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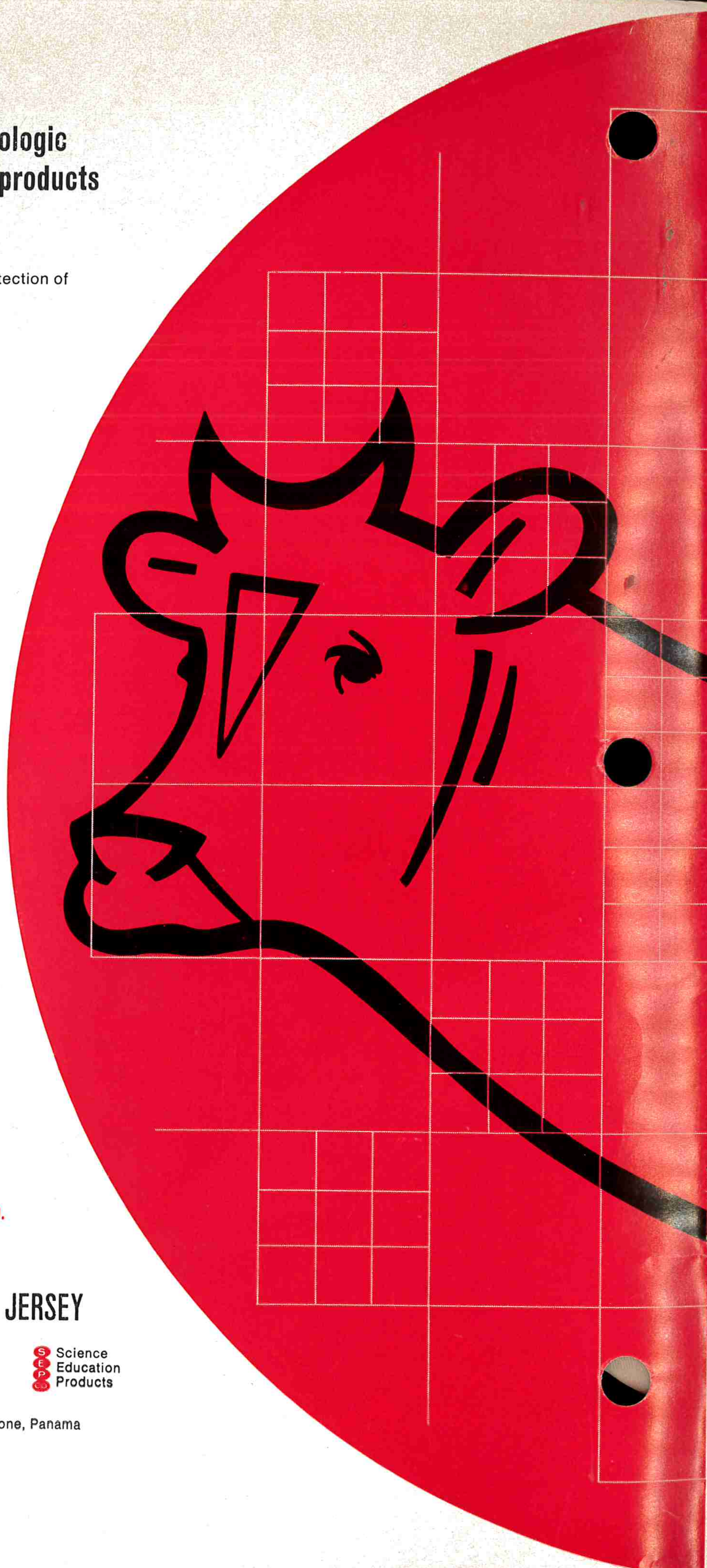
*Journal of*

# MILK and FOOD TECHNOLOGY

*Official Publication*

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



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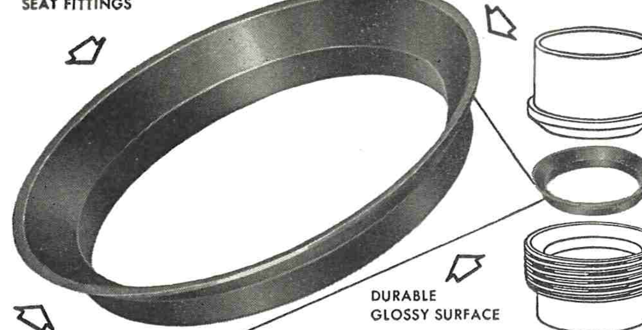


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# MILK and FOOD TECHNOLOGY

INCLUDING MILK AND FOOD SANITATION

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International Association of Milk, Food and Environmental Sanitarians, Inc.
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Vol. 29 December, 1966 No. 12

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# FACTORS RELATED TO THE ESTIMATION OF CATALASE ACTIVITY IN MILK[1]

R. E. Willits[2] and F. J. Babel

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(Received for publication October 18, 1966)

Summary

A definite relationship between the somatic cell count of milk and catalase activity was observed when the oxygen liberated was measured accurately with a Warburg apparatus. The somatic cell count could be predicted from the equation: $\log Y = 2.79 + (1.35 \log X)$, where Y = the somatic cell count in thousands, and X = the microliters of oxygen evolved from 0.5 ml of 1% hydrogen peroxide per milliliter of milk in 40 min at 30 C. The correlation coefficient for this regression is 0.90, and is highly significant.

Catalase activity of milk was maximal over the pH range of 5.64 to 10.74 and at 18 C. Activity was close to the maximum at 15 and 22 C and only slightly less at 10 and 25 C. Milk which contained 590 catalase-producing *Staphylococcus aureus* organisms per milliliter liberated very little oxygen; such numbers would not influence conclusions from the catalase test.

The catalase test was recognized as a method for distinguishing between normal and abnormal milk in 1906 *(10)*. It was reported by some investigators *(5, 6)* to be at least as sensitive as other available tests, but was not recommended for routine use because of the time and equipment required *(6)*. Other investigators *(4)* reported a poor correlation between leucocyte counts and catalase activity.

Interest in the catalase test was renewed when Spencer and Simon *(9)* developed a simple method for measuring the oxygen liberated by catalase. Corbett *(3)* reported results of catalase tests conducted on bulk milk shipments by the Chicago Board of Health modification of the Spencer and Simon test. He noted a good correlation between the catalase test and the California mastitis test.

This investigation was conducted to determine the relationship between numbers of somatic cells in milk and catalase activity, and to study some of the factors (pH, temperature, and catalase-producing bacteria) that might influence this relationship.

[1]Published with the approval of the Director of the Purdue Agricultural Experiment Station as Journal Series Paper No. 2918.

[2]Present address: The Pillsbury Co., Minneapolis, Minn.

## Experimental Procedures

*Catalase activity.*

A Warbug apparatus was used to measure the oxygen liberated. The procedure was as follows: 1.50 ml of milk was placed in the reaction flask. If the somatic cell count was high, the volume of milk was reduced and the difference made up with distilled water to maintain constant volume. Hydrogen peroxide (0.5 ml of a 1% solution) was placed in the side arm of the flask, and 0.20 ml of 20% potassium hydroxide (absorbed on a 1 x 3 cm strip of filter paper) was placed in the center well. After allowing the solution to equilibrate, the hydrogen peroxide was dumped into the milk. The manometer was zeroed and mechanical shaking started (100 strokes per min). The gas evolved was measured at 10-min intervals for 40 min. One flask containing distilled water was used as a thermobarometer to correct for changes in atmospheric pressure or variations in temperature. Results were recorded as the microliters of oxygen liberated from the hydrogen peroxide per milliliter of sample in 40 min at 30 C.

*Milk samples.*

The milk samples were less than 24 hr old and were obtained from individual cows.

*Somatic cell counts.*

Numbers of somatic cells were determined by the direct microscopic method *(1)*. Milk smears were stained with Levowitz-Weber stain.

*Determination of pH.*

A Beckman Laboratory Model G pH meter was used for all pH measurements.

## Results and Discussion

*Relation of catalase activity of milk to somatic cell count.*

Forty-two samples of raw milk from individual cows were tested in duplicate for numbers of somatic cells and catalase activity. The samples had somatic cell counts ranging from 45,000 to 4,550,000 per ml. The data obtained are shown graphically in Figure 1. The correlation coefficient calculated from the data was 0.90 and the regression calculated by the least squares method was $\log Y = 2.79 + (1.35 \log X)$; where Y = the somatic cell count in thousands, and X = the microliters of oxygen liberated from 0.50 ml of 1% hydrogen peroxide per milliliter of milk.

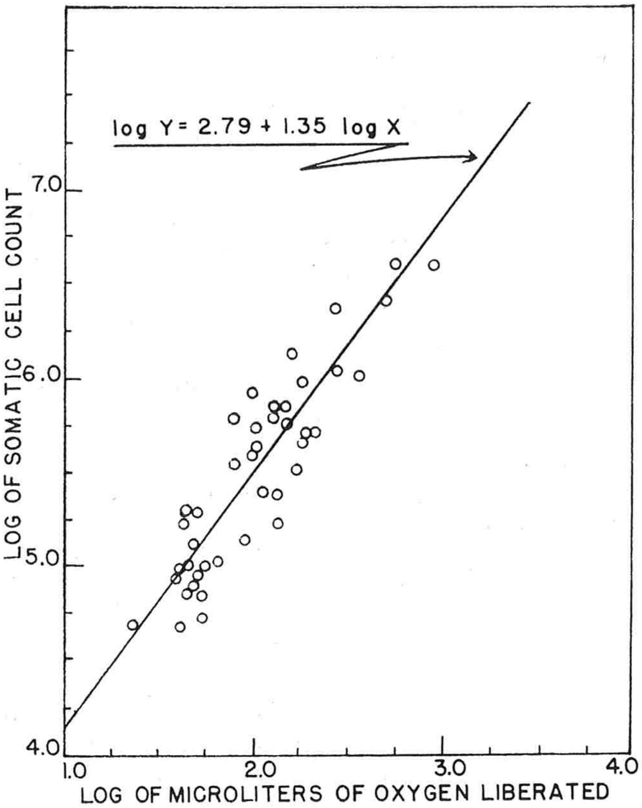


Figure 1. Relationship of the catalase activity of milk to the somatic cell count.

The data indicate that if the oxygen liberated in the catalase test is measured accurately, there is a very significant correlation between numbers of somatic cells and catalase activity.

*Effect of pH on catalase activity.*

The volume of oxygen liberated by 0.10 ml of raw milk in 30 min at 30 C from 0.50 ml of 1% hydrogen peroxide was determined at several pH values. The milk selected for this experiment was obtained from an animal known to have mastitis. Ellis' universal buffer, adjusted to the desired pH value by adding 0.10 N HCl or 0.10 N NaOH, was used to prepare a milk-buffer mixture (0.10 ml of milk + 1.4 ml of buffer). Catalase activity was determined over the pH range of 3.03 to 11.46.

Data plotted in Figure 2 indicate that catalase activity is maximal over the pH range of 5.64 to 10.74. The decrease in activity was less at pH values below 5.64 than at values above 10.74. No activity was evident at pH 11.46.

For comparison, a sample of blood taken aseptically from a cow was used to determine the effect of pH on catalase activity. The blood was defibrinated and diluted 1:1,000 with 0.85% saline. The data obtained was practically identical to that obtained with milk.

The results reported here, on catalase activity at different pH values, vary somewhat from the results obtained with other catalase preparations. Chance *(2)* reported that catalase activity was constant over the pH range of 4.0 to 8.5; above 8.5 activity decreased slowly and fell to about 20% at pH 11.4. Lovrien *(7)* noted that catalase activity decreased rapidly outside of the range of 3.8 to 10.0.

Variations in the pH of milk should have little effect on the catalase test for the detection of abnormal milk. Mastitis milk generally has a higher pH than normal milk but it never reaches the pH which interferes with catalase activity. Also, appreciable growth of lactic acid-producing bacteria in milk would be necessary to lower the pH value to the point that the enzyme would be inhibited.

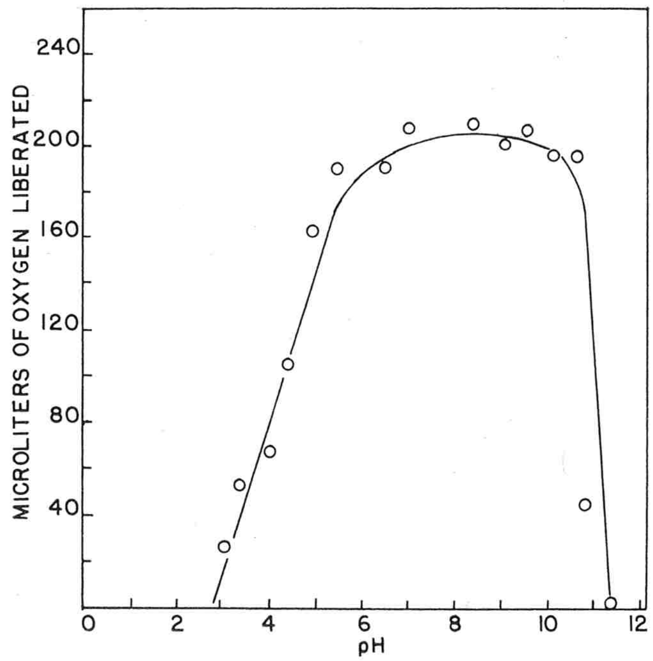


Figure 2. Influence of pH on the catalase activity of milk.

*Effect of temperature on catalase activity.*

Preliminary trials indicated that the optimum temperature for catalase activity in milk was within the range of 15 to 20 C. To establish the optimum temperature more closely, additional trials were conducted with a sample of milk containing 5,500,000 somatic cells per milliliter. A 0.1-ml portion of this sample was mixed with 1.40 ml of tris (hydroxy methyl) amino methane buffer adjusted to pH 7.2 with 0.1 N HCl.

Figure 3 shows that the optimum temperature for milk catalase activity is 18 C. However, values obtained at 15 and 22 C were very close to the optimum and those obtained at 10 and 25 C were almost identical and only slightly less than the optimum. The catalase activity of defibrinated cow blood was also maximal at 18 C. Morgulis et al. *(8)* noted

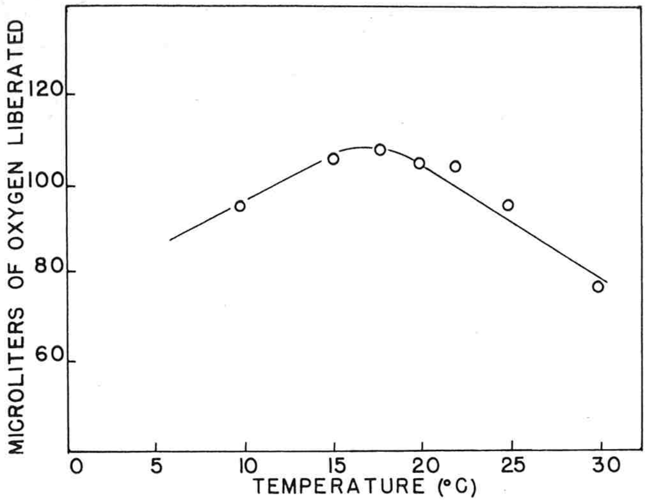


Figure 3. Influence of temperature on the catalase activity of milk.

