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Editorials

The opinions and ideas expressed in papers and editorials are those of the respective authors. The expressions of the Association are completely recorded in its transactions.

The Annual Convention

Several annual meetings of the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS have been outstanding in their significance. We recall the concern in 1929 with which we considered the possibility of filling the gap left by the death of Ivan C. Weld, our "grand old man". Then there was the great meeting in Atlantic City in 1936 celebrating the twenty-fifth anniversary of the work of the Association. The Louisville meeting in 1937 authorized the publication of the JOURNAL OF MILK TECHNOLOGY, thereby making possible the present enlarged field of usefulness of the Association.

And now comes the New York meeting in October. It bids fair to exceed all our other meetings in attendance and importance. It will be a joint convention of the NEW YORK STATE ASSOCIATION OF DAIRY AND MILK INSPECTORS with the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS. Heretofore, the programs of these organizations have been rich in papers of importance to milk sanitarians and technologists. This year, the program is a composite of the excellence of each.

Hundreds will be present to acquaint themselves with the latest developments in the field—so rapidly changing. Valuable plant trips are being arranged for all who want to see milk handled in huge plants and also in small dairies, the transportation and handling of milk in the great metropolis. How can this help me in my smaller city? We reply: In several ways, of which one is as follows. Edison once told a prominent milk executive-producer that if he wanted to make a machine to do a good harvesting job, he would design it to mow down a forest, because there is less difficulty in trimming down than building up.

And the World's Fair! This will be the last chance to see this great spectacle. It closes the end of October. Words are inadequate to describe it properly. Don't miss it. You can't afford to. Living accommodations vary over a wide range to suit all pocket books.

Remember the date: October 17, 18, and 19. Headquarters: Hotel Pennsylvania.

Evaporated and Condensed Milk Standards

The Federal Food and Drug Administration has recently issued new standards and definitions for the sale of evaporated and condensed milk. These are presented in abstract form on page of this Journal. They differ in only relatively minor aspects from those in current force but they are important because they indicate that the federal food control officials are now beginning to recognize that other considerations than mere standards of composition must obtain in the marketing of these foods.

For too long, official quality standards in these products have been measured entirely by their chemical composition—a criterion long since outgrown in the milk and ice cream industries and now being discontinued in the butter industry. Milk sanitarians know that a sterile product is not necessarily one that has been produced and handled under commonly accepted standards of sanitation. Within the last few years, the food control officials have stimulated the butter industry to clean up and correct some of its heretofore undesirable practices. Now, a beginning is made on the evaporated milk industry. We refer to the correction of standardization of the milk fat content downwards and the use of sodium bicarbonate.

The proximate analytical standards for the composition of evaporated milk have been a minimum of 7.8 percent milk fat and 25.5 percent total milk solids. The new standards are set at a minimum of 7.9 percent milk fat and 25.9 percent total milk solids. The fat content was raised because the "findings of fact" demonstrated that the ratio of non-fat milk solids to milk fat in the average fluid market milk is about 2.275. Under the old procedure, some of the milk fat was removed before packing. The new regulations forbid this "skimming". Inasmuch as evaporated milk competes with bottled market milk, consistency requires that if sophistication is prohibited in one, it should likewise be forbidden in its competitor. Quite generally, the mechanical adjustment (standardization) of bottled market milk is forbidden by health officers. Now, evaporated milk is held up to the same standard of practice.

Of greater sanitary significance than the foregoing is the prohibition of the use of sodium bicarbonate. The use of a chemical stabilizer is often necessary in the technology of production of evaporated milk in order to prevent curdling and denaturation in the can. A reasonable use of stabilizers is as defensible as the use of neutralizer in the manufacture of butter or color in ice cream. Technically, they may be considered to be adulterations, but trade practice over many years, technological considerations of production, uniformity in quality, and consumer acceptance establish their desirability—or at least their permissibility. Their use does not conceal inferiority, and therefore partake of no element of fraud.

Sodium bicarbonate has been used by some manufacturers for the purpose of stabilizing milk for evaporation, but it can be and sometimes is used (1) for the purpose of neutralizing sourness so as to make possible the use of unfit milk. This would not be tolerated for bottled milk. Much of the evaporated milk of commerce is produced from milk supplies of as high a quality as any bottled market milk. But there are some that do not measure up to this high standard. Other insanitary practices should also be corrected.

The federal officials have now made a start toward improving conditions in the evaporated and condensed milk industries. These initial efforts are to be commended. It is hoped that they will go farther. The evaporated and powdered milk industries need to be awakened to the fact that they are lagging behind the bottled market milk industry, the ice cream industry, and the butter industry in improving their sanitary technology. If the concentrated milk industry would bestir itself as effectively as other branches of the dairy industry have, then evaporated, condensed, and powdered milk will be in fact, as well as in claim, all that the public expects them to be in sanitary quality.

J. H. S.

(1) *Federal Register* 5, 2442 (1940).

Dr. Frandsen Honored

In these hectic days of international brutality and domestic turmoil, accentuated by our customary hurry and bustle, it is refreshing to find people who stop long enough to voice their appreciation of the good work done by the pioneers who made possible the benefits we now enjoy.

