The RRT was not determined on one sample because of a laboratory accident. Consequently, there is one less degree of freedom for statistical comparisons involving the RRT. Critical values were obtained from *Principles and Procedures of Statistics (23)*.

RESULTS AND DISCUSSION

Correlation coefficients (r) among the seven bacterial tests, the leucocyte count, and the farm score for the two storage treatments are presented in Table 1.

Comparisons with the farm score

The only statistically significant r value between a bacterial test and the farm score was with the PBC. Improperly cleaned and sanitized milk-contact surfaces, especially the bulk tank, are conducive to the development of a large psychrophilic population. Since an unclean surface cannot be effectively sanitized, it may become a reservoir for psychrophiles. The bulk tank has a much larger surface area than other equipment, and the milk is in continual contact with it, whereas the milk is only in transitory contact with much of the other equipment. Since the bulk tank often has milk in it when the inspector or fieldman visits, it may be in an unsanitary state and yet not be detected. For this purpose, the score card was heavily weighted for cleanliness and sanitizing of milk-contact surfaces. Hence, a significant relationship would be expected between the farm score and the PBC. If many of the psychrophiles had not also been enumerated by the SPC and TC, one would expect much closer correlation of the farm score with the PBC than with the SPC or TC.

The agreement between the PBC and the farm conditions was better than with the SPC or the TC.

TABLE 1. CORRELATION COEFFICIENTS OF 30 GRADE-A RAW MILK SAMPLES[a] RECEIVING SPECIFIED STORAGE TREATMENTS

Comparison	Sample storage: 3.3 C for 3 days	Sample storage: PI[b]
Farm score vs.:	r[c]	r[d]
Psychrophilic count	−0.48	−0.43
Total count	−0.35	−0.33
Standard Plate Count	−0.35	−0.34
Coliform count	−0.28	−0.32
Resazurin reduction time	−0.27	−0.29
Enterococcus count	−0.18	−0.19
Thermoduric count	−0.18	−0.18
Leucocyte count	—	−0.64
Standard Plate Count vs.:		
Total count	0.91	0.95
Thermoduric count	0.82	0.57
Psychrophilic count	0.80	0.89
Enterococcus count	0.62	0.70
Coliform count	0.51	0.73
Resazurin reduction time	−0.49	−0.56
Leucocyte count	—	0.13
Total count vs.:		
Psychrophilic count	0.87	0.90
Thermoduric count	0.73	0.57
Coliform count	0.47	0.69
Enterococcus count	0.41	0.56
Resazurin reduction time	−0.42	−0.56
Leucocyte count	—	0.14
Psychrophilic count vs.:		
Thermoduric count	0.57	0.49
Coliform count	0.48	0.69
Enterococcus count	0.38	0.59
Resazurin reduction time	−0.30	−0.39
Leucocyte count	—	0.26
Thermoduric count vs.:		
Enterococcus count	0.52	0.47
Resazurin reduction time	−0.57	−0.51
Coliform count	0.43	0.20
Leucocyte count	—	0.39
Enterococcus count vs.:		
Resazurin reduction time	−0.49	−0.67
Coliform count	0.26	0.45
Leucocyte	—	0.20
Resazurin reduction time vs.:		
Coliform count	−0.05	−0.34
Leucocyte count	—	0.14
Coliform count vs.:		
Leucocyte count	—	0.02

[a]The counts were transformed by taking logarithm$_{10}$ (count + 1) and the resazurin reduction times were transformed by taking logarithm$_{10}$ (reduction time + 1).

[b]Preliminary incubation samples were stored at 3.3 C for 54 hr, and then at 12.8 for 18 hr before being analyzed.

[c]Critical value of r (5%, 28 degrees of freedom) = 0.36.
Critical value of r (5%, 27 degrees of freedom) = 0.37.

[d]Critical value of r (5%, 22 degrees of freedom) = 0.40.
Critical value of r (5%, 21 degrees of freedom) = 0.41.

However, the PBC is relatively expensive and time-consuming. Even though there was better recovery of microorganisms with the TC than with the SPC, neither count showed a significant correlation with the farm score.

The lack of significant correlation of the farm score with the EC and the CC is of interest because both groups of microorganisms have been proposed as indicators of production conditions. Some workers have reported that the CC is not a reliable index of production conditions (*5, 12, 21, 26*), but Sherman and Wing (*21*), Johns (*13*), and Fay (*9*) believed that, with efficient cooling, the coliform results would be suitable for this purpose. However, results of our study show that the CC is not highly correlated with production conditions on the farm. The low correlation between the EC and the farm score obtained in this study agrees with the conclusions of White and Sherman *(25)*. There was no significant relationship between the two indicator groups on the sample stored at 3.3 C for 72 hr. The bacterial flora varies from farm to farm so that no specific group can be expected to be present in relation to the level of farm sanitation. When the milk samples were preincubated, there was significant correlation between the EC and CC. The coliforms grow much more rapidly than the enterococci during PI. The significant correlation indicates that higher CCs were obtained on PI samples that had the higher ECs.

The r value was not statistically significant between the farm score and the TdBC. This was expected since continued neglect in cleaning and sanitizing over an extended period is necessary for a thermoduric population to become established *(8, 17)*. Such continued neglect should not be common on grade-A farms.

The RRT can not be relied upon to evaluate high-quality milk. Only one of the 29 samples stored at 3.3 C for 72 hr had a RRT other than 4 hr. Only two of the 24 preincubated samples had a RRT other than 4 hr. This should be remembered when comparing the RRT with other bacterial test results. Also, the RRT was not significantly correlated with the farm score. The inability of the RRT to measure the quality of adequately cooled milk has been recognized for some time *(3, 16, 19, 22, 24)*.

A significant r value was observed between the leucocyte counts (determined on fresh milk samples) and the farm scores. This indicates that the dairyman who ignores recommended cleaning and sanitizing procedures also has difficulty in maintaining herd health.

The multiple correlation coefficient of the coliform and psychrophilic count with the farm score gave a more comprehensive measure of production conditions. This value was only slightly higher than the

simple correlation of PBC with the farm score for the sample stored at 3.3 C for 72 hr. The correlation was not significant on the PI sample, probably because fewer samples were analyzed for this treatment.

Low correlation between certain bacterial test results and production conditions also has been observed recently by Atherton *(4)*, and Johns et al. *(14)*. The low correlation of the bacterial test results with farm scores could be the result of many factors, the chief being the interaction between different microbial groups in a mixed population, as influenced by physical and chemical factors. Also there are limitations of the tests themselves, and a lack of guidelines for the development of proper weightage in the score card.

Correlation between counts

The r value was significant between the SPC and the other five bacterial counts and the RRT. The high correlation between results of the two tests may be because many of the same microorganisms are enumerated by both methods. Correlation between the SPC and TC was higher than the correlation between the SPC and PBC. These observations were probably related to the temperature of incubation employed for the different tests. In the same light there was a significant correlation between the SPC and CC. The coliforms were enumerated by both counts.