TABLE 1. CATALASE ACTIVITY OF A PURE CULTURE OF *Staphylococcus aureus*

| Incubation time and temperature | Plate count per ml | Microliters of oxygen liberated |
|---|---|---|
| Trial 1 | | |
| Not incubated | 8 | 5.50 |
| 24 hr at 5 C | 8 | 3.70 |
| 48 hr at 5 C | 6 | 3.02 |
| 48 hr at 5 C + 3 hr at 37 C | 10 | 1.57 |
| Trial 2 | | |
| Not incubated | 380 | 2.16 |
| 24 hr at 5 C | 380 | 9.36 |
| 48 hr. at 5 C | 350 | 2.20 |
| 48 hr at 5 C + 3 hr at 37 C | 590 | 6.72 |

that catalase activity was greatest between 0 and 10 C. Loss of activity was much smaller between 10 and 20 C than between 20 and 30 C. Great loss of activity occurred between 30 and 40 C. Holding catalase for 1 hr at temperatures up to 40 C caused no inactivation of enzyme.

The temperature studies with milk and bovine blood catalase indicate that the catalase test should be conducted within the range of 10 to 25 C. Temperatures above 30 C should not be used even though recommended in some of the earlier published procedures.

*Catalase activity of Staphylococcus aureus.* The general opinion is that the catalase detected in milk originates from the cow and is associated with the leucocytes. However, S. *aureus* is a common cause of mastitis and it has a catalase enzyme. Experiments were conducted to determine whether catalase from S. *aureus* might interfere with the relationship of numbers of somatic cells to catalase activity.

A strain of S. *aureus,* isolated from mastitis milk, was added to sterile milk to obtain numbers comparable to those that might be found in raw mastitis milk. The inoculated milk was held at 5 C for 24 hr and for 48 hr, and at 37 C for 3 hr. Plate counts and catalase activity tests were conducted on the samples. Two trials were conducted; in one trial the initial count of S. *aureus* organisms was 8 per milliliter of milk, and in the other trial 380 per milliliter were present.

Data presented in Table 1 indicate that the strain of S. *aureus* used did not grow in milk at 5 C and very little growth occurred during 3 hr at 37 C. Consequently, little oxygen was liberated. If excessively large numbers of this organism were present they might have an influence on the catalase test. However, most samples of mastitis milk do not contain large numbers of the causative organism and growth is restricted by the holding temperature.

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# CORRELATION BETWEEN STANDARD PLATE COUNT AND FOUR DIRECT MICROSCOPIC COUNT PROCEDURES FOR MILK

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(Received for publication September 1, 1966)

SUMMARY

The standard plate count (SPC-32 C) and the direct microscopic count (DMC) of samples of commercially pasteurized milk inoculated with pure cultures of actively growing (18-24 hr growth) bacteria commonly found in milk were compared. Four staining procedures for DMC were used: *(a)* Levowitz-Weber's methylene blue stain; *(b)* a modified Levowitz-Weber stain incorporating basic fuchsin; *(c)* alcoholic-acetic acid fixation followed by periodic acid-bisulfite treatment and staining with $pH_4$ toluidine blue; and *(d)* alcoholic-acetic acid fixation and staining with $pH_4$ toluidine blue. Counting was standardized by the use of a geometrical pattern. Correlations between SPC and each DMC procedure, or among the DMC procedures were little influenced by the number of microscopic fields counted, their location on the smear or the definition of "clumping" used. Correlations were influenced by the type of bacterial culture inoculated in milk and by the staining procedure. Precision of DMC was shown to be independent from the staining procedure, but varied directly with the number of cells per field and inversely with the square root of the number of fields counted.

Standard plate counts (SPC), direct microscopic counts (DMC), and dye reduction methods are used interchangeably in the grading of raw milk. Frequently the disagreement between these methods is such that a substantial proportion of milk samples would be upgraded or downgraded depending on the grading method used *(2)*.

LaGrange and Nelson *(5)* reported that with pure cultures of various psychrophilic bacteria, SPC's invariably exceeded DMC's. They suggested that dispersal of clumps during dilution for SPC's was probably the main cause of the observed differences.

The distribution of bacteria in a microscopic smear has been shown to be non-uniform *(4)* and quite recently a definite ratio has been shown among leucocyte counts made from various positions on the microscopic smears *(7)*.

Although there is no report of a particular type of bacteria failing to stain by standard methods procedures, inadequate contrast with the background may, however, cause many cells to be overlooked or to be confused with artifacts in the smear. The type of bacteria in milk might conceivably be a factor in the discrepancy between SPC and DMC.

Since publication of the last edition of *Standard Methods for the Examination of Dairy Products (9)*, at least three new staining procedures have been proposed which show promise of being superior to procedures now in use. These are: *(a)* a modified Levowitz-Weber stain incorporating basic fuchsin in which bacteria are stained blue against a mottled pink background *(3); (b)* a periodic acid-bisulfite-toluidine blue staining procedure which is outstanding for staining bacteria in heat-processed or dried milk *(6);* and *(c)* a nucleic acid staining procedure using alcohol-acetic acid for fixation followed by staining with $pH_4$ toluidine blue. Stains described in *(b)* and *(c)* above stain bacteria purple against an absolutely featureless, colorless background *(6)*.

These new staining procedures were compared with SPC and with a procedure currently in use.

## EXPERIMENTAL METHODS

SPC's in duplicate were done according to *Standard Methods (9)*. Plates were incubated at 32 C for 48 hours.

All microscopic smears were prepared according to *Standard Methods (9)*. Breed pipettes were used to transfer milk from sample to smear. The staining procedures were used in accordance with the specific instructions of their originators.

Pure cultures of *Pseudomonas fluorescens, Escherichia coli, Pseudomonas fragi, Alcaligenes viscolactis, Aerobacter aerogenes, Micrococcus varians,* and *Bacillus subtilus* were grown in nutrient broth for 18 to 24 hours. Portions of each actively growing bacterial culture were added to 50 ml of commercially pasteurized milk of good quality (in all cases less than 3,000/ml by SPC).

A procedure for counting microscopic fields was developed and standardized. Figure 1 shows the geometrical pattern used for the selection of microscopic fields. A graduated mechanical stage was used to determine the geometrical pattern on each smear. A total of 60 microscopic fields was selected as follows: 18 fields along AB (horizontal); 18 fields along CD (vertical) and 6 fields along each of the following lines, IJ, KL, EF, and GH. The distance between fields along each line was selected so as to be fairly representative and was determined with the graduated mechanical stage.

Counts were made of individual cells and of clumps, defining "clump" as *(a)* like cells visibly connected (touching); *(b)* like cells within one cell diameter, and *(c)* like cells separated by a distance less than twice the smallest diameter of the two cells nearest each other, the present standard definition according to "Standard Methods" *(9)*. The four

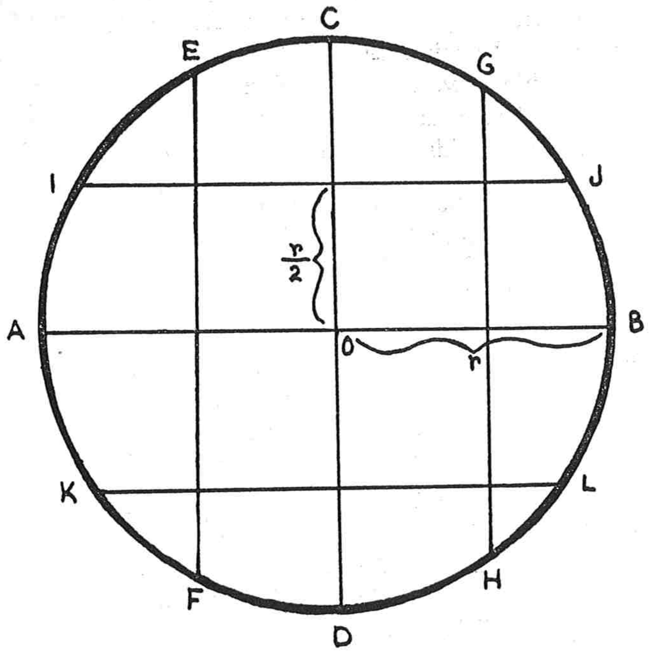


Figure 1. Geometrical pattern used for the selection of microscopic fields on smears.

counts were recorded for each microscopic field counted.

Counts per ml of milk were reported on the basis of 60 fields (total number of fields); on the basis of 36 fields (18 on AB and 18 on CD); on the basis of 18 horizontal fields (on AB); and on the basis of 18 vertical fields (on CD). In addition, two more counts were reported: one on the basis of 10 fields selected at random (5 on AB and 5 on CD), and the other on the basis of 5 fields selected at random along AB.

On the basis of SPC, bacteria populations investigated ranged from 180,000/ml to 60,000,000/ml.

A total of 132 microscopic smears was counted, that is, 33 sets of four smears: *Ps. fluorescens,* 7 replicate sets of four smears; *E. coli,* 5 sets; *M. varians,* 5 sets; *Ps. fragi,* 4 sets; *B. subtilus,* 4 sets; *A. aerogenes,* 4 sets; and *A. viscolactis,* 4 sets. Each smear was stained by one of the following procedures: Staining procedure A, Levowitz and Weber methylene blue stain *(9);* staining procedure B, a modified Levowitz and Weber methylene blue stain with basic fuchsin *(3);* staining procedure C, a periodic acid-bisulfite toluidine blue stain *(6);* and by staining procedure D, an alcoholic-acetic acid fixation, toluidine blue stain *(6).* A grand total of 7920 microscopic fields was counted (microscopic factor of 600,000); that is, 1980 microscopic fields for each staining procedure.

Results and discussion of the present study will be presented in three parts. Part one will deal with correlations between SPC and the four DMC procedures; part two will deal with correlation among the four DMC procedures; part three will deal with the precision of counting.

## Results and Discussion

*Correlations between SPC and DMC procedures.*

Table 1 shows the variations in correlation between SPC and DMC depending on the type of staining procedure used in DMC. Staining procedure D has the highest correlation with SPC. Inasmuch as SPC is a count of viable bacteria, staining procedure D appears to be more specific for viable bacteria than any of the other procedures.

Correlations between SPC and DMC's when the so-called "clump" definition was introduced are shown in Table 2. When staining procedures A, C, and D were used, the correlations between SPC and counts based on "touching" or "individual" were slightly higher than for counts based on "1 diameter" or "2 diameters". The number and the location of microscopic fields counted did not sensibly modify the correlations shown in Table 2, which were based on 60 fields per smear.

The correlations between SPC and DMC's for milk samples inoculated with various pure bacterial cultures are shown in Table 3. These correlations vary widely depending on the staining procedure and on the bacterial culture in the milk samples. Regardless of the staining procedure, SPC's and DMC's of milk inoculated with *Ps. fluorescens* or *A. aerogenes* were correlated significantly (all reference to statistical significance indicates significance at the 5% level of probability); SPC's and DMC's of milk inoculated with *B. subtilus,* however, were not correlated significantly. In milks inoculated with *E. coli* or *Ps. fragi,* SPC's and DMC's were correlated significantly except for staining procedure B. On the other hand, with procedure C, DMC's were not significantly correlated to their SPC for milks inoculated with *A. viscolactis* or *M. varians.*

Table 1. Correlation Between Standard Plate Count (SPC) and Four Direct Microscopic Count (DMC) Procedures—All Cultures by Number and Location of Microscopic Fields Counted

| Number and location of Field | Staining procedures[a] | | | |
|---|---|---|---|---|
| | A | B | C | D |
| 60 H[b] & V[c] | 0.906* | 0.857* | 0.864* | 0.952* |
| 36 H&V | 0.913* | 0.857* | 0.859* | 0.948* |
| 18 H | 0.912* | 0.846* | 0.870* | 0.941* |
| 18 V | 0.903* | 0.855* | 0.841* | 0.951* |
| 10 random H&V | 0.914* | 0.846* | 0.833* | 0.955* |
| 5 random H | 0.926* | 0.839* | 0.827* | 0.955* |

[a]A—Levowitz-Weber's methylene blue stain.
B—Duitschaever-Leggat's fuchsin modification of stain A.
C—Moat's alcoholic-acetic acid, periodic acid-bisulfite treatment and staining with $pH_4$ toluidine blue.
D—Moats' alcoholic-acetic acid treatment and staining with $pH_4$ toluidine blue.
[b]H—Horizontal.
[c]V—Vertical.
*Significant correlation at the 5% level (31 df)

TABLE 2. EFFECT OF "CLUMP DEFINITION" ON THE CORRELATION BETWEEN SPC AND FOUR DMC PROCEDURES (ALL CULTURES, 60 FIELDS COUNTED)

| "Clump" definition | Staining procedures[a] | | | |
|---|---|---|---|---|
| | A | B | C | D |
| Touching | 0.919* | 0.863* | 0.866* | 0.955* |
| 1 diameter | 0.900* | 0.860* | 0.863* | 0.949* |
| 2 diameters | 0.893* | 0.851* | 0.857* | 0.946* |
| Individual | 0.911* | 0.854* | 0.868* | 0.957* |

*Significant correlation at the 5% level (31 df).
[a]See Table 1.

TABLE 3. CORRELATION BETWEEN SPC AND FOUR DMC PROCEDURES FOR MILK SAMPLES INOCULATED WITH PURE BACTERIAL CULTURES (COUNTING ON 60 FIELDS H&V)

| Milk inoculated with: | df | Staining Procedures[a] | | | |
|---|---|---|---|---|---|
| | | A | B | C | D |
| *Ps. fluorescens* | 26 | 0.930* | 0.713* | 0.866* | 0.908* |
| *E. coli* | 18 | 0.858* | 0.429 | 0.685* | 0.917* |
| *Ps. fragi* | 14 | 0.659* | −0.163 | 0.890* | 0.752* |
| *A. viscolactis* | 14 | 0.567* | 0.676* | −0.138 | 0.606* |
| *A. aerogenes* | 14 | 0.767* | 0.833* | 0.860* | 0.942* |
| *M. varians* | 18 | 0.651* | 0.709* | 0.337 | 0.862* |
| *B. subtilus* | 14 | 0.146 | −0.063 | 0.369 | 0.306 |

[a]See Table 1.
*Significant correlation at the 5% level.

Within each bacterial culture, the variation in correlation between SPC and DMC depended on the staining procedure used. In general, correlations between SPC and DMC were most consistently high for staining procedure D.

In a previous study *(2)* where staining procedure A was used, the correlation between SPC and DMC varied widely for milk supplies from different geographical locations in the United States. In the present study, correlation between SPC and DMC (staining procedure A) varied according to the type of bacterial population inoculated in milk. It is possible, then, that differences in the predominant bacterial flora from different geographic sources might account for variations in correlation between SPC and DMC noted in the previous study.

When correlations between SPC and DMC's were calculated for each type of bacterial population on the basis of numbers of fields counted or on their location on the smear, the pattern was the same as that shown in Table 3 which was based on 60 fields.

Data for *Ps. fluorescens* was further broken down on the basis of "clump" definition, number of fields counted, and location on the smear. Regardless of the "clump" definition used, DMC's and SPC's were significantly correlated, except for staining procedure B. In this case, DMC's based on "individual" or "touching" were not correlated significantly with their SPC regardless of the number or location of microscopic fields counted.

*Correlations among the four DMC procedures.*

Table 4 shows the correlations among the DMC procedures when all the cultures are lumped together and when counting is reported on the basis of 60 microscopic fields. Correlation was highest between staining procedures A and D. On the other hand, correlation was lowest between staining procedures B and C. When counts were reported on the basis of number of microscopic fields counted, correlations among the DMC procedures varied little from the correlations shown in Table 4.

When the data relative to all cultures were divided according to the "clump" definitions, correlations among the DMC procedures changed little and were not affected by the number of microscopic fields counted or by their location on the smear.

Correlations among DMC procedures for milk samples inoculated with various types of bacterial populations are shown in Table 5. Counting was based on 60 microscopic fields. Staining procedures B and C were not significantly correlated for milk inoculated with *E. coli, Ps. fragi, A. viscolactis,* or *B. subtilus.* On the other hand, procedures B and C were significantly correlated for milk inoculated with *Ps. fluorescens, A. aerogenes,* or *M. varians.* Again, as between SPC and the four DMC procedures, neither the number of microscopic fields counted nor their location on the smear affected the correlations among the four DMC procedures.

TABLE 4. CORRELATION AMONG FOUR *DMC* PROCEDURES-ALL CULTURES WITH COUNTING ON 60 FIELDS H&V

| Staining[a] Procedures | B | C | D |
|---|---|---|---|
| A | 0.939* | 0.958* | 0.968* |
| B | | 0.854* | 0.904* |
| C | | | 0.950* |

*Significant at the 5% level (31 df).
[a]See Table 1.

These results show that correlations among various staining procedures depend on the type of organism inoculated in milk. This points to the danger of extrapolation of results based on a single type of bacterial culture to the correlation when mixed cultures are used. When data relative to *Ps. fluorescens* were analyzed, on the basis of "clump" definition, number of microscopic fields counted, and their location on the smear, correlations varied little among the four DMC procedures.

All the correlations in this report were calculated on the basis of actual counts. Nevertheless, a statistical analysis was made of the same data after transformation into logarithms. When the data were analyzed without reference to the type of bacterial population inoculated in milk, the correlations between SPC and DMC's and within the DMC procedures were slightly higher than when actual counts were used. On the other hand, the correlations were always slightly lower when the data were analyzed on the basis of individual types of bacteria. In general, the use of logarithms in lieu of actual counts did not sensibly modify the results, *B. subtilus* was a notable exception. When actual counts were analyzed, correlations between SPC and DMC procedures were non-significant regardless of the staining procedure. On the other hand, analysis of logarithms for *B. subtilus* showed low, but significant correlation between SPC and DMC for staining procedures C and D.

*Precision of DMC*

The accuracy of DMC is controlled by the systematic errors *(1)* which consistently produce results either too high or too low. On the other hand, the precision of DMC is controlled by the random errors *(1)* which introduce dispersion in the results.

In DMC, the term "accuracy" must be used with caution because there is no absolute standard for rating the accuracy of a procedure. On the other hand, the precision of DMC can be determined in terms of standard deviation, standard error, or confidence intervals. Although a confidence interval is usually expressed as percentage of the count per milliliter, we expressed it as percentage of the average bacterial count per field.

Bacteria are randomly distributed in a smear. So for the purpose of calculating precision, the counting of 60 fields in one smear is equivalent to the counting of one field in 60 smears of the same sample. Furthermore, the relative precision of DMC for counts based on 36, 18, 10, or 5 fields was calculated on the basis of the estimated standard error of the mean for counts of 60 microscopic fields.

Table 6 shows the influence of the level of bacterial population, on the precision of counting. Precision was shown to be significantly independent from the staining procedure, but was influenced significantly by the number of microscopic fields counted. Although only two staining procedures are shown in Table 6, the results apply to the other two staining procedures.

Over a wide range of counts the precision of counting is better when 60 microscopic fields are counted, but this is not practical. An adequate count, using a geometrical pattern to select microscopic fields, takes about 2 hours. The precision of counts based on 18 fields chosen horizontally and 18 fields chosen vertically is practically the same. On the other hand, the precision for counts based on 10 random field is low for low-count milk, but is acceptable for high-count milk. The precision of counts based on five fields selected at random is quite low even for high-count milk.

Table 5. Correlation Among Four DMC Procedures for Milk Samples Inoculated With Pure Bacterial Cultures (Counting on 60 Fields H&V)

| Staining[a] Procedure | *Ps. fluorescens* | | | *E. coli* | | | *Ps. fragi* | | |
|---|---|---|---|---|---|---|---|---|---|
| | B | C | D | B | C | D | B | C | D |
| A | 0.809* | 0.944* | 0.978* | 0.784* | 0.622* | 0.910* | 0.376 | 0.764* | 0.982* |
| B | | 0.625* | 0.736* | | 0.119 | 0.488* | | –0.28 | 0.237 |
| C | | | 0.977* | | | 0.721* | | | 0.852* |

| Staining[a] Procedure | *A. viscolactis* | | | *A. aerogenes* | | | *M. varians* | | |
|---|---|---|---|---|---|---|---|---|---|
| | B | C | D | B | C | D | B | C | D |
| A | 0.938* | 0.552* | 0.942* | 0.990* | 0.982* | 0.869* | 0.907* | 0.910* | 0.839* |
| B | | 0.320 | 0.940* | | 0.986* | 0.919* | | 0.742* | 0.765* |
| C | | | 0.487 | | | 0.921* | | | 0.645* |

| Staining[a] Procedure | *B. subtilus* | | |
|---|---|---|---|
| | B | C | D |
| A | 0.345ns | 0.849* | 0.926* |
| B | | 0.400ns | 0.176ns |
| C | | | 0.944* |

*Significant at the 5% level.

[a]See Table 1.

TABLE 6. PRECISION OF DMC EXPRESSED AS 95% CONFIDENCE INTERVAL IN TERMS OF PERCENTAGE OF AVERAGE NUMBER OF BACTERIA PER FIELD AND BASED ON THE ESTIMATED STANDARD ERROR OF THE MEAN COUNTS USING 60 FIELDS H & V — VARIATION IN PRECISION DUE TO LEVEL OF BACTERIAL POPULATION, STAINING PROCEDURE, NUMBER AND LOCATION OF MICROSCOPIC FIELDS COUNTED

| | Average number of bacteria per field | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0.72 | | 4.83 | | 11.3 | | 40.0 | |
| Staining procedure[a] | A | D | A | D | A | D | A | D |
| Number and location of field | Percent deviation from mean of the 95% confidence interval | | | | | | | |
| 60 H & V[b] | 23.7 | 27.6 | 10.2 | 10.7 | 8.4 | 8.0 | 7.1 | 7.3 |
| 36 H & V | 27.9 | 32.0 | 16.3 | 15.7 | 12.3 | 11.7 | 10.3 | 9.9 |
| 18 H | 38.9 | 46.1 | 24.8 | 24.1 | 16.1 | 18.2 | 14.9 | 15.6 |
| 18 V | 41.7 | 50.0 | 23.0 | 22.8 | 21.3 | 16.2 | 15.3 | 13.8 |
| 10 random H & V | 79.2 | 86.7 | 36.7 | 41.5 | 27.1 | 25.7 | 23.2 | 22.3 |
| 5 random H | 117.1 | 89.0 | 68.7 | 81.6 | 46.1 | 47.4 | 42.1 | 47.0 |

[a]See Table 1.
[b]H = Horizontal
V = Vertical

Routine examination of milk samples by DMC, by counting five fields selected at random horizontally, does not appear to give adequate precision. For low-count milk 18 fields will give adequate precision, and for high-count milk 10 fields will give adequate precision.

While this report was being prepared, a paper by Schneider and Jasper *(8)* came to our attention. Their results on the precision of microscopic count of somatic cells( that it varies inversely with the working factor, i.e., the number of microscopic fields counted, and directly with the actual cell content) were similar to the variation of precision reported in the present study for direct microscopic counts of bacteria in milk.

Their results, as well as ours, are consistent with the Poisson distribution principles *(1)* that the precision of direct microscopic counts is a function of two variables, the number of fields counted and the number of cells per field (Table 6).

## CONCLUSIONS

1. Correlation between SPC and DMC was influenced by the type of bacteria present in the milk. Type of bacteria present also influenced the correlations among the DMC procedures.

2. Correlations between SPC and DMC, and among four DMC procedures, were little influenced by the number of microscopic fields counted or by their location on the smear. Furthermore, the definition of "clumping" did not much affect the correlations between SPC and DMC procedures nor those among the four DMC procedures.

3. Correlation between SPC and the four DMC procedures varied according to the staining procedure used. Staining procedure D, an alcohol-acetic acid fixation followed by staining with $pH_4$ toluidine blue, appeared to be more specific for viable bacteria than any of the other staining procedures tested.

4. The precision of direct microscopic counting varied directly with the number of cells in the milk sample, but varied inversely with the square root of the number of fields counted. Because precision was low when counts were based on 5 fields selected at random, we recommend the use of 10 fields selected at random (5 horizontally and 5 vertically) for milk samples with high cell counts and of 18 fields horizontally or vertically for samples with low cell counts.

## ACKNOWLEDGMENTS

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# REPRODUCIBLE VOLUME DELIVERED BY AN 0.01 ML "LOOP"

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Summary

A platinum cylinder is described which may be used in place of a standard loop to give improved accuracy.

Jasper and Dellinger *(2)* recently made a thorough study of the variations in volume of milk delivered by a standard 0.01-ml loop. The volume was found to depend on the speed and angle of withdrawal of the loop and providing these two factors were kept under control the variation in volume delivered was found not to be too great for the purpose of making leukocyte counts in milk. However, it is clear that the variability must depend on the skill of the worker and it seems probable that if the variation between workers were included the total variation would be greater than that which was recorded. If something more accurate than an ordinary loop were available it would be *(a)* less dependent on a high level of skill in use or *(b)* available for more precise work.

As Jasper and Dellinger point out, the volume withdrawn by the loop is a function of the shape of the liquid-air interface. Thus the smaller this interface can be relative to the volume, other things being equal, the more reproducible will the volume be. Reducing the interface leads eventually to the capillary pipette, and the convenience of a loop has been sacrificed. A cylinder open both ends and of suitable dimensions forms an attractive compromise. A platinum cylinder 0.2 mm thick, 3 mm long and 2 mm in diameter (volume = .00943 ml) was tested by Berridge *(1)*. It was welded to a platinum wire 0.5 mm in diameter at right angles to the axis of the cylinder.

## Results

In a set of experiments to determine the reproducibility of volumes transferred by means of this cylinder, several workers were asked to make transfers in triplicate with no instructions or previous practice. The first group was seven in number and included inexperienced laboratory assistants and one engineer. The volumes transferred were measured by using 5.0 N hydrochloric acid, rinsing, and titrating with 0.25 N caustic alkali in a stream of nitrogen using an "Agla" micrometer syringe. In this experiment the individual values ranged from 86 to 118% of the general mean.

After this, five of the assistants were asked to repeat the experiment according to a set of instructions which was now provided. In this case the individual values ranged from 95 to 105% of the general mean, the spread for each worker being considerably smaller.

Contrary to expectation, the cylinder was found to be easy to keep clean. The only precaution beyond that used for an ordinary loop was to rinse once with distilled water before flaming to avoid the excessive accumulation of ash.

## Conclusion

It is clear that a cylinder of this type is capable of higher reproducibility than is a normal loop and that it is less dependent on the skill of the worker.

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# SANITATION PROBLEMS IN FOOD VENDING MACHINES[1]

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Food machines are not a public health problem as long as they are constructed and operated in compliance with the Code *(1)*.

One method of problem solving consists of an awareness of the possibility of a problem and the consequent action for the preparation of materials and methods for its prevention. This has been the situation with food vending machines. A brief account of the developments in food vending machines with respect to public health will provide a better understanding of the present situation.

Approximately ten years ago the National Automatic Merchandising Association (NAMA) added a staff member whose sole responsibility is public health. In addition, the NAMA voluntarily formed a council of health advisors composed of representatives from all of the national public health organizations which have an interest in the general area of food protection. This includes the IAMFES, as an example. The council membership includes people from state, local and federal governmental agencies, the universities, the armed forces, professional organizations and industry. The council has not and does not endorse or approve anything. It recommends policies and procedures to the NAMA which, incidentally, has implemented every recommendation made to it. Thus, the NAMA, a self regulating voluntary group, formed the Automatic Merchandising Health Industry Council (AMHIC) which tries to anticipate problems relating to the vending of foods and recommends procedures for their prevention. The success of this industry in policing itself by working with governmental and professional groups is an outstanding example of the public health policy of cooperation instead of coercion.

## SOME PROBLEMS AND ACCOMPLISHMENTS

A review of the AMHIC minutes for the 1965 meeting will provide a general idea of the scope, depth, and attention to detail which the council gave to possible problems in food vending machines. The problems and situations reviewed in the following paragraphs are not listed in order of relative importance.

There is a need for better communication within the industry in order to bring health accomplishments to industry at desirable levels of management. Included in this were the steps taken to keep the directors and members more fully informed.

Interpretation of Vending Code of the U. S. Public Health Service by the NAMA and the NSF should be more uniform. During 1965 the correspondence relating to machine approval, listing, and identification indicated that all problems were settled satisfactorily. Continuous efforts are made by all agencies to further good relations and promote uniformity. Those who have had experience with the Milk Code, the Restaurant Code or with Standard Methods for the Analysis of Milk or Water know that it takes many years to achieve uniformity of interpretation. This is a continuing situation which is really not a problem as various solutions are evident. However, it merits constant attention and the demonstration schools for instruction in machine inspection attest to its importance. Any health department wishing to train its sanitarians in the inspection of food vending machines has merely to request that help from the Public Health Counsel of the NAMA.

Emphasis was given to the importance of the 45 F milk temperature requirement in the Milk Code and its relationship to the Vending Code. Probably the most important aspect of food vending relates to control of temperature. The Vending Code specifies that "Potentially hazardous food within the vending machine shall be maintained at a temperature of 45 F or below or 140 F or above, whichever is applicable". Regulatory agencies spend considerable time and effort in the seemingly never ending work of convincing commissary operators that holding foods at either cold or hot temperatures is an excellent method for the prevention of food poisoning. Obviously, temperature control is not the only method for the prevention of food poisoning and other equally important items will come to mind, such as hygienic practices and environmental cleanliness; but temperature control is a problem.

[1]Presented at the 53rd Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians, Inc., in Minneapolis, Minnesota, August 15-18, 1966.

### Evaluation of Equipment Design and Operation

Recognizing the logic and value of the Code requirements, the NAMA enlisted the help of two universities to act in the capacity of evaluating agencies. Their job consists of the interpretation of the Public Health Service Code by means of a manual provided by AMHIC. All new machines are examined against a detailed checklist and manufacturers whose equipment meets the requirements are issued a Letter of Compliance which indicates to all health departments that the machine was built to conform with the specifications of the Code.

The experience of the evaluating agencies to date has been that the manufacturers have cooperated 100% in trying to meet the health requirements. It is to their benefit to do so, as operators of machines will not purchase them unless they are assured that each model has been examined and has been approved for the Letter of Compliance. The NAMA publishes an annual list of approved machines and this is available on request. The system of examination and approval has prevented many situations from becoming problems and the professional public health workers who have been a part of AMHIC can point with pride to a decade of experience without a single case of food poisoning which can be related to machine construction. Note that the operation of a machine is a matter entirely separate from its construction, and this is a problem in food vending.