There are reports of correlation *(7, 10)* and lack of correlation *(11, 15, 18, 26)* between coliform and total bacterial counts. Correlation coefficients were higher on the preincubated samples than on the samples stored at 3.3 C for 72 hr for all bacterial tests except TdBC. This was expected because the temperature used during the preincubation (12.8 C) is approaching the optimum growth temperature of most microbial groups found in milk in contrast to 3.3 C storage. The lower correlation coefficient of the SPC with the TdBC on the PI sample indicates variable SPC and TdBC responses to PI. In every comparison with other bacterial tests, the agreement with the TdBC was lower on the PI sample.

Correlation values between the TC and the other six bacterial tests results were statistically significant. As explained earlier, these correlations were probably governed by the temperature of incubation for the various tests. Except for the TdBC, the correlation between the TC and the other bacterial tests was higher for the PI sample than for the sample stored at 3.3 C for 72 hr.

The agreement between the PBC and results of bacterial tests that measure many nonpsychrophilic microorganisms was lower, but still significant. Their association probably results from the common origin of contamination. There was no significant correlation between the PBC and the RRT. Since most psychrophilic microorganisms are poor reducers, good agreement would not be expected.

The correlation coefficient between the EC and the RRT was statistically significant for both sample-storage treatments. Enterococci, with the exception of *Streptococcus durans*, are active reducers so one could expect a relationship between their numbers and the RRT.

The r value was not significant between the RRT and the CC. One would expect a high correlation in high-coliform count milk since the coliform organisms rapidly reduce resazurin dye. Milk used in this experiment had a low coliform count and hence the low correlation. The degree of agreement was much higher, but still not significant, with the preincubated sample. Closer agreement between CC and RRT on the PI sample is probably associated with rapid multiplication of actively reducing coliforms during storage at 12.8 C for 18 hr.

The only significant r value between the leucocyte count of the fresh milk sample and the bacterial test results of the preincubated milk samples was with the TdBC. The reason for this relationship is not clear. High bacterial counts frequently result from contamination, especially from the milk handling equipment, rather than from the udder of the cow.

Effect of preliminary incubation

Within this experimental design, PI did not improve the ability of the bacterial tests to show significant correlation with the farm score. It cannot, therefore, be considered of much practical value for application in grade-A raw milk evaluation. With the PBC (the only bacterial test that showed significant correlation with the farm score), correlation with the farm score on the PI sample was lower than the correlation on the sample stored at 3.3 C for 72 hr. Correlation of the PBC with all bacterial tests except the TdBC was higher on the PI sample. This resulted from the ability of psychrophilic microorganisms to grow rapidly when the incubation temperature was increased. The microorganisms enumerated by tests other than the TdBC multiplied in proportion to those enumerated by the PBC. Some of the organisms enumerated by the other bacterial tests could have been psychrophiles. Although PI may increase the agreement between two bacterial tests, if those results are not an accurate appraisal of production conditions, the higher correlation is of no significance in evaluating production conditions.

Results of several bacterial tests, when evaluated with farm scores, indicate that they would not reflect failure in adhering to recommended procedures for the production of grade-A milk. Farm inspection still is a necessary part of quality control. The relationship of farm inspection to laboratory control

is quite correctly stated in *Standard Methods for the Examination of Dairy Products* (*1*, p. 10-11) which emphasizes the importance of milking-time inspections, and further states that laboratory tests in themselves do not constitute a complete quality control program.

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MICROBIOLOGY OF RESTAURANT-CAFETERIA PREPARED FOOD DISHES

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ABSTRACT

Food samples were collected directly from serving lines in cafes and cafeterias in the Twin City metropolitan area. The samples were subjected to a battery of tests chosen to evaluate the microbiological quality of the foods.

Bacterial and yeast counts and culture results are reported. Salmonellae, shigellae, and *Clostridium perfringens* were not found. Numbers of microorganisms found varied considerably with the type of food. The ranges found are probably indicative of values which could be expected in restaurant-cafeteria foods.

The laboratory procedures used appeared to be satisfactory for a relatively small bacteriology laboratory and provided sufficient information with which to evaluate the microbiological quality of the food.

Hopefully, the data will contribute to efforts being made to establish microbiological standards for restaurant-cafeteria foods.

Throughout the country laboratory research and field studies have been continually undertaken by public health and food industry people to evaluate potentially hazardous foods from the standpoint of (*a*) determining the presence of pathogenic microorganisms, (*b*) developing uniform laboratory procedures, and (*c*) establishing acceptable microbiological standards.

Experiments have been conducted on commercially prepared and wrapped sandwiches for contaminating microorganisms *(4, 5, 14, 16)*, on the presence of *Clostridium perfringens* in foods *(10, 11, 17, 21, 23)*, on salmonellae in prepared and processed foods *(1, 7, 19)*, and on *Staphylococcus aureus* in causing food disease outbreaks *(5)*. Bacterial levels *(6, 9, 12, 13, 15, 18)* in foods have also been studied. Other projects *(8, 20, 22)* indicate the extensive amount of research and evaluation necessary to develop standards for the many varied restaurant-cafeteria prepared foods.

The purposes of this study were: (*a*) to select a group of tests which could be performed in a relatively small bacteriology laboratory and which could give considerable information on the microbiological quality of foods, and (*b*) to apply that group of tests directly to foods from restaurants and cafeterias for the purpose of establishing a microbiological range which may be expected in certain selected foods served in the Twin City area.

MATERIALS AND METHODS

Samples were collected over a period of two summers, with the assistance of the local health departments throughout the metropolitan area of Minneapolis and St. Paul, Minnesota. These samples were taken just prior to serving time, placed in a sterile glass jar or in a sterile plastic bag, then transported immediately to a University of Minnesota laboratory in an insulated carrying case. It was considered preferable to obtain as complete information as possible on the range of microbial counts, rather than attempt to control such variables as ingredients used, number of persons preparing the food, sanitary condition of the food facility, etc. As a matter of fact, it appeared more desirable to get more thorough information on the actual range of microorganisms and their numbers that might be anticipated because of this variation.

The methods for the direct microscopic count, the total plate count, and the coliform colony count were taken from *Standard Methods for the Examination of Dairy Products*, 1960 Edition. Staphylococcus medium 110 and SPS Agar (Difco) were used for the *Staphylococcus aureus* and *Clostridium perfringens* counts, respectively. The search for salmonellae and shigellae involved preliminary enrichment in selenite broth with subsequent streaking on SS Agar, Brilliant Green Agar, and Desoxycholate Agar (Difco).