### Need for Educating the Operator

The best mechanical device ever made, be it an automobile or a vending machine, cannot and will not function properly unless the operator understands the conditions under which it is to be used and how to use it. If he has a commissary which does not pass the Restaurant Code, then he might possibly make a mistake in the kind of food which he offers for sale. If he does not store, transport or handle perishable products the way he should, the machine will not correct his mistakes. It is up to local health departments to determine these facets of food preparation and handling. Good food in good condition put into a vending machine will stay that way if the operator keeps his machine clean and in first class working order. If he is negligent concerning the type of foods and the care of his equipment, then it is up to the sanitarian to investigate the situation and apply corrective measures where indicated.

If one had to name the primary problem in food vending, it would probably be the relationship of the local health department with the commissary supplying the operator and this would include the manner in which the machines are operated. In the few instances wherein some sickness has been reported in relation to food and beverage vending machines, it has been determined that some change in machine construction was made locally.

Changes in the Manual were recommended by the council and the details were left to the Secretary. Also there was a recommendation that publication of summaries of federal, state and local regulations be continued. Included in this was information on vegetable base lighteners and a $CO_2$ cylinder safety manual.

Additional discussion related to the implementation of a program for rechecking machines to be sure of continued compliance. The attention of the group was directed briefly to the use of soda pop bottles for vending milk. This has not become widespread and does not constitute a problem in food vending machines. Similarly, there was a report on the characteristics of the new non-nutritive sweeteners being used in syrups.

### Importance of Proper Operation

In summary, sanitation problems arise from the manner in which a machine is operated. It was pointed out that the temperature control is a major problem and requires constant attention. The machines are not perfect but the manufacturers are willing and anxious to adopt changes in their methods if the Automatic Merchandising Health Industry Council recommends that they do so. It is possible to keep the equipment in first class operating condition and to take great care in the preparation, transportation and storage of perishable foods. Health department personnel whose duties involve the sanitation of food vending machines can do a great deal to prevent the occurrence of a problem by working closely with the various groups in this industry.

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# SANITATION PROBLEMS IN UTILIZATION OF AMERICAN DAIRY PRODUCTS OVERSEAS[1]

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Dairy products of the United States have been shipped overseas in vast quantity, until the recent downturn in production. With lagging food production, in contrast to expanding population growth, the need for dairy products is greater than ever and will remain so in the foreseeable future. Under the impetus of market development and with slowly improving economies, the commercial demand has likewise grown spectacularly and this would continue if U. S. products were available for export.

Most U. S. products are mixed with and supplement local production. This implies responsibility and challenges. The adverse conditions which challenge overseas operators are water, archaic food laws, untrained personnel and consumer indifference or lack of understanding. Sanitation is a key factor in processing, packaging and marketing dairy products overseas.

In the early fifties a significant U. S. effort, commonly referred to as Point IV or the Marshall Plan, was made to help rebuild a war-scarred Europe. It was also in this period that truly massive quantities of U. S. food and fiber began to move overseas regularly as a newly emerging American aid pattern. Under both these efforts we learned as never before the bitter truth about all aspects of sanitation and we encountered many other technical challenges in food processing and distribution.

The permissive legislation for a continuation of these programs was Public Law 480. It's successor today, tailored and modified to meet new conditions, is referred to as the Freedom From Hunger legislation.

PL480 was responsible for a great range of activities which are underway today. Most of these programs have been beneficial to the U. S. Agricultural Community. It would be utterly futile to try and elaborate on more than a few. Therefore, I shall confine my comments to the ones relating to the subject assigned to me.

[1]Presented at the 53rd Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians, Inc., Minneapolis, Minn., August 15-18, 1966.

## The DSI Program

Dairy Society International, drawing on and applying the superior technical skills and expertise of U. S. industry in a combined industry/government effort, has worked to increase our export of dairy products. An automatic side effect as we have increased our marketing, is that to a large degree technology must accompany the product; and this has the additional benefit of teaching improved techniques overseas and, in the broadest sense, developing local economics.

Most of you know the enormity of the flow of American dairy products going overseas. Secretary Freeman last May noted that we have shipped truly staggering amounts – over 6 billion lbs. of nonfat dry milk, 1/4 billion lbs. of evaporated and condensed, 23 million lbs. of dry whole milk, 3/4 billion lbs. of cheese, and 1/4 billion lbs. of butteroil. As a part of these totals our *commercial* sales, until the present U. S. production drop downward, had risen from an obscure beginning in the mid-fifties to nearly $300 million annually.

To a large extent American dairy products moving overseas are used to supplement local supplies. This assumes, of course, that there is a local dairy industry —and there is one, in various stages of development in almost every country. The only exception to this supplemental use is illustrated by the Japan school lunch project which features reconstituted U. S. nonfat dry milk for children; and a part of the Alliance For Progress effort initiated under President Kennedy which also features milk included in the school lunches, and this reaches a high percentage of children in Latin America.

Because our dairy products generally do get mixed with local products, we have a two-fold involvement and challenge:

1. We must expect to bear some responsibility for the consumer attitude toward dairy products. In this respect, no matter how high the quality of U. S. products when shipped from the U. S., this seldom is distinguishable when it reaches the consumer.

2. If U. S. commercial sales are to increase, a part of every overseas program must be devoted to up-

grading and increasing the dairy products and, in general, all food product in the market place. This applies both qualitatively and quantitatively.

This latter point has taken on new political, economic and even humanitarian overtones in recent weeks inasmuch as the U. S. has officially committed itself to augment help to friendly developing nations —those which show evidence of helping themselves— in order to reserve the alarming reality of lagging food production.

## Need For Sanitation Education

Our Point IV specialists who were assigned overseas were both appalled and frustrated by their inability to fully accomplish their assignments. And very often at the heart of their dilemma was failure to achieve responsive understanding on sanitation questions. As more U. S. personnel was dispatched overseas under various programs, as voluntary agencies such as CARE and Church World Service became operational and as the multilateral development training efforts got underway, principally by UNICEF and FAO, in almost every instance it became apparent that little progress would be made without first attacking the lack of understanding about sanitation.

There are particular problems for each segment of the industry involved. The producer of the products in the U. S. to avoid trouble must build to higher sanitation standards to meet the rigorous conditions of overseas transport and marketing practices. This applies to both the product itself and the packaging. The plant operator overseas, should it be a U. S. interest either alone or combined with local industry, will encounter unimaginable difficulties, principally stemming from lack of clear-cut food laws, governmental ineptitude, pilferage, and most of all the lack of trained personnel.

## Programs For Supplying Trained Personnel

The technological training of necessary personnel is by far the most difficult problem of all. It stems from the inadequacies in the educational systems in the developing countries, and the inability of qualified students to attend institutions offering specialized training.

All agencies including UNICEF/FAO, the nonprofit Foundations and many forward thinking governments, are giving priority attention to this bottleneck. Thousands of students are enrolled in institutions of higher learning both in the U. S. and in other advanced countries. The great majority are subsidized. All too often however, the student likes the life in the advanced country and is reluctant, even conniving, about returning home where his skills are desperately needed. This stipulation must be clearly understood and applied to all before any student is sanctioned for study.

A stop-gap measure to speed up training are the short courses offered by FAO, Denmark and other countries. These are usually offered on a regional basis and the best qualified workers in plants are selected. DSI trained over 100 plant operators in Colombia and an immediate improvement was noted in the quality of milk. The curricula offered resemble the short courses offered by Land Grant Colleges in the U. S.

The approach to building the market must retreat to conditions fifty or more years ago and use simple uncomplicated systems and materials. Our market development experience has proven these facts beyond dispute. DSI undertook the role of dairy Cooperator with the Foreign Agricultural Service of USDA in 1956, another key provison of PL480. Our purpose in this program was the development of commercial markets for U. S. dairy products.

## Conditions Encountered

Where information on a country's dairy industry was insufficient we sent qualified experts to seek out the pertinent facts on the status of dairy development. Some fifty of these intensive studies have been made as preludes to undertaking some form of market development work by DSI and the local industry. I do not know of one such survey which has not underscored the need to upgrade sanitation practices. Most often the lack of even elemental sanitation is noted at the farm level where it is not uncommon to find wet-hand milking, no prewashing of cows, straining milk through filthy discarded cloth and little attention, if any, given to farm cooling.

I want to make clear here that any countries mentioned in the following discussion are chosen for no other purpose than to illustrate conditions of a general nature in the early stages of development. And I am encouraged to report that in almost every case great improvements would be noted with these same problems if one were to observe the practices after our technical programs were underway a while.

Early in Israel's monumental development Bernard K. Schuman, Dairy Sanitation Consultant, in his summary report dated June 10, 1958, made these comments:

"The problem in the production of good quality raw milk in Israel bears serious implication. It is primarily one of economics. Nearly fifteen percent of the milk produced for shipment to dairy plants is lost because the quality is such that it is not acceptable for processing or that it will not stand up under temperatures required for pasteurizing or sterilizing. This simple fact is the major reason for an all out effort to improve the quality of milk produced on the farms of Israel.

"Animal housing ranges from fair to excellent. Poorly cleaned stables and lounging areas with heavy fly infestation are common. Damp, manure sodden yards and pens and areas adjacent to stables are sources of flank and udder crusting, resulting in unsanitary milking practices. Animals are not clipped, or infrequently clipped, making it nearly impossible to keep manure and other soils from being introduced into milk at milking time. Heavy fly infestations on most dairy farms were evidently due to the traditional practice of banking or piling manure in huge packs. Often cattle would have serious eye infections spread throughout the herd by such swarms of flies.

"Most of the hand milking equipment (pails, strainers, and transport cans) are of poor sanitary construction, with beaded and open seams and fine wire screen strainers. Many are dented and rusted beyond the point of being satisfactorily cleaned and sanitized. Single service cotton or flannel strainer pads are not yet available at costs favoring their use on small farms.

"Although this is not a direct problem in the production of high quality of raw milk, it is most certainly a contributing factor. The pH and mineral and salt contents of water vary greatly from one area to another. The effectiveness and performance of dairy cleaners and sanitizers are related directly to the kind of water they are mixed with.

"At present the Israeli Dairy Farmer is not trained in milk production methods as he must be. His responsibilities have not been defined for him. Given training, good tools (utensils, cans, cleaners and sanitizers) and the understanding that he must meet his responsibility of producing satisfactory quality raw milk, the Israeli will do much to make dairy farming a more successful economic venture."

The same observations might equally apply to another 70 or 80 countries, even today, although I emphasize that encouraging progress is underway.

## VALUE OF TRADE FAIR DEMONSTRATIONS

Another technique to stimulate improvement which DSI has successfully employed is the Trade Fair. In approximately half of the forty-five in which we have participated, on every continent except Australia, we have installed on the floor of the exhibit a fully operational model dairy plant. The majority have featured the recombining of U. S. produced ingredients and the manufacture, before the eyes of the startled public, of everything from regular and chocolate milk to multi-flavored ice creams. In the production cycle we have demonstrated proper pasteurization, homogenization, cooling, packaging (both glass and paper) and storage.

The convincibility of our demonstrations has been overwhelmingly proven because in many cases, for example, in Yugoslavia, Japan, India, Egypt, Spain, W. Germany and Colombia, components of or all the processing equipment have been purchased and remain in the country to increase the availability of properly processed milk products.

Setting up and operating such Fair demonstrations often is a logistical nightmare. The training of the help in the simplest sanitation procedures often takes days and unending supervision throughout the Show.

Our files are full of testimonials regarding the beneficial effects of these Trade Fair demonstrations. Conservatively, several thousand career dairymen have been reached with the fundamental lessons of modern sanitation procedures as well as proper engineering to achieve processing efficiency and ease of cleanup. Total public attendance count at the Fairs where dairy products have been featured has exceeded 100 million and a large percentage of these potential customers have tasted products recombined from our U. S. ingredients. Their most frequent request is "Why can't we buy products like these daily?" Our followup job after this demonstrating of the latent demand is to inspire local industry to improve their procedures and thus increase their marketing.

## RESPONSIBILITIES OF RESIDENT DSI DIRECTORS

By far the most challenging test comes in market development when a resident DSI director is assigned on a long term basis—three or more years—in a foreign country. To date, the Society has conducted such programs in Colombia, Chile, Lebanon and Thailand. Obviously, such countries are chosen because they offer excellent prospects for relatively rapid commercial development of the dairy industry with the subsequent promise of a significant rise in per capita consumption.

The first hurdle is to create genuine and sustaining interest on the part of all affected people, for without it your best efforts may be doomed to utter failure. Primarily, the director must reach the government officials—industry, public health, transportation, to name a few—and gain their active support. The competitive companies in the market, once they understand the probability of increased business for themselves will frequently cooperate both with money and services. Once the processing plants are on stream, producing quality products, the last obvious target is the consumer.

Let's look at each of these steps in more depth, based on our work in Thailand. Dorothy McCann directed DSI's market development program there for six years. When she began, no semblance of a modern dairy producer or processing plant existed, although a U. S. company was just completing a modern fully-integrated facility. The main fare of dairy products was imported sweetened condensed plus varieties of flavored water ice, unworthy of the name of ice cream.

Mrs. McCann's reports candidly appraise the difficulties. She accurately notes that in most developing tropical countries there is almost total ignorance of the need for sanitary food standards or practices as we understand them. There is no screening and no refrigeration in the average home, and ants, roaches, rats are accepted as necessary evils. Food, consequently, is bought for only one meal at a time and consumed in the same manner. Charcoal is usually the only fuel and it is costly enough so that its use is limited to cooking. Certainly it is not used to heat water for washing or sterilizing dishes or utensils. True, wherever possible, utensils are dried in the sun, but uncovered they are not immune from other contamination.

Only the better educated, more sophisticated realize that there is a relationship between cleanliness and health. The people may be very clean about their persons and not recognize the importance of cleanliness in other ways. Water, for example, is thought to be a cleanser even if the same river or canal is used for swimming and bath, brushing one's teeth, cleaning vegetables, eviscerating chickens, or even a disposal for raw sewage.

The average citizen is accustomed to buying the scarce available milk only in bulk. He frequently sees and smells the filthy city stables—or milk being taken to the plant in cans without tops but rather stuffed with hay to keep the milk from spilling out. He knows that as the peddler's milk supply gets lower in the can, he dilutes it with water from the nearest source. He is accustomed to boiling such milk for his children but he never drinks it himself.

## Utilization of Health Personnel

In these countries there are no effective sanitary regulations and the ones in use have been borrowed from some advanced country twenty or thirty years ago. In any case, they usually do not have sufficient funds to have inspectors, if, indeed trained inspectors would be available.

It is important to know the health department people, not only at the top levels but even more importantly those people who are responsible for the day-to-day activities. Persuading them to visit the plant is vital because they observe the attention to pure, tested and controlled water supplies, cleanliness and health examinations of employees, daily freshly laundered uniforms, required showers and other hygienic regulations—all this in addition to the closely supervised production, processing, and the laboratory controls, daily in-place cleaning and sanitizing of all equipment, etc.

A commercial milk plant beginning operations in a country like this has a long and difficult task in training people to understand the need for following instructions that seem like wasted energy to them. Often they don't want to wear uniforms. The bottle inspector is careless, and rusty wires, glass, or just mud or bugs may be left in the bottles. The person in the laboratory relaxes and doesn't check bacterial counts or acidity as he should. The delivery man doesn't put enough ice/salt on the milk and a whole lot is soured but he delivers it anyway because he doesn't want to bring it back. Between the refrigerated ice cream truck and the store, with outside temperatures near 110°F, the ice cream softens to a degree. If too many boxes are carelessly pushed into a cabinet, the lids become dislodged and the ice cream is not only ruined in appearance but contaminated.

All kinds of perils and economic losses occur when the store operator, until taught differently, pulls the electrical plug on the ice cream cabinet each night because "it saves electricity".

Should there be an epidemic of cholera, as occurred once, the newspaper headlines might read: "If you want to be dead, eat ice cream or drink milk." Such wholesale condemnation can undo the work of years in building an understanding of the need for milk products for better health, growth, longevity, etc. Happily, in this case, the doctor in charge of the national health department responded at once to a call for help, and issued a statement endorsing the products of the milk plant as being the only safe ones to consume, and condemning those of the itinerant vendors as being unsafe, and dangerous. As a result, the scare headlines were a help but it might have gone the other way.

If there are competitors in a country, it is well to get them together to try to work with them in developing proper sanitary and quality standards. One must show them how to capitalize on such a program by enlisting the support of the health department and publicizing improvements through the schools, teachers, doctors, nurses, and all available media. Education will awaken individuals and governments to the importance of sanitary standards for the individual and every food industry.

## Ultimate Value of the Program

To demonstrate how effectively these needs were met in Thailand, here is a brief synopsis of DSI's terminal report:

"In 1956, pasteurized milk and milk products were unknown in Thailand. By the end of 1963, there were numerous school, home, and commercial delivery routes in Bangkok, and the commercial routes stretched out in a radius of

90 miles. Not only was there a fast growing acceptance of whole (65%) and flavored milks, but there were 15 flavors of ice cream or sherbet, cottage cheese, sour cream, whipped cream, yogurt, buttermilk, and novelties such as drumsticks. It was estimated that at least 60% of the regular customers were local citizens.

"To accomplish this, an educational, promotional, and sampling program was undertaken in schools (nursery schools through universities)—with government agencies and offices from the ministries down; all departments of defense in the Bangkok area; all commercial and industrial companies; clubs, associations. Publications were prepared based on outstanding authoritative nutrition data. These were distributed throughout the schools and offices, etc., supplemented with an illustrated cartoon flip chart talk. Never before had this been done. The nutrition publications were highly valued. Store demonstrations were held, and sampling was undertaken at charity, school, and sporting events, including athletes training for international meets. In the last year, as sampling was discontinued, funds were directed to an advertising program on TV and cinemas, extensive newspaper publicity, etc."

As a consequence of the milk plant established in Bangkok, new jobs have been created and new skills taught to hundreds of Thais. The local and national economy have been boosted greatly by the use of many Thai agricultural and industrial products, patronizing of service organizations, and paying of numerous taxes. Moreover, the growing awareness of U. S. milk products and the importance of milk in the daily diet has stimulated considerable competition in a country where just a few years ago it was said "Thais won't drink milk".

As a part of the market development, technical guidance is a full time and continuing job. New plateaus require new concepts. This is illustrated by the DSI educational brochure on butter. This is technical in nature reminding buyer and seller that butter must be bought by specifications, if quality is to be guaranteed. It goes on to describe safe shipping and packaging materials, proper storage temperatures both during transit, at the wholesaler's storage and in the retailer's case. If a foreign importer would follow these suggestions to the letter, it is highly unlikely that quality problems would arise and probable that a growing trade would develop due to consumer satisfaction and confidence.

We feel so strongly about the value of this type of guide for buyers, based upon comments and approvals from around the world, that we have underway the development of similar ones on nonfat dry milk and toning. At a later stage we may do others on cheese and specialty dairy products.

As I have suggested, sanitation is linked to every facet of moving, exporting and using our dairy products overseas. Exports will improve in direct ratio to the solution of sanitation problems. We have underway sound programs toward this end and I am confident that our future holds promise.

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## THE SANITARIAN*

There are times when I get weary of this day in—day out grind.
There are times when I'm disgusted and think I'll lose my mind.
Then there are time when money's scarce and those times become more frequent.
My account's overdrawn, my savings shrink and my bills are all delinquent.

Now I've a little girl named Tru, she's about the age of eight.
She has a lot of playmates, and in my yard they congregate.
The other day I overheard quite a lengthy conversation,
On the merits of different fathers, primarily occupation.

There were bankers, welders, airplane drivers, doctors, lawyers, deepsea divers.
Then silence fell as True began, "MY daddy is a Sanitarian."
The other girls grew open eyed and silent as a cat.
Then Sandra spoke the mind of all. "Just what in the world is that?"

"Well, without my dad you couldn't eat a solitary bite.
Unless you took the chance of being very sick all night.
You couldn't drink a glass of milk, or eat a piece of pie.
'Cause if you did you might get sick, and maybe even die."

"And you couldn't go in swimming, who'd see if the water was nice?
You couldn't have an ice cream cone, or eat a piece of ice.
The streets and alleys would be a mess with garbage everywhere.
And things would be real smelly if my daddy wasn't there."

"Course I might be exaggerating, Things might not be that bad
But they certainly could happen if it weren't for men like dad.
Oh there's lot and lots of other things my daddy has to do.
But it takes too long to tell them so I've only named a few."

I look down at my shirt cuffs.
They were frayed just like my collar.
I looked around at the furniture.
It was worthless as a dollar.
Our car out in the driveway—it's completely second-hand.
But I have my badge of honor. I'm a Sanitarian.

For if our kids live longer in this world that we safe-guard,
That's worth more than money and will be enough reward.

So now I stand up straighter with my shoulders squared away.
My step is sure, my eyes are bright as I go to face the day.
And if you really care to—step up and shake the hand
Of a guy that's really proud to be a SANITARIAN.

ANON

*From the Maryland Association of Sanitarians Newsletter.

# THE ROLE OF ACIDS IN DAIRY AND FOOD EQUIPMENT SANITATION[1]

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The attainment of soil-free milk and food production, transport, storage, processing and service equipment devoid of bacterial population is an undertaking which has been so simplified and standardized in technique that individuals of average I.Q. may be expected to perform it effectively. Nevertheless, it involves a rather complex, inter-related series of physical, chemical, and biological actions and reactions. The pH levels of wash and sanitizing solutions and of post-wash rinse waters determine the rates and magnitudes of the chemical reactions involved, encourage certain advantageous physical phenomena sought, and favor or inhibit bacterial biological activities. In the language of dairy farm, milk plant, and food establishment personnel, the acidity or alkalinity of wash solutions, of post-wash rinse waters, of sanitizing solutions, and of washed and sanitized equipment surfaces determine the effectiveness of soil removal and bacterial control.

The function of the alkalinity—or causticity—of a wash solution in the disintegration and emulsion of soils (fats), so as to facilitate their removal from equipment surfaces, is elementary to most sanitarians. In this discussion it shall be my objective to emphasize the various roles played by acids, as compared with alkalies, in both detergents and sanitizers. I shall attempt to enumerate the uses of acids in equipment sanitation in the chronological order in which the uses were developed.

## Use of Acids in Scale Removal

The initial use of acid in sanitation was to remove scale from mechanical washers. The formation of scale in bottle washers, can-washers and dish-washers interferes with efficient operation by increasing the load on motors, reducing heat transfer to wash solution and rinse water, reducing the diameter of spray-nozzle orifices, and increasing carry-out of wash solution. Furthermore loosened flakes become lodged in and on washed articles. Hydrochloric acid, in one form or another, is the base of most scale removers.

A brief review of the causes of scale formation is in order because one of the causes accounts for the use of acids in several phases of equipment washing. The effect of heat in precipitating carbonates of calcium and magnesium (temporary hardness) from waters used to prepare wash solutions is now well understood by sanitarians. Since mechanical washers cannot effectively be operated without hot wash solution and rinse water, it must be recognized that one condition responsible for the formation of scale is continuously operative.

Another cause of the precipitation of dissolved minerals from waters—one of which sanitarians are not so generally conscious—is the change in pH in wash solution make-up waters effected by the addition of the chemicals required to produce alkaline wash solutions. Consequently, particularly in bottle-washing solutions, and to a lesser extent in can-washer and dish-washer solutions, both of the primary causes of the precipitation of minerals from water operate and scale is formed— unless the detergent compound includes in its composition sufficient water conditioning chemical to prevent the precipitation of water minerals.

Milk sanitarians whose experience extends back to the 1940's will recall that the Lathrop-Paulson can-washing technique dispensed with alkaline wash solution and employed a combination of levulinic acid and wetting agent. The objective was the progressive removing of the build-up of water minerals and milk solids in milk cans and preventing the formation of new coatings. Another objective advanced but not too widely conceded was the creation in washed cans of an acid environment unfavorable to the biological activity of the types of bacteria common to milk cans. This latter objective will be referred to later.

Manufacturers of conventional can-washers were in no position to meet the competition from the general acceptance of acid washing without major remodeling of washers necessary for complete conversion. But the manufacturers of can-washing detergents met the issue by developing acid-wetting agent detergents and by advocating the adoption of the "Alternate" or "5-2" method, in which an alkaline wash solution was employed for five consecutive days followed by acid washing for the remaining two consecutive days of the week. Thus, in using conventional washers, all milk cans could be subjected

[1]Based on a paper presented at the Annual Meeting of the Florida Association of Milk and Food Sanitarians, University of Florida, Gainesville, October 20, 1965.

to milkstone removal treatment at weekly intervals without seriously disrupting can-washing schedules.

### Use of Acids in Washing Procedures

My first knowledge or experience with milkstone remover was in the early 1930's. The compound, as I recall was an acidic powder applied to surfaces in the form of a paste, allowed to remain for some minutes, and then rinsed off. Its application combined the chemical effect of the acid and the abrasive effect of the pumice, of which I assume some of the powder consisted. The removal of "milkstone" or food film from equipment surfaces is "old shoe" to most sanitarians and no time will now be devoted to a discussion of it. Permit me to emphasize, however, that this application of acid is identical in principle to the removal of scale from mechanical washers—and from blanchers in canneries, except that acids less active than hydrochloric are employed. Less mineral matter is to be removed in most instances and the avoidance of corrosion of non-stainless metals and the comfort of users of the less active acids is taken into consideration.

Those responsible for the maintenance of equipment in which edibles are produced, transported, stored, processed, or served are in agreement that the formation of mineral film or deposit, or even water spots, is to be avoided if possible. A number of chemical compounds capable of sequestering or of chelating water minerals, so that precipitation of water minerals does not occur, are available. And there are numbers of detergent compounds available which include sufficient proportions of such components in their compositions to handle the composition of most waters.

Why are mineral film and deposits so prevalent? That question does not imply that I think detergent users do not buy products suited to the situation. I am certain that detergent compounds available are capable of minimizing the films and coatings so evident to trained observers. And I am also certain that ample supplies of "milkstone remover" are available.

### Mineral Deposits from Rinse Waters

The conclusion must be that mineral film is being deposited on equipment more rapidly than it is being removed even by conscientious clean-up personnel. And the cause of this situation should have been obvious to all of us sanitarians, manufacturers of detergent supplies, and equipment users and operators who have ignored this cause so long. The precipitation of dissolved minerals from the waters with which *wash* solutions are prepared has long been recognized and detergent compounds have been fortified with water conditioners to meet that situation. But we have continued to use the same mineral-loaded waters to *rinse* the residual alkaline wash solution from equipment without first treating it!

A brief analysis of what takes place makes it rather apparent that untreated post-wash rinse waters are heavier contributors to mineral deposits on equipment than are treated wash solutions prepared with waters from the same sources. Wash solution is generally rinsed from equipment before the deposition of precipitated minerals occurs and the minerals are flushed out with the wash solution. On the contrary, post-wash rinse waters adhering to equipment usually are allowed to evaporate and leave behind their entire load of mineral salts. Equipment operators are urged to facilitate the drying of surfaces wherever practical to encourage the development of corrosion-inhibiting oxide film. Also the existence of a film of moisture under a coating of mineral tends to result in the formation of a Galvanic cell with a small area of stainless steel surface, the end result of which is pitting, that is, corrosion.

### Effective Stabilization of Rinse Waters

A program of treatment of post-wash rinse waters so as to reduce to a minimum the deposition of mineral salts is obviously necessary. What should this treatment consist of? Acids again take an up-stage position. By adding acid to post-wash rinse water the alkalinity of wash solution clinging to equipment surfaces can be neutralized and precipitation of stabilized mineral salts in the rinse water does not occur. The creation of a pH level of 5.5 or less in post-wash rinse water effects such neutralization of residual alkaline wash solution, and also results in the solution of any water-insoluble chemical solids suspended in it, thus facilitating their complete removal from equipment by the rinsing operation.

### Acidified Surfaces Inhibit Bacteria Growth

Acids introduced into post-wash rinse waters have a third function, in addition to those of neutralizing the alkalinity of residual wash solution. The acids become components of the post-wash rinse waters and while such rinse water as adheres to equipment remains in the fluid state, and even after it evaporates, these surfaces are slightly acidified. Neutralization of the alkalinity of unremoved wash solution is more nearly complete. Any degree of reduction in the alkalinity of an environment also decreases the influence of a factor favorable to the biological activity of bacteria.

There may be some question as to the manner in which post-wash rinse water may be acidified. In the first place, only food-grade acids are usable. The addition of an ounce of stock acid for each 5 gallons of water drawn into the rinse compartment of a wash vat, or in the rinse water tank of a wash solution circulation system, requires no mechanical wizardry. However, the introduction of precisely the desired proportion of acid into a flowing stream, spray, or fog, applied from a hose nozzle, does necessitate the availability of a mechanical device.

The several applications of the acidification of post-wash rinse waters which have been discussed may be regarded as "straws-in-the-wind" which indicate a definite trend. We are in an era which will be characterized by and noted for the efforts devoted to the prevention of water-spotting, filming, and coating of equipment surfaces by water minerals by treating post-wash rinse waters. The removal of a coating of water minerals impregnated with milk proteins from a fleet of farm pick-up or transport tanks, a battery of storage tanks, or a ring 30 feet above the floor of a silo-type storage tank, or from any milk or food processing equipment is not a manual task to be undertaken blithely. Prevention of the development of conditions necessitating a removal operation—which often assumes an emergency status—is a far more practical managerial and operational policy.

### USE OF ACIDS IN SANITIZERS

I have enumerated the applications of acids to milk and food equipment washing operations. The remainder of this discussion will be devoted to their applications to sanitization.

We are aware that the germicidal effectiveness of hypochlorite sanitizing solutions at any specific concentration of available chlorine can markedly be increased by adding a small proportion of hydrochloric acid to the solution, that is, by lowering the pH of the solution. This is a potentiality which has not developed into a popular and prevalent practice, however, because the inherent corrosiveness of solutions consisting primarily of hypochlorites is thereby also sharply increased.

The element iodine, like chlorine, is also one of the halogens but is somewhat less active than chlorine. Iodine sanitizers are compounded in a manner differing widely from that in which hypochlorite sanitizers are made. Iodine is combined with a non-ionic compound, generally a wetting agent, and this combination is acidified with these three objectives:

1. To increase the germicidal effectiveness of the available iodine. These sanitizers are as germicidally effective at 12 1/2 ppm. of available iodine as are hypochlorite solutions, unacidified, at 50 ppm. of available chlorine).

2. To provide for the removal of already-formed mineral film or coating, and

3. To create an acid environment on treated surfaces, disadvantageous to the biological activity of any surviving or subsequently-deposited bacteria.

Why is it practical or feasible to incorporate acid into iodine sanitizers or detergent sanitizers, whereas it is somewhat hazardous to equipment and to personnel to acidify hypochlorite sanitizers? Mild acids are employed in the composition of iodine sanitizers and the acids formed with iodine are not nearly as corrosive as the hydrochloric and hypochlorous acids formed in hypochlorite solutions.