Accordingly, the procedures are outlined in Fig. 1 as follows: Five grams of the sample were transferred to a mortar with a spoon or forceps. A small amount of previously baked and sterilized sand was added, and the sample was emulsified by grinding with the mortar and pestle.

A total of 45 ml of phosphate buffer *(4)* was added. Initially, only 1 or 2 ml were added with subsequent grinding in order to produce a thick, homogeneous paste. When this stage was reached, the balance of the buffer, up to 45 ml, was added, giving a dilution of 1:10.

The time required to accomplish a high degree of emulsification varied considerably with the type of food. Soups, pies, and most other soft foods required only 2 or 3 min of grinding and mixing in order to produce a relatively homogeneous suspension, whereas foods such as coleslaw and carrot salad required 15 or 20 min of grinding.

After stirring the 1:10 dilution, 2 ml were transferred with a large bore pipette to 18 ml of phosphate buffer, making a dilution of 1:100. Similarly, 2 ml of the 1:100 dilution were transferred to a third tube containing 18 ml of buffer and making a 1:1000 dilution.

One ml aliquots of all the dilutions used were transferred to the appropriate petri dishes, Staphylococcus 110 medium and selenite enrichment broth.

A calibrated bacteriological loop used to transfer 0.01 ml of the 1:10 dilution of the sample to milk smear slides; 0.01 ml was deposited on each of three circular areas, each equal

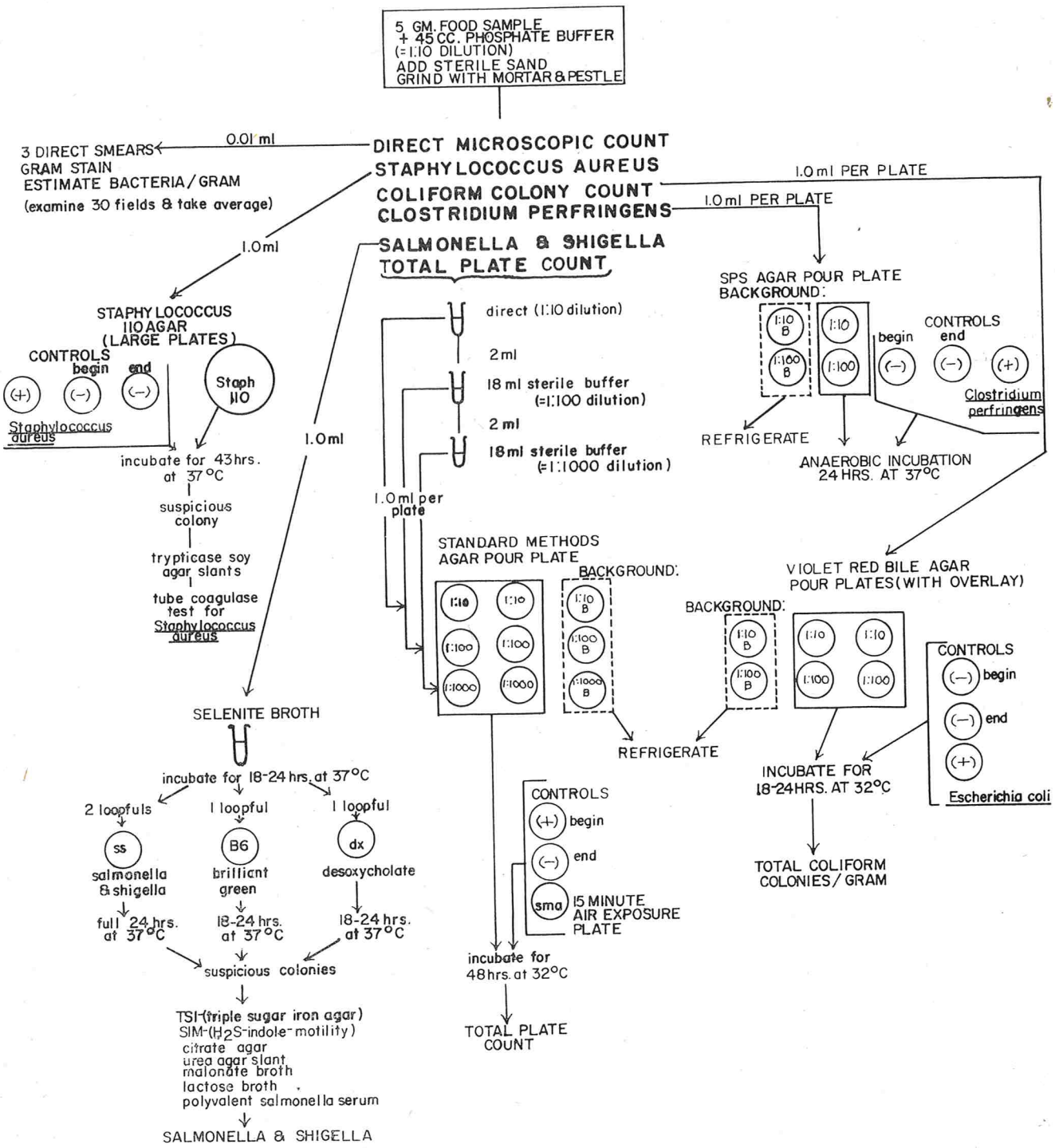

Figure 1. Laboratory procedure for the microbiological analysis of food specimens.

to 1 cm^2, for the direct microscopic count.

Duplicate plates plus a "background" plate of each of the three dilutions were prepared for the total plate count. The plates were gently rotated and tilted to disperse the sample in the agar. The duplicate pour plates were placed in the incubator at 32 C for 48 hr and the background plates were refrigerated at 40 F.

A petri plate containing solidified Standard Methods Agar (2) was exposed to the air for 15 min during the time of pouring to determine microbic density of the air.

The "background" plate used with the total plate count, *Staphylococcus aureus* colony count, and *Clostridium perfringens* colony count proved very helpful during the colony counting process. The "background" plate was merely a duplicate plate of each food dilution which was refrigerated instead of incubated. Prior to counting the incubated plates, the background plate was examined to determine whether particles of food were present which might be confused with microbial colonies. It is noted again that tiny particles of many foods resembled bacterial colonies. Some food particles,

TABLE 1. RESULTS OF MICROBIOLOGICAL ANNALYSIS OF FOOD SPECIMENS[a]

Specimen	No. Sampled		Direct Microscopic Count No./Gram	Total Plate Count No./Gram	Coliform Colonies No./Gram	*S. aureus* Colonies No./Gram
Egg Salad	8	Bact.	0-4,000,000,000	26,000-11,000,000	<10-25,000	<10-240
		Yeasts	0-28,000,000			
Tuna Salad	12	Bact.	0-350,000,000	2,100-6,800,000	20-76,000	<10
		Yeasts	0-48,000,000			
Ham Salad	8	Bact.	0-270,000,000	370-310,000	<10-34,000	<10
		Yeasts	0-170,000,000			
Turkey Salad	2	Bact.	0-400,000	6,900-480,000	<10	<10
Chicken Salad	5	Bact.	0-220,000,000	14,000-1,900,000	120-73,000	<10-380
		Yeasts	0-68,000,000			
Salmon Salad	1	Bact.	12,000,000	2,600,000	3,000	<10
		Yeasts	39,000,000			
Ham	3	Bact.	400,000-21,000,000	340-1,300,000	<10-22,000	<10
		Yeasts	0-1,100,000,000			
Barbeque beef	1	Bact.	270,000	5,000	<10	<10
		Yeasts	69,000,000			
Baked noodle casserole	1	Bact.	24,000,000	<300	<10	<10
Chow mein	4	Bact.	0-58,000,000	<300-3,200,000	<10-70,000	<10
Beef stew	1	Bact.	400,000	4,100	<10	<10
Beef	2	Bact.	0	<300-300	<10	<10
Salisbury steak	1	Bact.	22,000,000	650,000	350,000	<10
Spaghetti hot dish	2	Bact.	2,400,000-39,000,000	<300-6,700	<10-820	<10
Macaroni and cheese	1	Bact.	34,000,000	7,700,000	450	<10
		Yeasts	400,000			
Meat loaf	1	Bact.	110,000,000	<300	<10	<10
		Yeasts	340,000,000			
Chicken supreme	1	Bact.	1,000,000	spreader	<10	<10
		Yeasts	13,000,000			
Creamed turkey	1	Bact.	0	<300	<10	<10
Baked beans	1	Bact.	0	360,000	150,000	<10
Instant potatoes	5	Bact.	130,000-2,400,000	1,200-12,000	<10	<10
		Yeasts	0-270,000			
Potato salad	11	Bact.	0-350,000,000	9,300-1,600,000	25-390,000	<10-10
Goulash	1	Bact.	530,000	130,000	6,900	<10
Chicken gravy	1	Bact.	130,000	<300	<10	<10
Poultry stuffing dressing	1	Bact.	0-69,000,000	<300	<10	<10
Chili	1	Bact.	230,000,000	12,000,000	80	<10
Vegetable soup	2	Bact.	130,000-800,000	<300	<10	<10
Hard cooked eggs	1	Bact.	48,000,000	380,000	5,000	<10
Thousand island dressing	1	Bact.	270,000	<300	<10	<10
Russian dressing	1	Bact.	1,200,000	770,000	7,300	<10
Cole slaw	2	Bact.	1,500,000-4,400,000	7,300-15,000,000	165-400	<10
Carrot salad	1	Bact.	260,000	40,000	510	<10
Rice and chopped fruit	1	Bact.	240,000,000	6,800,000	980	<10
Fruit delight (fruit cocktail)	1	Bact.	13,000,000	430,000	360	<10
		Yeasts	5,700			
Coney island sauce	1	Bact.	16,000,000	970	<10	<10
Carrot and raisin slaw	1	Bact.	0	16,000,000	92,000	150
Lemon dessert	1	Bact.	530,000	<300	<10	<10
Chocolate cream pie	1	Bact.	0	4,000	15	<10
Custard	1	Bact.	0	410,000	230,000	<10
Coconut cream pie	1	Bact.	0	860	<10	<10
Ice milk	1	Unreadable		19,000	15	<10
Ice milk mix	1	Unreadable		240,000	4,900	<10
Whipped cream	1	Bact.	130,000	1,000	<10	<10
Dried milk product	3	Unreadable		<300-2,300	<10	<10

[a]Because of dilution techniques (2), no determinations were made for total plate counts below 300 organisms, and coliforms and S. *aureus* below 10 organisms per g.

when placed in the violet red bile agar for the coliform colony count, took on the red color which is supposed to be indicative of a coliform colony.

For the enumeration of *Staphylococcus aureus,* one ml of the 1:10 dilution was streaked with a bent glass rod on a large (150 x 25 mm) petri plate. The adoption of the larger petri plate resulted when it was observed that there was an excessive amount of food debris on the surface of the regular sized (100 x 15 mm) petri plates. The plate was incubated at 37 C for 43 hr. If yellow colonies were observed, they were counted, and a representative number of colonies were picked for coagulase testing.

For the coliform colony count, duplicate plates were prepared and a cover layer of medium poured on each plate to inhibit surface colony formation. Plates were incubated at 32 C for 18-24 hr. Red colonies at least 0.5 mm in diameter on uncrowded plates were counted.

Clostridium perfringens colony counts were made on single plates with the 1:10 and 1:100 dilution. Single plates of SPS agar were used because of the limited space available in the anaerobic incubator jar. A Gaspak anaerobic jar (BBL) was used to provide anaerobic conditions. Anaerobic indicator solution (BBL) was placed in the jar as well as a positive control plate containing *Clostridium perfringens.* Plates in the anaerobic jar were incubated at 37 C for 24 hr and were examined for black colonies.

One ml of the 1:10 dilution of the food sample was placed in selenite enrichment broth to culture for salmonellae and shigellae. After incubation at 37 C for 18-24 hr, the broth was streaked on SS, Brilliant Green, and Desoxycholate Agars. These plates were incubated for 24 hr at 37 C. Suspicious colonies were transferred to Triple Sugar Iron Agar slants and subsequently to other differential media.

RESULTS AND CONCLUSIONS

It was originally hoped that the direct count would provide an early indication of the microbiological quality of the food. However, because of the great amount and variability of the food debris and the peculiar staining qualities of some foods, bacteria were not always easily differentiated from food particles. This problem was most apparent when trying to count Gram-negative bacilli because the large majority of the foods tested were stained pink by the Gram stain. Picking out a pink colored cell in the midst of a large amount of pink food debris was indeed difficult.

Little obvious correlation was observed between the direct count and the plate counts. Two broad general conclusions are made: (*a*) when no microorganisms were observed on the direct count, the number of colonies observed on the total plate count was usually moderate or low, and (*b*) when very numerous microorganisms were observed on the direct count, the number of colonies observed on the total count plate was usually high.

During the experiment the microbic density of the air of 15 colonies per plate in 15 min was never exceeded *(2).*

The microbiological study of 99 food samples, as recorded in Table 1, shows the following results:

(*a*) Salmonellae, shigellae, and *Clostridium perfringens* were not isolated from any of the food samples. This does not mean necessarily that the organisms were not present, but simply shows these organisms were not found in the five gram samples analyzed.

(*b*) *Staphylococcus aureus* was isolated from several samples, but not in numbers usually associated with food disease outbreaks.

(*c*) The high bacteria and yeast direct microscopic count with a relatively low total plate count (viable cells) in many of the foods sampled suggests a lack of good sanitation practices during the production and preparation of this food.