Many surfactant (wetting agent) compounds possess germicidal properties. The germicidal properties of quaternary ammonium compound sanitizers are derived from cationic surfactant complexes. Some anionic surfactants are also germicidal as well as acid. But in these cases again, the pH level of the sanitizing solution determines the degree of germicidal effectiveness. The pH level essential for practical germicidal effectiveness of sanitizing solutions of anionic surfactants is relatively low—3.9. Such a low pH level of sanitizing solutions is attained by incorporating into the compound another acid (usually one of the phosphoric acids). The surfactant property of sanitizing solutions may also be enhanced by including in the compound another surfactant.

In this manner a type of sanitizer compound has been developed which is adequately germicidal to comply with Chambers Test criteria of a 99.999+ percent kill of specified micro-organisms, acid enough to dissolve films and coating of water minerals, and with sufficient surface tension reducing capacity to penetrate deposits of milk and food solids, and to have some detergent properties. The acidic nature of sanitizing solutions of this type leaves treated surfaces with an environment unfavorable to bacterial biology as previously mentioned. These sanitizers, at double the normal use solution concentration, are effective against bacteriophages. The compounds are liquid, which is advantageous in some applications.

Acid-type sanitizers are competitive with other types except for the fact that use dilutions are relatively heavy—1 oz. per gallon of water—making their routine use somewhat more costly. There are numerous situations, however, in which certain advantages accruing from their use far outweigh the cost factor.

### A NEW ERA

Milk and food sanitation consists of an agglomeration of practices and procedures which experience has proven to be effective. New techniques are constantly being added to the arsenal, resulting in the eventual abandonment of traditional, or even conventional, procedures.

The increased use of acids in equipment sanitation in acidifying post-wash rinse waters and in activating germicidal agents in sanitizing solutions are examples of new techniques in sanitation which bid fair to mark the beginning of an era.

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## PUBLICATIONS OF INTEREST

**Editorial Note: Listed below are books, pamphlets and reprints on a variety of subjects considered to be of interest. Requests for material should be addressed to the source indicated. Note cost of books and certain items.**

Chemicals Used in Food Processing. 1966. Pub. No. 1274. Nat. Acad. of Sciences—Nat. Res. Council. Wash., D. C. $6.50.

Milkers Manual. Bull. No. A-37. College of Agric., Univ. of Arizona, Tuscon.

Questions and Answers about Leucocytes in Milk. NW Ext. Pub. No. 70. College of Agric., Oregon State Univ., Corvallis.

Mastitis Questions and Answers leaflet. College of Agric., Univ. of Wisconsin, Madison.

Mastitis is a Costly Disease. Bull. No. EC60-635. College of Agric., Univ. of Nebraska, Lincoln.

Mastitis Control in the Milking Herd. Ext. Bull. No. 344. College of Agric., Michigan State Univ., East Lansing.

Milking Management and its Relation to Milk Quality. Pub. No. AXT-94. College of Agric., Univ. of California, Davis.

Has the United States Enough Water? Estimates and projections to year 2000 of water supplies and demands for the 19 major drainage basins. Supt. of Doc., Govt. Printing office, Wash., D. C. 20402.

Guide to the Analysis of Pesticide Residues. Two volume compilation of methods for recommended analysis of pesticide residues. Prepared for Public Health Service, 1966. Supt. of Doc., Govt. Printing Office, Wash., D. C. 20402. $12.75.

Air Conservation. A report of the AAAS Air Conservation Comm., 1965. AAAS Publications, 1515 Mass. Ave. N.W., Wash., D. C. 20005. $8.00.

Food Quality: Effects of Production Practices and Processing. Editors, George W. Irving, Jr. and Sam R. Hoover, 1965. AAAS Publications, 1515 Mass Ave. N.W., Wash., D. C. 20005. $8.50.

What You Should Know About Oysters, Clams and Mussels. PHS Pub. No. 1393. Public Inquiries Branch, PHS U. S. Dept. of HEW, Wash., D. C. 20201.

Environmental Sanitation Handbook. For training supervisors and hospital cleaning personnel. Published by University Hospital, Office of Environmental Health, Univ. of Michigan Medical Center, Ann Arbor 48104. $20.00.

Publications of U. S. Dept. of Commerce for Scientific and Technical Information. (Order by stock number from Clearing House, U. S. Dept. of Commerce, Springfield, Va. 22151):

- Stock No. AD-633 390. A Study of the Microbiology of Selected Dehydrated Food Products. $3.00.
- Stock No. TID-22515. Application of Radiation—Pasteurization Processes to Pacific Crab and Flounder. $4.00.
- Stock No. NYO-3426-1. Study of Economics of Controlling Salmonellae in Foods by the Use of Ionizing Radiation. $3.00.
- Stock No. UCD-34P80-3. Radiation Technology in Conjunction With Postharvest Procedures as a Means of Extending Shelf Life of Fruits and Vegetables. $5.00.
- Stock No. PB-169 371. Symposium on Streamflow Regulation for Quality Control. Twenty one papers. $7.30.
- Stock No. CONF-651024. Radiation-Pasteurization of Foods, Summaries of Accomplishment. $6.00.

Selected U. S. Government Publications. (Order by Catalogue No. from Supt. of Documents, U. S. Govt. Printing Offices, Wash., D. C. 20402).

- Cat. No. FS 2.95; 947-65. Hill-Burton Program Progress Report. July 1, 1947-June 30, 1965. 40c.
- Cat. No. FS 1.20/a:Ai 71/3. The Clean Air Amendments and Solid Waste Disposal Act of 1965. 15c.
- Cat. No. Y 4. At 7/2:F73/4. Radiation Processing of Foods. Hearings held before subcommittee of joint congressional Committees on Atomic Energy. 1965. $2.50.
- Cat. No. C 41.2:C76/965. Sources of Information on Containers and Packaging. 20c.
- Cat. No. FS 1.20/s:W291/2. Water Quality Act of 1965. Contains history of the Act and gives information on grants and water quality standards. 15c.
- Cat. No. FS 16.2:W29. The New Federal Water Pollution Control Program. Describes the six major activities. 5c.
- Cat. No. I 49.4:226. The Effects of Pesticides on Fish and Wildlife. 45c.
- Cat. No. FS 2.2:L46/4. Symposium on Environmental Lead Contamination. Papers presented 1965. $1.25.
- Cat. No. PrEx 8.2:W 29. A Ten-Year Program of Federal Water Resources Research. Prepared by Comm. on Water Resources Research of Federal Council for Science and Technology. 40c.
- Cat. No. Fs 2.74/3: D9/2. Design Features Affecting Asepsis in the Hospital. Rev. 1966. 15c.
- Cat. No. FS 2.302:A-1/2. Emergency Health Preparedness Publications Catalog, 1966 Edition. Lists currently available publications specifically related to Division of Health Mobilization program areas. 20c.
- Cat. No. FS 2.2:Ai 7/30/966. Air Pollution Films. Listing of films available for free showing on national air pollution problems. 5c.
- Cat. No. HH 1.2:P 94/8/966. Programs of the Department of Housing and Urban Development. 20c.
- Cat. No. HH 2.2:E1 2/996. Some Facts about FHA Housing for the Elderly, Projects and People. Information on characteristics of the new FHA-insured housing projects for the elderly. 15c.

# ASSOCIATION AFFAIRS

## REPORT OF THE COMMITTEE ON APPLIED LABORATORY METHODS—1966

The interim report (J. Milk and Food Technol., March 1966) showed goals of the Committee during the past two years. Most activities of the Committee were connected with administrative responsibilities relative to final reviews of the final draft of the 12th Edition of Standard Methods for the Examination of Dairy Products (SMEDP). It is anticipated that the 12th Edition of SMEDP will be published by Spring 1967.

### Subcommittees on Laboratory Methods for the Examination of Milk and Milk Products and Water and Other Environmental Samples

*Activities.*

During the final review of the 12th Edition of SMEDP, changes were noted in addition to those already discussed in the previous interim report. The method for the determination of the hydrogen-ion concentration of media at 45 C has been deleted as well as use of whey agar for determination of antibiotic residues in milk and/or milk products. Use of 0.5-inch penicillin reference, penicillinase, and unimpregnated discs is recommended. Although not included in previous chapter drafts of the 12th Edition of SMEDP, simplified viable count methods for the examination of raw milk are now shown in a separate chapter. Tests for determination of potential toxicity of detergent residues on glassware, toxicity of dilution water, and suitability of distilled water, which are recommended for use by laboratories, are now included in the Appendix section of SMEDP; methods for the measurement of hydrogen-ion concentration of media, preparation of dilution water, and cleaning of glassware are also included in the Appendix section. The procedure for the direct microscopic count method lists only one procedure (Levowitz-Weber Method) for preparing films and recommends use of microscopes having microscopic factors of 500,000 and 600,000.

*Media Certification.*

Although the APHA Coordinating Committee for Laboratory Methods has not published a new protocol for check testing of viable count media, the Appendix section of the 12th Edition of SMEDP (final draft) lists two methods, either of which may be used for the productivity tests for Standard Methods Agar Medium. During the performance of productivity tests by laboratories, SMEDP recommends that only the APHA Reference Standard for Standard Methods Agar be used to determine the acceptability of each lot of new media; the use of a secondary standard for official testing is not permissible. Of the two methods shown, results from Method A, which requires analysis of 50 samples of raw whole milk and 50 samples of pasteurized whole milk for acceptance, should show a definite statistical relationship between the productivity of Reference and that of new lots of media. Analysts using Method B are required to examine only six (6) composites of milk samples, three raw and three pasteurized. Although each composite is prepared from at least five well-mixed individual milk samples, there is no reason to believe that the bacterial flora of each composite sample would include the various types of bacterial flora present in 50 samples of raw and 50 samples of pasteurized milk. When Method B is used, freezing of composite samples is permissible prior to testing (although freezing may impair the growth properties of certain bacteria in composite samples). Although statistical analysis of Method B counts is indicated, arithmetic means of sample counts have been substituted for log means even though correct interpretation of results is more likely when logarithms are used in statistical analyses. Although Method A may require more equipment and time than Method B, use of a larger number of samples would appear more desirable.

Past analyses made by two statisticians familiar with check testing procedures show that at least 20 separate samples are necessary to provide a reasonably powerful statistical test for detecting greater variation in replicate counts from one medium than from another.

For neither method do the criteria developed include complete consideration of significant incubation factors, e.g., location of culture plates in incubators (front and rear), incubator temperature variations, and proper stacking of plates prepared from the same dilution and poured with reference and test media lots.

Information received from laboratory directors and laboratory supervisory personnel has indicated a need for certification of coliform media used for the examination of dairy products as well as drinking water samples. Criteria that would be recommended for evaluating suitable formulation of growth and inhibitory ingredients in these media are being considered. Future activities of the Applied Laboratory Methods (ALM) Subcommittees for the Examination of Milk and Milk Products and Water and Other Environmental Samples will include suitable studies on liquid and solid coliform media.

*General.*

Reassignment of committee members to the three ALM subcommittees concerned with the Examination of Milk and Milk Products, Foods, and Water and Other Environmental Samples has been made and additional subcommittee members assigned. An interim report of the Subcommittee for the Examination of Foods has been prepared and is included in this report. The ALM Committee Chairman and Subcommittee Chairman solicit the support of IAMFES members for information regarding qualified laboratory investigators to fill anticipated and existing vacancies on all subcommittees.

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## Interim Report of the Subcommittee on Laboratory Methods for the Examination of Foods

The purpose of the subcommittee is to, "conduct laboratory collaborative studies and other activities concerned with the establishment of 'standard' microbiological methods for the examination of foods and chemical methods where applicable." Since the membership of this subcommittee was not firmed-up and clearance obtained for all members until May of 1966, no meetings have been held to date. Because of this, no activity by the committee itself can be reported at the present time.

Some progress in relation to the purposes of our subcommittee has been made both nationally and internationally, however, by a number of agencies. A method for the isolation of coagulase-positive staphylococci from foods was presented to the AOAC, October 11-14, 1965, at the national meeting in Washington, D. C. and has been published (Journal of the AOAC, 49:270-271. 1966) by E. F. Baer of the FDA. Also under the auspices of the AOAC a collaborative study on methods for the detection and quantification of *Clostridium perfringens* in food is being carried out under the direction of Dr. H. E. Hall.

A recent publication in Association of Food and Drug Officials of the United States, Quarterly Bull. 30:3-19, 1966, on Microbiological Criteria for Foods, combines the opinions expressed by Dr. F. S. Thatcher, Department of National Health and Welfare, Ottawa, Canada, Mr. R. Paul Elliott, Dr. M. T. Bartram and Dr. G. G. Slocom, FDA, Washington, D. C., and Dr. C. F. Niven, Jr., California Packing Corporation, San Francisco, California, and Dr. K. H. Lewis, PHS, Cincinnati, and Dr. K. H. Lewis, PHS, Cincinnati, Ohio, on Microbiological Specifications, Evaluation of Public Health Hazards, Problems of Sampling and selection of indicators and methods.

A report of the International Committee on Microbiological Specifications for Foods is in the process of preparation by Dr. F. S. Thatcher, Chairman.

The Advisory Committee on the Microbiology of Frozen Foods submitted its report on Microbiological Examination of Precooked Frozen Foods to the Association of Food and Drug Officials of the United States. This report is in two parts and includes in Part One, Microbiological Indicators and Methods of Analysis and in Part Two, the Sampling and Interpretation of Microbiological Data on Frozen Foods. Individual publications as listed below in the various journals continue to emphasize the point that methods for the examination of foods for pathogenic and indicator organisms are of vital interest and have not begun to reach a condition of stasis.

Raj, H. Enrichment medium for selection of salmonella from fish homogenate. Appl. Microbiol., 14:12-20. 1966.

Surkiewicz, B. F. Bacteriological survey of the frozen prepared food industry. I. Frozen cream-type pies. Appl. Microbiol., 14:21-26. 1966.

Greenberg, R. A., et al. Use of the anaerobic pouch in isolating *Clostridium botulinum* spores from fresh meats Appl. Microbiol., 14:223-228. 1966.

Silliker, J. H., et al. The fluorescent antibody technique as a means of detecting salmonellae in foods. J. of Food Sci., 31:240-244. 1966.

It appears to us that our subcommittee can best serve its parent organization by taking a close look at the present state of food methodology and determining in what areas studies can be made that will be most apt to bring some order to the chaotic situation as it presently exists. It is recommended that the results of considerations of present methods and needs by our subcommittee be submitted through IAMFES to AOAC and rather than trying to set up a program of collaborative studies on its own, those in IAMFES who have the time and facilities for such work offer their services to the AOAC and that the group as a whole consider the methods that come from such studies for acceptance as "standard" methods.

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## FRED UETZ WINS AWARD AT NEW YORK SANITARIAN'S MEETING

Fred E. Uetz, Junior Past-President of IAMFES, received the Emmet Gauhn Award at the 43rd Annual Meeting of the New York State Association of Milk and Food Sanitarians at Utica September 12-14, 1966. The Award is made annually in recognition of outstanding service to the state organization in its program in the interests of the state dairy and food industry. Fred is with the Pioneer Ice Cream Division of the Borden Company in New York City.