(*d*) The coliform counts for many of the foods were exceedingly high. The potato salad samples ranged from 25 to 390,000 per g; tuna sandwich spread ranged from 20 to 76,000, and other sandwich salad spreads were equally high. Apparently the soil residue was not removed from the vegetables and/or there was contamination during the preparation of the foods.

(*e*) It is interesting to note the high yeast counts in foods which are chopped, ground, or macerated during the preparation of the food dish. This fact indicates rather clearly the poor sanitary conditions which must have prevailed sometime during the production and final preparation of the potentially hazardous foods.

(*f*) The laboratory procedures and microbiological tests, as outlined, appear to be suitable and workable for use by a relatively small bacteriology laboratory.

Finally, this limited evaluation of foods indicates the need for a controlled study. These "control" standards should be at a high level of sanitation for the preparation and serving of these foods. Such a study would serve as a base-line for microbiological quality of restaurant-cafeteria foods analyzed in the future.

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ASSOCIATION AFFAIRS

ANNOUNCEMENT CONCERNING THE SANITARIANS AWARD FOR 1969

Announcement is made that nominations will be accepted for the annual Sanitarians Award until June 1, 1969, and the members of the International Association of Milk, Food and Environmental Sanitarians, Inc. are requested to give consideration to the nomination of individuals whose professional work in the field of milk, food, or environmental sanitation has been outstanding.

The Award consists of a Certificate of Citation and $1,000 in cash, and is sponsored jointly by the Diversey Chemical Corporation, Klenzade Products, Inc., and Pennsalt Chemical Corporation. It is administered by the International Association of Milk, Food and Environmental Sanitarians, Inc., and is presented annually. The next presentation of the Sanitarians Award will be made at the 56th annual meeting of the Association which is to be held at Louisville, Ky., in August 1969.

The Executive Board of the Association has established the following rules and procedures governing the Sanitarians Award.

Eligibility:

1. *General Criteria*
   To be eligible for nomination the Sanitarians Award offered annually by the International Association of Milk, Food and Environmental Sanitarians, candidates must:
   a. Have been a member of IAMFES in good standing for a period of five years prior to the date when the Award is to be presented;
   b. Be a living citizen of the United States or Canada who, at the time of nomination, is employed as a professional sanitarian in the field of milk, food, and/or environmental sanitation by a county, municipality, state or federal government provided that in the odd years beginning with 1969 the Sanitarians Award will be limited to state and federal employees and the even years to county and municipal employees.

Members of the Executive Board, members of the Committee on Recognition and Awards of the International Association of Milk, Food, and Environmental Sanitarians, and industry members shall not be eligible for the Award. Race, sex or age shall not enter into the selection of the Award recipient.

c. Have made a meritorious contribution in the field of milk, food or environmental sanitation, to the public health and welfare of a county, counties, district, state or federal government with the United States or Canada.

d. Have completed the achievements and contributions on which the nomination is based during the seven-year period immediately preceding January 1, of the year in which the Award is to be made.

2. *Additional Criteria*

a. Co-workers are eligible for nominations if both have contributed equally to the work on which the nomination is based and each independently meets the other qualifications for nomination.

b. Where co-workers are selected to receive the Award, each shall receive a certificate and share equally in the cash accompanying the Award.

c. No person who has received, or shared in receipt of the Award, shall be eligible for renomination for this Award.

Nominations

Nominations of candidates for the Sanitarians Award may be submitted by the Affiliate Associations of the IAMFES, or by any member of the Association in good standing except members of the Executive Board, members of the Committee on Recognition and Awards, and employees of the sponsoring companies. Nominations from persons who are not members of the Association cannot be accepted. No member or Affiliate may nominate more than one candidate in any given year.

Each nomination must be accompanied by factual information concerning the candidate, a resume of his work and achievements, evidence supporting his achievements and if available, reprints of publications. A form for the submission of nominations may be obtained upon request from H. L. Thomasson, Executive Secretary, International Association of Milk, Food and Environmental Sanitarians, Inc., P. O. Box 437, Shelbyville, Indiana 46176.

Submission of Nominations

The deadline for submission of nominations is set annually, and all nominations and supporting evidence must be postmarked prior to midnight of that date. The deadline this year is June 1, 1969. Nominations should be submitted to Dr. R. P. Elliker, Chairman, Committee on Recognition and Awards.

Selection of the Recipient

The Committee on Recognition and Awards of the International Association of Milk, Food and Environmental Sanitarians, Inc., has full responsibility for selecting from among the candidates nominated the recipient of the Sanitarians Award. In judging the contributions of each candidate, the Committee will give special consideration to (*a*) originality of thought, mode of planning, and techniques employed, (*b*) the comprehensive nature of the candidate's achievements, and (*c*) their relative value as they affect the health and welfare of the area served by the candidate. The Committee will give consideration also to the efforts of the candidate to establish professional recognition in the area in which he serves, as well as to his research, administrative development, program operation and educational achievements. Additional information or vertification of submitted information will be requested when considered necessary by the Committee. Testimonial letters in behalf of a candidate are not desired.

If after reviewing the nominations and supporting evidence, the Committee decides that the work and achievements of none of the candidates have been significantly outstanding, the Award shall not be made. In this connection, it is fundamental that if meritorious professional achievement cannot be discerned the Award shall be omitted for a year rather than to lower the standards for selections of a recipient.

Dr. P. R. Elliker, Chairman,
Committee on Recognition
and Awards.
Dept. of Microbiology,
Oregon State University,
Corvallis, Oregon 97331

NOTICE TO MEMBERSHIP

In accordance with our Constitution and By-laws which requires our Second Vice-President and Secretary-Treasurer to be elected by mail ballot, you are hereby notified that President A. N. Myhr, at the annual meeting in St. Louis, Missouri, August, 1968, appointed R. P. March, Cornell University, 118 Stocking Hall, Ithaca, N. Y. 14850 as Chairman of the Nominating Committee for 1969.

Nominations for the office of Second Vice-President and Secretary-Treasurer are now open and any member wishing to make a nomination should send a picture and biographical sketch of his nominee to Mr. March not later than March 1, 1969.

Roy Fairbanks, Secretary-Treasurer,
IAMFES, Inc.

FRED UETZ HONORED

During the course of the general business meeting of the International Association of Ice Cream Manufacturers in Chicago on October 15, Fred E. Uetz, long-time user group participant in the 3-A Committees, was presented the coveted 3-A bronze plaque honor award.

There being no Fall 3-A meeting this year, the occasion when the 3-A plaque is normally presented, the plaque was made the subject of a brief convention ceremony at the request of IAICM, which Fred has represented for nearly 20 years.

The citation was read by 3-A Chairman Dean Stambaugh, and the plaque was tendered to Fred by IAICM President, H. R. Scheid.

Fred responded graciously with the following remarks, so appropriate to the occasion:

I am honored and flattered in being presented with this beautiful plaque. I know its beautiful because I had the privilege of making the presentation to Mr. C. A. Abele of the Diversey Corporation at a very lively meeting of the 3-A Standards Committees in Oklahoma City in 1966.

I'm extremely flattered that its presentation was considered worthy of taking up your time at this convention, and no less so in that a similar award was presented last year to the Public Health Service through no lesser person than the Surgeon General with much fanfare and hopefully much publicity, which I heartily endorse.

We have come to a point in the history of the 3-A Sanitary Standards Committees where everyone concerned with dairy sanitation and the cleanability of processing equipment, literally from the cow to the consumer, has more than a passing knowledge of the connotation of the 3-A Symbol when applied to a piece of equipment.

Briefly, the 3-A concept is the culmination of a cooperative effort wherein we the users of dairy equipment, the fabricators of that equipment and the concerned regulatory sanitarians have met, on common ground, each with our own particular ideas, knowledge, experience and expertise. We have through countless hours of discussion, debate, concessions and compromise, evolved a set of standards which have become the envy of most other segments of the food industry.

Today, we find that the fabricating industry has progressed tremendously since the inception of 3-A Sanitary Standards. With automation has come sophistication. The consolidation of plants, together with high wages, has demanded equipment of greatly increased capacities operated by very few people. In many instances, mechanical cleaning devices have been incorporated as a matter of design, rather than as an extraordinary demand on the part of the purchaser. It is a happy commentary that mechanical cleaning is far more consistent and effective than manual cleaning. Regulatory agencies at every level have come to recognize this fact so that we find in updated sanitary codes, or regulations, specific references to the acceptability of these cleaning practices.

Our sanitarian friends in 3-A have kept abreast of the technological advancement in our industry. They have been most tolerant of radical changes. The old line of field sanitarians have been gradually supplemented by technicians and engineers, who must be satisfied that systems devised for automation will also be fail safe for the protection of the health of the consumers of our products.

As a long time representative of the user group, I am reluctant to admit that I too find myself more and more dependent on our industry engineer committee members when complex controls are required to guarantee the necessary end result required to produce a safe product.

Over the years I have had the highest regard for my employer who has seen fit, without question, to permit me to participate in the 3-A effort as a service to the industry of which he is a part.

To you gentlemen, who also may exercise the right to contribute the services of capable quality control and/or engineering personnel, I strongly urge that you do so.

As prime users of dairy and food equipment you better believe that you must exercise the right granted to you through the Sanitary Standards Subcommittee of the Dairy Industry Committee.

You are the people who must pay the bill and it would seem to be just poor business on your part not to get the most for your money because you are not there to protect your interests when the decisions are about to be made.

MINUTES OF THE MEETING OF THE SANITARIAN'S JOINT COUNCIL

Statler Hilton Hotel, Detroit, Michigan
November 14, 1968

Delegates Attending: Gilbert L. Kelso—American Public Health Association, Francis J. Goldsmith—National Association of Sanitarians, B. Russell Franklin, Chairman—American Public Health Association-Engineering & Sanitation Section, John H. Fritz—International Association of Milk, Food & Environmental Sanitarians, Inc., William V. Hickey, Secretary-Treasurer—International Association of Milk, Food & Environmental Sanitarians, Inc.

A report of the minutes and activities of the past year was read by the Secretary.

A financial report which indicated a bank balance of $546.09 as of September 30th, with no disbursements in 1968, was read and accepted.

Correspondence relating to the definition of the sanitarian as approved by the Council in Miami, was read and was discussed at length. Upon recommendation of Mr. Goldsmith, the definition was amended as follows:

"A Sanitarian is a practitioner who through education, training, and experience, acquires the skills *in the prevention and correction of* (New wording is in italics and words deleted are "to identify.") environmental deficiencies resulting in health problems, and those factors contributing or causing them, and the art to work with social institutions to effect positive changes in the environment for the benefit of man."

Mr. Franklin and Mr. Fritz recommended that delegates should urge their respective sponsoring agencies to adopt the definition, as amended (above) in the interest of uniformity.

The Model Registration Act for Sanitarians was discussed. It was noted that this Act was originally developed by the Sanitarian's Joint Council. The question was raised: Should this Act be updated or revised?

It was moved, seconded and carried by unamimous vote, as follows: "The Chairman of the Sanitarian's Joint Council should contact prime movers in the Conference of State Sanitarians' Registration Agencies to acquaint that proposed Group with S.J.C.'s plan to undertake a periodic review of the Model Registration Act, State Acts, invite them to provide recommendations regarding any changes they feel are needed in such an Act."

(Mimeograph copies of above in quotes to be sent to S.J.C. delegates and alternates for transmission to respective sponsors, and/or the attendees at the Florida and Chicago meetings of the proposed State Sanitarians' Registration Agencies Group).

Under the sponsorship of the Sanitarian's Joint Council, a public meeting was held on Wednesday, November 13th, 1968, in Detroit. Mr. B. Russell Franklin, Chairman, S.J.C. presiding. The Panelists were: John R. Fleming, M.P.H., S. M. Stephenson, R.S., Nicholas Pohlit, M.P.H., H. L. Thomasson, A.B.

An audience of almost 100 people responded to the discussions of the panelists and the summation of Mr. Franklin with many comments and questions. The environmental technician was described. The role he will play in the future was more adequately defined. Continuing activities in developing the sanitary technician were better defined.

Following discussion of the public meeting, the S.J.C. recommended that John Fleming should be requested to serve as Chairman of an Ad Hoc Committee to the S.J.C. to better define the difference between the "sanitary technician" and the health "aide". It was further requested that the same Committee would better define the manner in which the sanitary technician will be employed in official agency public health and/or industry public health. Mr. Fleming to appoint such Committee members as he feels would lend the greatest assistance to the Committee.

Secretary-Treasurer W. V. Hickey submitted, with regrets, his resignation from the Council. The press of other obligations prevents his continuance on the Council. By direction of Chairman B. Russell Franklin and the entire Board membership present, the Council accepted, with extreme regret, the resignation of its efficient and effective Secretary.

New Officers were elected for 1969, and they are as follows: Chairman, John H. Fritz, I.A.M.F.E.S.; Secretary-Treasurer, Harry Pool, N.A.S.

Records, bank books, and all other pertinent materials are to be transferred from W. V. Hickey to Harry Pool, at the earliest convenient date.

The Meeting adjourned at 12:45 P.M.

Respectfully submitted,
William V. Hickey,
Secretary-Treasurer

AWARDS TO BE GIVEN BY KENTUCKY ASSOCIATION

As in the past several years, the Association will again give awards to an outstanding fieldman and sanitarian at our annual meeting in the Spring. In order to receive nominations and have them properly processed in time for the meeting, nominations will be received from now until the first of January.