Well known for his activities on behalf of the International Association, Fred has been equally diligent in his support of the State Association. He has served as president as well as chairman and member of a number of responsible committees during his long time membership of the organization. Since its inception and at present he is the Delegate to the Dairy Remembrance Fund maintained by the Dairy and Food Industry Supply Association to honor the memory of former members. Fred has also served on the Dairy Equipment Committee which has contributed substantially to the achievements of the 3-A Standards Committee.

The New York Association's 43rd Annual Meeting was held jointly with the Cornell University Dairy and Food Science Department. Several general sessions were scheduled as well as separate sessions for laboratory, food, fieldmen and plant personnel. A number of nationally known speakers recognized for their particular knowledge and experience in the field of dairy and food sanitation contributed to an interesting program.

New officers elected for the year are John Raht, President; Wilbur Farnsworth, President-Elect; and Richard P. March, Secretary-Treasurer. Past President is Robert F. Holland. Members of the Executive Committee are Howard B. Marlatt, Francis R. Brady, and Francis Brennan.

## WISCONSIN ASSOCIATION HAS INTERESTING MEETING

The Wisconsin Association of Milk and Food Sanitarians in conjunction with the Wisconsin Dairy Fieldmen's Association held the 22nd Annual Meeting at Madison on September 15-16, 1966.

A morning tour of the meat packing plant of Oscar Mayer & Co. opened the two day program. Discussion topics at the formal sessions included: Legal Aspects of Interstate Milk Shipments, Changes in Agricultural Extension Work, Evaluation of Mastitis Screening Tests and Water Quality Problems in Wisconsin.

The program closed with a full afternoon panel discussion on the Future of Dairying. Panel discussants included representatives from the State Department of Agriculture, the University Dairy Science Department, a large dairy processor, a grocery distribution chain and also a dairy farmer.

At the Annual Awards Banquet Mr. Donald I. Thompson in charge of the Grade A. Laboratory Certification program for the Wisconsin State Board of Health, was named "Sanitarian of the Year." He was honored not only for his contributions to the betterment of the dairy industry in Wisconsin but particularly for his work in developing better laboratory procedures for which he has gained national recognition. This includes a method of testing performance of milk laboratories by means of liquid split samples, a loop method for determining viable counts of raw milk, and the Wisconsin Mastitis Test, an indirect estimate of leucocytes in milk. All of this work has been covered in articles in the *Journal of Milk and Food Technology.*

## ISAAC I. PETERS

Dr. I. I. Peters, 56, Professor in the Dairy Section of the Department of Animal Science at Texas A&M University, died October 10th. He joined the Texas A&M faculty in 1950 as Assistant Professor of Dairy Science. He became Associate Professor in 1953 and was promoted to the rank of Professor in 1963.

Born in Bergthal, Russia, he earned a B.S.A. degree in Dairy Science from the University of Manitoba, Canada in 1942. He received his M.S. degree in 1944 from Michigan State University and his Ph.D. degree in 1947 from Iowa State University. From 1948 to 1950 he was Assistant Professor in Dairy Science at Iowa State University. His primary research interests were in the field of microbiology of milk and milk products and cheese technology. Some of his recent work dealt with the manufacture of cheese from concentrated milk products. He was the author of more than 35 technical papers.

Dr. Peters held membership in many honorary and professional societies including the International Association of Milk, Food and Environmental Sanitarians. He was a Fellow of the American Association for the Advancement of Science and of the Texas Academy of Science.

## PAPERS REPRESENTED AT AFFILIATE ASSOCIATION MEETINGS

**Editorial Note: The following is a listing of subjects presented at recent meetings of Affiliate Associations. Copies of papers presented may be available through the Secretary of the respective Affiliate Association.**

### NEW YORK STATE ASSOCIATION OF MILK AND FOOD SANITARIANS

43rd Annual Conference
Utica, New York
September 12-14, 1966
(Sponsored jointly with the Cornell University Food Science Department)
(*Secretary,* R. P. March, 118 Stocking Hall, Cornell University, Ithaca, N. Y.)

GENERAL SESSIONS
Applied Imagination for the Sanitarian—*A. M. Darroch*
Our American Way of Life—*Harry Bowser*

LABORATORY SESSIONS
A Micro-capillary Method for the Determination of Butterfat—*M. W. Cucci*
The Variability of Different Lots of Plate Count Media—*J. C. White*
The New Public Health Service Water Laboratory Evaluation Program—*Ann E. Hohenstein*
Methods of Determining Fat in Milk—*W. F. Shipe*
Pesticides—*Elmer George, Jr.*
Analytical Determination of Rancidity in Milk and Milk Products—*D. H. Kleyn*

FOOD SESSIONS
Education and Training Sub-Committee of Food Protection Committee Report—*A. E. Abrahamson*
New York State Food Salvager's Law—*Maurice Guerrette*
Food Service Sanitation and Inspection Procedures—*Ralph Adams*
Uniform Interpretation and Enforcement of Food Protection Programs in New York State—*J. C. White*
The Problems of Food-Borne Disease—*J. H. Fritz*
Evaluation of Food Protection Programs—*Harry Steigman*
Research and Development in Synthetic Foods—*W. E. Hartman*

FIELDMEN'S SESSIONS
Current Information on the Vermont Milk Flavor Program—*H. O. Clark*
Checking Calibration of Bulk Tanks—*J. H. Worley*
Abnormal Milk Screening Tests Program in the Northeast—*R. P. March*
Interim Report of Interstate Milk Shipments Activities—*H. K. Johnston*
Proposed Northeast Milking Machine Standards—*S. E. Barnard*
Dairy Farm Waste Disposal Requirements—*J. A. Salvato and F. O. Bogedain*
Status of the Industry Farm Score Sheet—*D. H. Race*
Regional Ventilation Recommendations for Dairy Buildings—*R. G. Light*
Fluid Manure and Loose Housing Guidelines for New York State—*C. H. Colvin*
An Approach to Mastitis Control—*W. G. Merrill*
Problems in the Aging of Bulk Tanks—*H. V. Atherton*

PLANT SESSIONS
Aseptic Processing of Dairy Products—*V. R. Carlson*
New Practices and Devices for H.T.S.T. Pasteurizers—*R. W. Dickerson*
Report of the I.M.S. Committee on Fabrication of Single Service Containers and Closures for Milk and Milk Products—*R. M. Parry*
Sanitary Air Control Methods—*Robert H. Avery*
Comparative Analysis of European and United States Plant Techniques—*Alan Ingram*

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### WISCONSIN ASSOCIATION OF MILK AND FOOD SANITARIANS

22nd Annual Meeting
Madison, Wisconsin
September 15-16, 1966
(Sponsored jointly with the Wisconsin Dairy Plant Fieldmen's Association)
(*Secretary,* L. Wayne Brown, 4702 University Ave, Madison, Wis. 53705)

Legal Aspects of Interstate Milk Shipments—*George Sieker*
What It Takes To Become A Registered Sanitarian—*C. A. Stravinski*
Changes in Agriculture Extension—*Henry Ahlgren*
Evaluation of Mastitis Screening Test—*Donald Thompson*
Improving the Image of the Milk and Food Sanitarian—*Edward Friday*
Progress of the Grade A Pasteurized Milk Ordinance—*Darold Taylor*
Water Quality Problems in Wisconsin—*Harvey Wirth*

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### CALIFORNIA ASSOCIATION OF DAIRY AND MILK SANITARIANS

48th Annual Meeting
Anaheim, California
October 3-5, 1966
(Held jointly with State Department of Agriculture Training Course)
(*Secretary,* Kenneth Hayes, 6520 Steiner Drive, Sacramento 7, Calif.)

Water South (Water for Southern California)—*R. E. Hudson*
Environmental Health Programs of the World Health Organization—*C. A. Senn*
The Real Meaning of the Laboratory Pasteurized Count—*W. R. Thomas*
Automatic Flow Diversion Valves and the C.I.P. System—*R. P. Jones*
Current Water Pollution Problems in California—*A. W. Reinhardt*
The Dairy Industry in the South-West—*D. B. Whitehead*
Control of Microbial Contamination in Space Craft Assembly Facilities—*Wm. Paik*
Packaging Milk—*N. C. Myrick*
Dairy Inspectors are Consumers, Too—*G. P. Whitlock*
The Responsibilities of the Dairy Sanitarian—*H. L. Thomasson*
Radioactive Fallout in California—*Amasa C. Cornish*
The Use of Preservatives in Milk and Dairy Products—*Ed Collins*

Merchandising in Todays Market—*C. W. Conrad*
Coordinating Laboratory Results Between Inspection Agencies and Industry—*Lee Biggs*
Proposed State Legislation and Departmental Activities—*A. E. Reynolds*
Safety Hazards on the Farm and Milk Plant—*Chris Hartford*
Equipment Installation, Pipelines, and Stainless Steel Fabrication—*J. E. Seeley*

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### INDIANA ASSOCIATION OF SANITARIANS

16th Annual Meeting
Indianapolis, Indiana
October 4-6, 1966
(*Secretary,* John D. Boruff, R. R. 1, Roachdale, Ind. 46172)

Current Trends of Public Health Agencies in the Field of Housing—*W. D. Conroy*
Migratory Labor Camp, Housing and Sanitation—*R. H. Kocher*
Recreational Sanitation—*J. P. Schock*
Design and Layout of a Sanitary and Efficient Food Service—*Arlene M. Wilson*
Review of Proposed State Food Service and Meat Inspection Laws—*W. R. Spangle & A. L. Klatte*
Microbiological Hazards Related to Synthetic Fillings for Pies and Pastries—*F. D. Crisley*
Report of the Farm Methods Committee Abnormal Milk Project—*Verne Cavanaugh*
Indiana Guidelines for Liquid Manure Handling—*N. J. Moeller and J. E. Mentzer*
Local Health Deparments Control of Soft-Serve Ice Cream—*J. R. Harton*
Philosophy of Laws and Regulations—*L. D. Spolyar*
Subsidies for Local Health Departments—*Robert Yoho*

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### KANSAS ASSOCIATION OF PUBLIC HEALTH SANITARIANS

37th Annual Conference
Manhattan, Kansas
October 26-28, 1966
(*Secretary,* Frank L. Kelley, 1216 Ohio St., Lawrence, Kan.)

How a Restaurant Owner Would Prefer to be Inspected—*Mike Getto*
Methods of Making Surveys, 1965 Ordinance—*Harold Thompson*
Use of Films and Slides in Local Health Department Programs—*Wm. Deam, Kenneth Ticknor and Ben Boyer*
New Design Milking Machine—*Bert Phillips*
Salmonella in Manufactured Non-Fat Milk Powder—*Harold Thompson*
Food for Immediate Consumption From Mobile Trucks—*Melvin Lynch*
Nursing Homes—Plumbing, Vents on Gas Stoves, State Plumbing Code Requirements—*Don Reed*
Sanitarians Registration—*Wm. Deam*
Lagoons, Liquid Manure Pits, Sand Filters at the End of Tile Field on Septic Tanks—*Mel Gray*
The New USPHS Vending Machine Ordinance—*Harold Thompson*
Some Facts About Salmonella—*V. D. Fultz*
New Methods of Water Analysis—*Marion Dych*
The Laboratory and the 1965 Milk Ordinance, General Problems—*Richard Ripper*
Counter Freezers Control—*Brace Rowley, A. A. Sauer and Dwight Tollefson*
How Sewage and Water Problems were Handled at the National Camporee at Kanapolis, Kansas—*Verne Hart*
Birds Infestations in our Cities—*Don Cross, George Halazon, Gene Fiskin and Vernon L. McKinzie.*

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## N. Y. ASSOCIATION URGES ADOPTION OF FOOD SERVICE SANITATION CODE

At its 1966 Annual Meeting September 12-14, the New York Association of Milk and Food Sanitarians passed a resolution recommending that all state and local health departments adopt, as the law or regulation for the control of food-service establishments, the *Food Service Sanitation Ordinance and Code – 1962 Recommendations of the U.S.P.H.S.* The resolution is as follows:

WHEREAS, the expansion of the food service industry to an interjurisdictional level has revealed widely differing food protection programs which may cause conflict among the concerned regulatory agencies, and

WHEREAS, there is a need for reappraisal of existing food protection regulations as they are affected by changes in technology and food service practices, and

WHEREAS, there is a need for reevaluation of current control techniques and programs used by health agencies in the field of food service sanitation, and

WHEREAS, the *Food Service Sanitation Ordinance and Code – 1962 Recommendations of the U. S. Public Health Service* has been developed by the Service with the assistance of food sanitation regulatory agencies at all levels of government, of various segments of the food service industry, and of educational and research institutions, and

WHEREAS, the National Restaurant Association, in their continuing efforts to upgrade the sanitation level of their member establishments, has endorsed this standard, and

WHEREAS, the Food Service Sanitation Ordinance is a standard which can uniformly and equitably be translated into food service establishments of high sanitary quality; Therefore be it

RESOLVED, that the New York State Association of Milk and Food Sanitarians recommends that the *Food Service Sanitation Ordinance and Code – 1962 Recommendations of the U. S. Public Health Service* be adopted by the State and local health departments as the law or regulation for the control of food service establishments, and be it further

RESOLVED, that the above resolution be transmitted to the New York State Department of Health, and its Public Health Council, the New York City Department of Health, and its Board of Health, and to the Executive Secretary of the International Association of Milk, Food, and Environmental Sanitarians.

# NEWS AND EVENTS

## ENVIRONMENTAL HEALTH FELLOWSHIPS AT NORTH CAROLINA UNIVERSITY

Applications for Environmental Health Fellowships are now being accepted for graduate study during the 1967-68 academic year at the Consolidated University of North Carolina. This is a broad interdepartmental program designed to give students training for careers in research, teaching, and practice in environmental health. It is sponsored by the Departments of Biostatistics, Environmental Sciences and Engineering, and Epidemiology of the School of Public Health; the Departments of Botany, Chemistry, City and Regional Planning, Geology, and Zoology of the College of Arts and Sciences; the School of Medicine; and the Department of Food Science at North Carolina State University at Raleigh. Students will generally enroll in the department of their basic specialty and then select courses in other departments in order to obtain a broad understanding of the problems of the environment and the application of their specialty to the solution of these problems. The fellowships are provided through the Institute for Environmental Health Studies and include tuition, fees, and a stipend. The amount of the stipend under these fellowships will be in accordance with current Public Health Service and University policy.

Further information may be obtained by writing the head of any of the sponsoring departments. All are located at Chapel Hill, North Carolina except the Department of Food Science which is located at Raleigh, North Carolina.

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## DAIRY TECHNOLOGY CONFERENCES AT OHIO STATE

Two major annual Dairy Technology Continuing Educational Conferences will be held on the Ohio State University Campus in February and March, 1967. Program plans are underway and the topics to be discussed will be unusually timely and interesting. More than 600 persons are expected to attend these two conferences.

The first event will be the 34th Dairy Industry Conference on February 14-16. The program is designed to serve the needs of persons from commercial dairy plants, health departments, and producer organizations of Ohio and the surrounding states. Outstanding dairy leaders from industry, education and government will participate in the program. Topics to be dsicussed are in such major areas as Milk Supply, Manufactured Milk and Milk Products, Management and Operations, Engineering and Processing, Laboratory Control and Cultured Products.

The 16th Midwest Workshop in Milk and Food Sanitation is on March 20-24. The program will be sponsored cooperatively with the Ohio Department of Health. The program is designed to serve the educational needs of Health and Regulatory Officials, Producer Cooperative Groups, and Dairy Plant Personnel. Each day the workshop will be a complete unit with the following broad topics discussed: First day—Principles and Practices of Dairy Microbiology: Second Day—Dairy Farm Practices: Third Day—Elements of Cleaning and Sanitizing: Fourth Day—Pasteurization Equipment and Methods. Fifth Day—Dairy Plant Practices. Visiting speakers and Dairy Technology Staff will handle the discussions with personnel from the U. S. Public Health Service available as resource persons.

More information may be obtained by writing to the Department, The Ohio State University, 2121 Fyffe Road, Columbus, Ohio 43210.

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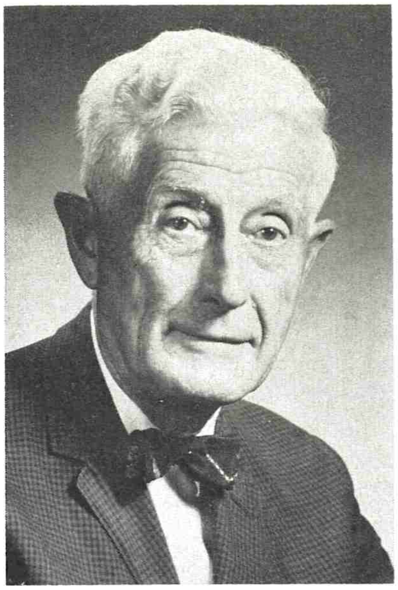
## OHIO STATE DISTINGUISHED ALUMNI AWARD TO PAUL DEW

Paul R. Dew, Vice President of Dairy Operations, Fairmont Foods Company, Omaha, Nebraska, was named the 1966 recipient of the Distinguished Alumni Award of the Department of Dairy Technology of The Ohio State University at the Department's 18th Annual Homecoming celebration on October 22. Mr. Dew was recognized for his outstanding accomplishments as a professional Dairy Technologist and industrial executive and leader of men.

Mr. Dew received his Dairy Technology Degree in 1945. His professional career has been entirely with the Fairmont Foods Company and he has held a succession of plant management positions. He became Vice President, Fairmont Foods Eastern Division in March, 1966 and assumed his new position with the Central Office on November 1.

Approximately 175 Alumni and friends attended the Homecoming event. Speakers included Dr. R. H. Bohning, College of Agriculture and Home Economics, and Dr. I. A. Gould, Chairman, Department of Dairy Technology who made the presentation to Mr. Dew on behalf of the Department.

## MALLMANN RECEIVES NAMA PUBLIC HEALTH REWARD



Dr. W. L. Mallmann, Professor Emeritus, Microbiology and Public Health, Michigan State University, was presented the Arthur J. Nolan Public Health Award of the National Automatic Merchandising Association at its 1966 annual convention in Chicago October 26.

It is the first time that the award was given. Established in February, 1966, by the N A M A Board of Directors, it is named in memory of the late Arthur J. Nolan. According to W. J. Manning, Jr., N A M A president, Nolan was largely responsible for the extensive public health program carried on by the association in behalf of the food vending industry since 1947.

In effect, close cooperation between Nolan and Dr. Mallmann laid the groundwork for the industry's extensive public health program as it exists today. Given to those individuals who have made meritorious contributions to the field of vending sanitation and public health, the award will be made only during years when it has been duly earned. In presenting the Arthur J. Nolan Award plaque, Manning cited Dr. Mallmann for his "outstanding service to the automatic merchandising industry through his devotion and activity in public health."

Dr. Mallmann was a member of N A M A's Automatic Merchandising Health-Industry Council for nearly 18 years. He helped develop the association's cup vending division, the uniform vending code issued by the U. S. Public Health Service, and the machine evaluation and public health programs at Michigan State and Indiana Universities, which are sponsored by N A M A. He also assisted in the formation of AMHIC, the vending industry's advisory health council.

One of the outstanding public health teachers and authorities in the country, Dr. Mallmann is widely recognized for his research studies from which many food equipment standards and improvements have been derived.

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## PROGRESS NOTED ON UNIFORM LABELING REGULATION

The Industry Section of the National Labeling Committee which met in Washington on October 10th and 11th reports that gratifying progress was made toward readying a Model State Regulation for the Labeling of Fluid Milk and Fluid Milk Products. When the industry members of the Committee have finalized their thinking, and additional meetings are planned, a first draft of a proposed Model Regulation will be sent for comment and review to the National Labeling Committee's regulatory section and to other organized regional groups interested in achieving uniformity in the labeling of all of the many products defined in the U. S. Public Health Service Pasteurized Milk Ordinance.

The National Labeling Committee hopes that State and local agencies will forego promulgation of any new labeling regulations or statutes until this Model Regulation is completed, so that the various jurisdictions may have an opportunity to examine and voluntarily adopt the recommendations. This Model Regulation not only will be a great boon to industry and regulatory officials, but will represent the successful completion of a mammoth task of coordinating and reconciling numerous and widely varying carton styles, industry practices, and jurisdictional requirements.

In its final form the Model Regulation will have been reviewed by the Food and Drug Administration, the U. S. Department of Agriculture and the U. S. Public Health Service.

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## SOME INTERESTING FACTS ON VENDING

Trends continue to point upward for the American vending industry, according to the annual "Vending Review" published by the National Automatic Merchandising Association. Sales of products through vending machines in the U. S. increased 8.77 per cent to over \$3.8 billion in 1965 and are expected to exceed \$4 billion for the first time in 1966, the report indicates. The 1965 sales record is more than double the \$1.75 billion total of 1955.

The Association termed food vending among the fastest growing segments of the vending business, with 1965 sales of prepared foods up 10 per cent to $166 million. The combination of conventional cafeteria and counter services with vending machines in factories, hospitals and colleges has emerged as one of the newer trends in food vending. More than half of all vending service firms now offer food through their machines, compared with only 36 per cent four years ago.

The report forecasts further advances in vending services for hospital staffs and visitors. Statistics show that more than half of the U. S. hospitals which use vending machines have installed them in the past five years. Hospitals presently account for only 3 per cent of total U. S. vending machine sales, compared with 37 per cent for "street" locations and 34 per cent for factories.

## USDA RELEASES 1966 YEARBOOK

The giant job of protecting our food against pests, disease, and damage is described in the 1966 Yearbook of Agriculture, "Protecting Our Food". The Yearbook is published by the U. S. Department of Agriculture.

In the foreword, Secretary of Agriculture Orville L. Freeman notes that U. S. food abundance is one of the miracles of the age, but that our food abundance didn't just happen. "The authors in this Yearbook point out that we have to fight 10,000 kinds of insects for our food," the Secretary says. "We have to combat 1,500 plant diseases and 250 animal diseases. We have to fight spoilage and decay. The results of this battle to protect our food are evident. In our own country, food quality is high, the abundance great, and the cost relatively low. Overseas, we have supplied 98 percent of food aid received by the less developed nations. Protecting our food is a giant job, and a vital one for both America and the world".

In 416 pages and 105 photographs the Yearbook follows our food supply from the farmer's field to the saucepan on the stove. The Yearbook describes every stage of safeguarding food from insects, rodents, bacterial contamination, and loss of bodybuilding values.

Men and women in 500 different occupations help protect our food, the Yearbook reports. They include chemists, entomologists, bacteriologists, horticulturists, meat and poultry inspectors, quality control specialists, refrigeration engineers, nutritionists, and food technologists.

The health and vigor of a nation depend in great part on the food it eats, and the United States has one of the finest food supplies enjoyed by any nation. Yet, the Yearbook points out, Americans spend only around 18 percent of their take-home pay for food, compared with nearly 30 percent spent by Britons, over 40 percent by Russians, and 50 percent or more by citizens of the less developed countries.

Copies of "Protecting Our Food", the 1966 Yearbook of Agriculture, may also be obtained for $2.50 each from the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402.

## NEW PHS PAMPHLET PROMOTES MILK AS A "BEST BUY"

The Milk and Food Branch of the U. S. Public Health Service has released a new publication entitled "Grade A Pasteurized Milk and Milk Products, Your Best Buy." It is designed to make known the important public health measures involved in the production and processing of safe and wholesome milk and to promote consumption of Grade "A" pasteurized products.

The dairy industry in the United States today is one of the most modern of industries. Many recent developments in equipment and sanitary procedures help make milk one of the safest, high-quality foods.

The milk sanitation program of the Public Health Service is one of the agency's oldest and most respected activities. The Service has contributed a very great deal to the protection and improvement of the nation's milk supply through technical assistance, training, research, standards development, evaluation and certification of activities.

As a further contribution, the Milk and Food Branch is making available to state and local milk control agencies as well as to industry this brochure as valuable supplemental educational material for milk sanitation programs. Individual copies of this PHS Bulletin No. 1510 may be obtained from PHS headquarters or regional offices or in quantities from the Superintendant of Documents, U. S. Government Printing Office, Washington, D. C. 20402.

## NATIONAL COMMISSION ON FOOD MARKETING

Culminating and 18-month study of the nation's food industry, the National Commission on Food Marketing recently presented its final report to President Johnson and the Congress. The Commission's report, which is entitled "Food From Farmer to Consumer," covers a wide area including such subjects as efficiency and market power of the food industry, regulatory activities of Government agencies, measures to benefit consumers and producers, and costs and profits accounting for farm-retail price spreads. In addition to the overall report, the Commission's research staff published ten technical studies. Two of these are of particular interest to those in the dairy industry: Tech. study no. 3 entitled "Organization and Competition in the Dairy Industry" and Tech. study no. 7 entitled "Organization and Competition in Food Retailing." Single copies of these reports are available from the National Commission on Food Marketing, Room 4050, GSA-ROB, 7th and D Sts., S.W., Washington, D. C. 20407.

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## THE 1966 DAIRY AND FOOD INDUSTRIAL EXPOSITION

A panorama of the 1966 Dairy and Food Industrial Exposition, held in Atlantic City October 23-28, shows half of the seven acres of displays by 328 member companies of the Show's sponsor, Dairy and Food Industries Supply Association. Other exhibits occupied two other levels of Convention Hall not shown here. More than 18,000 persons from more than 25 countries attended, representing dairy and food processors, suppliers and equippers, educators and students, and public officials and regulatory personnel.

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## MICHIGAN STATE SCHEDULES DAIRY ENGINEERING CONFERENCE

The 15th National Dairy Engineering Conference will be held on the campus of Michigan State University, Center for Continuing Education, on February 28 and March 1, 1967. The conference is sponsored jointly by the Departments of Agricultural Engineering and Food Science.

The program is being developed around the following major themes: An Idea That Saved Us Dollars; What's New in Packaging; Materials Handling Concepts and Equipment; Processing—What's New; and Instrumentation and Automation Revisited. Proceedings of the conference will be published.

Approximately 250 participants from throughout the United States and Canada are expected. Further information on the Conference can be obtained from Carl W. Hall, Professor and Chairman, Agricultural Engineering Department, Michigan State University, East Lansing.

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## KIHLSTRUM CHEESE CUPBOARD HOST


Elmer E. Kihlstrum (left), director of trade relations for the Johnson & Johnson Dairy Department, was attractively honored by two cheese fanciers at the company's 10th Anniversary Cheese Cupboard in Atlantic City, N. J. (Oct. 24-27). Brigitte Graupner (center), Miss Atlantic City, and Carol Ann Armacost of Upperco, Md., the 1966-67 American Dairy Princess, served him milk and some of the finest cheeses from the U. S. and Canada. Founded by Mr. Kihlstrum, the Cheese Cupboard has been held biennially since 1948 in conjunction with the Dairy and Food Industrial Exposition. Over 2000 pounds of cheese selected by Kihlstrum this year was sampled by 2500 invited delegates to the mammoth exposition. Johnson & Johnson is a leading supplier of multi-purpose milk filters to the dairy industry.

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*To:*

*All IAMFES friends, members, Subscribers and Advertisers.*

*We hope you had a wonderful Christmas and best wishes for a very Happy New Year.*

Executive Board, P. R. Elliker, *Pres.*
Journal Editors
"Red" Thomasson.

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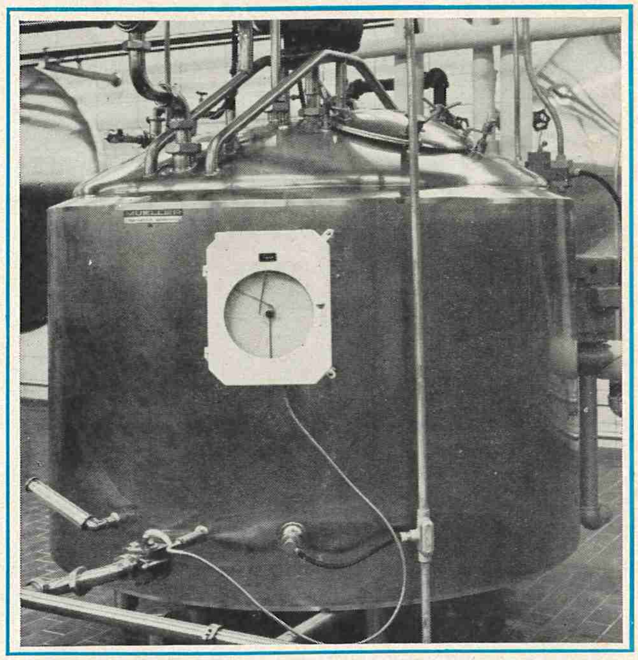


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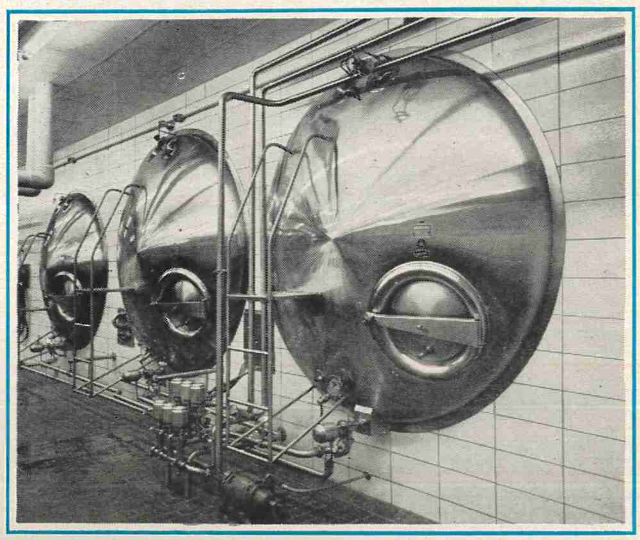

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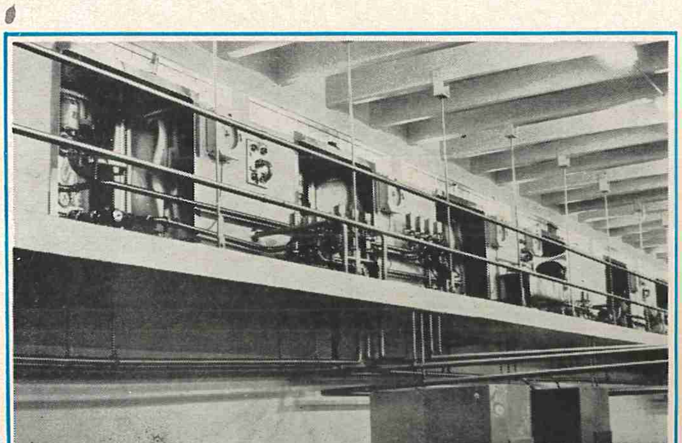

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