Anyone who is a member of the association, except officers and directors, who will judge the nominations submitted, may make one nomination for the sanitarian's award and one nomination for the fieldman's award.

Following are rules of eligibility for each:

Sanitarians' Award rules of eligibility:

1. Any living citizen of Kentucky who, at the time of nomination, is employed as a professional milk and food sanitarian, a member of the dairy and food industry or employed by State or Federal agencies, is eligible for the award. Membership in the Kentucky and International Association of Milk, Food and Environmental Sanitarians is not a prerequisite of eligibility, however, this will be a consideration in making the award. There are no restrictions as to race, sex or age.

2. A candidate shall have made a meritorious contribution in the field of milk and food sanitation to

the public health and welfare or a municipality, county or within the State of Kentucky.

3. Co-workers are eligible for nomination if both have contributed equally to the work upon which the nomination is based.

4. No person who has once received the Award shall be eligible for the nomination.

5. Supporting evidence for each nomination must be submitted in order for all officers and directors judging the nomination to have a knowledge of the candidate. This supporting evidence shall consist of a short resume of the candidates past activities and your reasons for nominating them for the award. Fieldman's Award rules of eligibility:

1. Service given to producers in relationship to quality and management.

2. Cooperation with regulatory and educational groups and participation in educational programs.

3. Public relations and status among fieldmen inside and outside his location.

4. Membership in the Kentucky or International Association of Milk, Food, and Environmental Sanitarians is not a prerequisite of eligibility, however this will be a consideration in making the award. There are no restrictions as to race, sex or age.

5. Supporting evidence for each nomination must be submitted in order for all officers and directors judging the nomination to have a knowledge of the candidate. This supporting evidence should consist of a short resume of the candidates' past activities and your reasons for nominating them for the award.

NEWS AND EVENTS

NATIONAL MASTITIS COUNCIL ANNUAL MEETING PROGRAM, JANUARY 27-29, 1969

Monday, January 27

Committee Meetings (As called by Committee Chairmen)

4:00-6 p.m. Registration

Tuesday, January 28

8:00 a.m. Registration

9:00 President's Address
Dr. C. J. Haller, Avon, New York

9:30 The Veterinarians's Approach to Mastitis
Dr. John Dahl, Clintonville, Wisconsin

10:15 The Fieldman and the Dairyman
Mr. Wm. F. Rhudy, Field Representative, Dairymen, Inc., Southeast Division
and
Mr. H. P. Richardson, Dairyman, Sugar Grove, Virginia

11:00 Mastitis—As We See It From Down Under
Dr. W. G. Whittlestone, New Zealand
Sponsored by: The Milking Machine Manufacturers Council

Noon Group Luncheon

1:30 p.m. Problem Herds—Mastitis and Bacteria Counts
Dr. R. B. Bushnell, Extension Animal Health Specialist, University of California

2:15 Intramammary Infection, Mastitis, and Machine Milking
Dr. John S. McDonald, National Animal Disease Laboratory, Ames, Iowa

3:30 Microbiological Procedures for Diagnosis of Bovine Mastitis
Dr. L. W. Slanetz, Chairman, Department of Microbiology, University of New Hampshire

8:00 Open Discussions
Screening Tests for Abnormal Milk
Dr. J. W. Smith, Chairman
Herd Management and Milking Problems
Wm. L. Arledge, Chairman, Dr. R. B. Bushnell, Dr. John Dahl, Dr. John S. McDonald, Dr. W. G. Whittlestone

Wednesday, January 29

8:45 a.m. Report of Nominating Committee

9:00 As A Regulatory Agency Sees An Abnormal Milk Program
W. I. Carr, Director, Dairy Division, Vermont Department of Agriculture

9:35 State Programs on Abnormal Milk
E. E. Kihlstrum, Chairman, NMC State Council Coordination Committee

10:10 Progress Report Abnormal Milk Program
Harold E. Thompson, U.S.P.H.S., Cincinnati, Ohio

10:45 Abnormal Milk Programs—Observations From Down Under
Dr. W. G. Whittlestone, New Zealand

11:30 Annual Business Meeting

12:00 Board of Directors Meeting

FOOD UPDATE 1969 TO TAKE PLACE IN BOSTON

The eighth Food Update seminar for food industry executive and technical management will take place February 9 to 12 at the Sheraton-Boston, the seminar's director, Franklin M. Depew, has announced.

According to Mr. Depew, who is also President of the Food and Drug Law Institute, "We expect the same stimulating exchange of opinion among industry, government and educational leaders for food industry executives in New England and eastern Canada as we have had in the Southeast and Far West."

The 1968 Food Update seminar was attended by almost 100 food industry leaders in Atlanta and the 1967 program took place in San Francisco. Previous meetings were held in Chicago and New York.

The format will consist of short presentations on various aspects of food service, nutrition, regulations and other topics designed to stimulate discussion among those attending.

Speakers representing the U. S. Dept. of Agriculture, New York City Department of Health, the Harvard School of Public Health, the Food Science Program of Columbia University, Pepsico, Best Foods, and other organizations and firms will lead discussions.

The series of Food Update seminars have become a major forum for the food and allied industries. They provide a chance to explore common technical and management problems and discuss solutions that represent the interests of all in the industry—consumer, manufacturer, farmer, scientists, and government representative.

Information about registration can be obtained from Mr. Depew by writing to the Institute at 205 East 42nd Street, New York, N. Y. 10017.

SYNTHETIC SWEETNER COUNTERACTS ANTIBIOTIC DRUG

A small amout of a synthetic sweetner now in wide use apparently counteracts the beneficial effect of an antibiotic drug, according to evidence just reported by a University of Michigan researcher.

The sweetner—sodium or calcium cyclamate—seems to block the antibiotic from being absorbed into the bloodstream and thus keeps it from reaching the site of infection.

Prof. John G. Wagner of the U-M College of Pharmacy says his experiments focussed on lincomycin hydrochloride, a common antibiotic for controlling bacterial infections. He found that absorption of the drug into the blood stream drops about 75 per cent in the presence of sodium or calcium cyclamate.

Cyclamates are extensively used in place of sugar in many "diet" drinks and "dietetic" foods. They are also used to improve the taste of some medicines, including antibiotics prepared in liquid form.

Dr. Wagner said the marked drop in adsorption of lincomycin "occurs not only when the cyclamate is present with the antibiotic in the (medicinal) syrup . . . but also when the cyclamate is ingested in the form of a diet drink and the mixing occurs in the human stomach."

He gave his findings Wednesday (Nov. 20) at the national meeting of the Academy of Pharmaceutical Sciences in Washington, D. C. The report is to be published in The Proceedings of The Symposium.

ADDITION MADE TO STAFF OF NSF

June 1, after four years as Director of the Bureau of Environmental Health of Baltimore County, Maryland, Ray Thursby joined the staff of the education project at NSF. He brings to his new responsibilities twenty-two years in environmental health, twelve of them in the United States.

Ray was born in England, earned two degrees there in sanitary engineering, and did post-master's study in air pollution control at the Leeds Institute of Technology. While in England he worked for the Port Health Authority and the cities of Sunderland and York. After coming to the United States in 1956 he spent eight years in environmental health in Alexandria, Virginia before taking the job as Director of the bureau in Baltimore County.

SELECTION AND USE OF DISINFECTANTS IN HEALTH FACILITIES

A new booklet titled "Selection and Use of Disinfectants in Health Facilities" is available free from the Division of Hospital and Medical Facilities of the Public Health Service.

The 120-page publication covers disinfection of equipment, supplies, and building surfaces and provides basic information on selecting disinfectants and evaluating their performance.

Chapters in the book were originally presented at an in-service training course for hospital sanitarians. Held in Albany, New York, the course was jointly sponsored by the Division of Hospital and Medical Facilities and the New York State Health Department.

Also available, and prepared in response to requests for information, are selected references on "Hospital Solid Wastes," "Hospital Laundry and Linen," "Disinfection," and "Hospital Infection Control."

Requests for single free copies of these four publi-

cations should be sent to: Mr. Vinson Oviatt, Division of Hospital and Medical Facilities, Room 332, 7915 Eastern Avenue, Silver Spring, Maryland 20910.

NEW LABORATORY BULLETIN

The Fisher Scientific Company announces the publication of a new Fisher bulletin which should prove to be quite interesting. Copies may be obtained from Harry M. Schwalb, 711 Forbes Ave., Pittsburgh, Pa. 15219.

TEXAS A&M SCHEDULES DAIRY INDUSTRIES CONFERENCE

The Second Annual Dairy Industries Conference sponsored by the Department of Animal Science, Texas A&M University has been scheduled for April 9 and 10, 1969. All activities will be held at the Holiday Inn, Bryan, Texas. Special activities for the ladies will be included. Further information may be obtained from Dr. H. E. Randolph, Dairy Section, Department of Animal Science, Texas A&M University, College Station, Texas, 77843.

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NOTICE OF PAGE CHARGE FOR PUBLICATION OF RESEARCH PAPERS

The Journal Management Committee recommended and the Executive Board voted to establish a page charge for research papers published in the Journal of Milk and Food Technology. Institution of the page charge is necessary to compensate for higher publication costs, to insure a continually expanding journal which will be of maximum benefit to its readers, and to make possible continued prompt publication of research papers.

A charge of $25.00 per printed page will become effective for all research manuscripts received after January 1, 1969. Most institutions accept the page charge as a necessary cost of conducting research and communicating the results. Nevertheless, it is realized that some authors may not have funds available for this purpose and hence exceptions can be made when necessary. Inability to pay the page charge shall not constitute a bar to publication of an acceptable manuscript.

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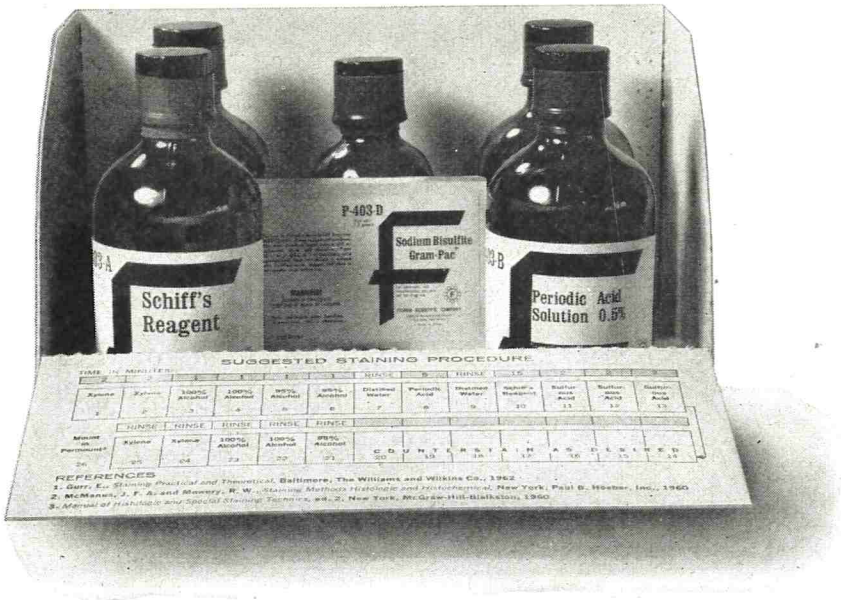

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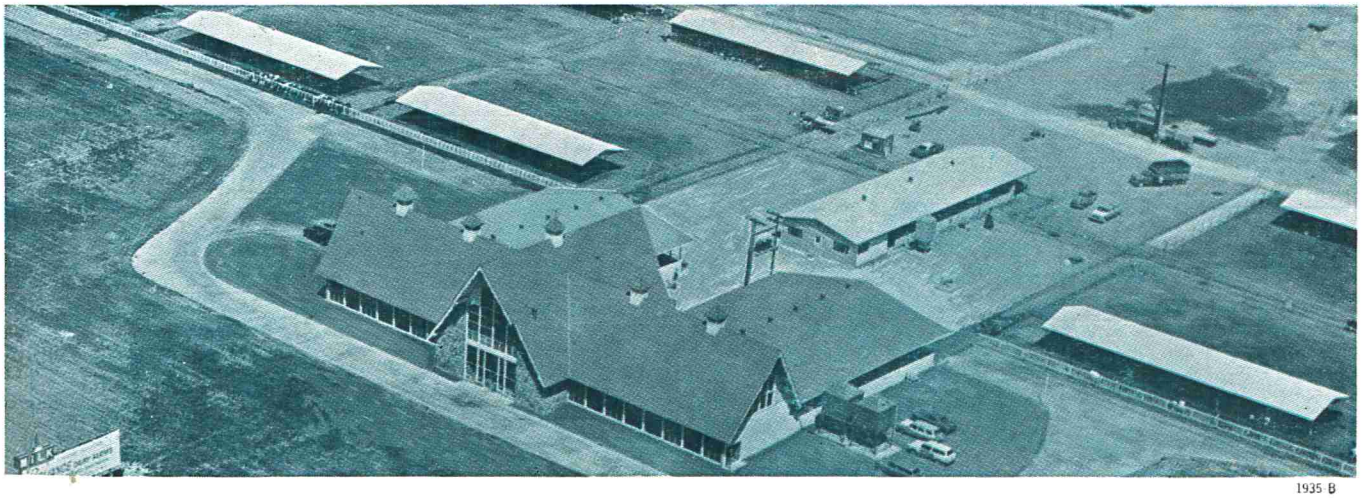

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