At the recent meeting of the American Dairy Science Association, a noteworthy tribute was given to Dr. J. H. Frandsen, Professor of Dairy Industry, Massachusetts State College, and a loyal and an active member of the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS. This honored recognition was extended him in the form of a scroll, worded as follows:

JULIUS HERMAN FRANDSEN
Dairyman,
Teacher, Investigator, and Editor

In recognition of outstanding service to dairy science in America, particularly in the conception, advocacy and establishment of the JOURNAL OF DAIRY SCIENCE which he so carefully nurtured and successfully edited and managed for eleven years,—a substantial and far-reaching contribution of inestimable value to the advancement of dairy research, teaching and practice,—the

AMERICAN DAIRY SCIENCE ASSOCIATION

at its thirty-fifth Annual Meeting at Lafayette, Indiana, this twenty-seventh day of June, one thousand nine hundred and forty, honors Professor Julius Herman Frandsen and presents this tribute.

(signed) R. B. Stoltz
Secretary

(signed) E. S. Guthrie
President

The vision to conceive the establishment of the excellent JOURNAL OF DAIRY SCIENCE, the courage to undertake it, the ability to edit it, the perseverance to stay with it through thick and thin, and the stamina to take all the grief that goes with maintaining such an enterprise, bespeaks a type of character and ability to which we all pay tribute.

J. H. S.

New Reports of Disease Outbreaks

When the Public Health Service began the collection and publication of information on the annual outbreaks of diseases attributable to milk and its products, it made a substantial contribution to the improvement in public health control measures. Its importance lay in its revealing character, that is to say, showing us the extent of the leaks in our system. By knowing what was happening in spite of our control procedure, we were in a better position to institute improvement in our regulatory measures. These outbreaks make our "case", so to speak, in substantiation for our increasingly strict supervision.

Since the recent reorganization of the Service, it has gone a step farther in supplying valuable information along this line. This time, it is in the form of an extension of the report of annual epidemics to those traced to other vehicles than milk

(1). Beginning with the calendar year 1938, the Service has enlarged this mimeographed tabulation of disease outbreaks to include water and food sources. Water still leads as a vehicle for disease transmission (in number of cases), then follows foods in general, and finally dairy products. The actual figures are as follows:

Vehicle	Outbreaks	Cases	Deaths
	Number	*Number*	*Number*
Water	48	31,693	17
Foods in general	70	2,247	25
Dairy products	42	1,685	27

An interpretation of the vital statistical significance of these figures for food-borne outbreaks indicates that there must be "1,000 or more outbreaks, hundreds of thousands of cases, and 400 or more deaths per year resulting from faulty sanitation". What a case these figures make for continued vigilance in safe-guarding our milk supplies and for improvement in the public health aspects of our food control!

J. H. S.

(1) Disease Outbreaks Resulting from Faulty Environmental Sanitation, by L. C. Frank, *Public Health Reports* 25, 1373, August 2 (1940).

Homogenization Not Considered 'Artificial' by Court

According to an account in Public Health Reports, July 5, 1940, the Washington Supreme Court made a ruling that would seem to have a far-reaching influence on the homogenization of milk in relation to increasing the depth of the cream line.

The milk ordinance of the City of Seattle prohibits the sale of "milk which has had the cream line increased by artificial means". The city health commissioner ordered a company to discontinue the sale of a 5 percent milk for the reason that the company in their standardization of the milk, had added pasteurized cream that was also homogenized. The product therefore was a combination of whole pasteurized milk and homogenized pasteurized cream.

The Court ruled that this practice was not an "artificial" treatment by reason of the fact that the ordinance otherwise recognized that homogenization of milk and of cream was legal. The Court held that if the City Council had wanted to prevent the deepening of the cream line by the addition of homogenized cream, it should have employed the word "mechanical" instead of "artificial". As the expression stood in the ordinance, the word "artificial" was interpreted by the Court to refer to the addition of foreign substances to milk to increase the cream line.

J. H. S.

Dairy Industries Exposition

The great machinery and supplies exposition of the Dairy Industries Supply Association will be held in the mammoth auditorium at Atlantic City, October 21-26. The International Association of Milk Dealers and also the International Association of Ice Cream Manufacturers will hold their annual conventions there during the same week. Attendance this year is expected to be particularly large because last year these trade conventions were held on the west coast.

Measuring the Sanitary Quality of Market Cream *

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INTRODUCTION

Several laboratory procedures, in addition to the standard plate count, recently have been proposed for measuring the sanitary quality of dairy products. Among these are the phosphatase test, the direct microscopic count, and the *Escherichia-Aerobacter* count. Several of these procedures have proved effective for controlling the sanitary quality of market milk, but their possible usefulness for measuring the sanitary quality of market cream has not been determined fully.

The principal objectives of this investigation were to determine the relative merits as well as the limitations of several laboratory procedures for evaluating the sanitary quality of cream; and secondly, to observe the relationship between the results obtained with the laboratory tests used.

To evaluate properly the phosphatase test results when applied to cream, certain preliminary studies were conducted under controlled conditions. The remainder of the data is based upon results from samples obtained from commercial plants.

COLLECTION OF CREAM SAMPLES AND DATA

The cream used for the trials conducted under controlled conditions was separated from milk received at the Kansas State College creamery. The commercial samples of pasteurized cream and milk were collected by milk sanitarians from 28 plants located in six Kansas cities having standard milk ordinances. Samples were collected, packed in ice, and transported to the laboratory at Kansas State College. Usually, not more than five hours elapsed between the time of taking the samples and their arrival at the laboratory, and in no instance was the elapsed time more than twelve hours. Samples of pasteurized milk were also obtained from plants which separated their cream from pasteurized milk. This milk was used to compare results of tests on the milk with those obtained on cream made from the milk. Data were also collected by the sanitarians relative to the equipment used and the procedures followed in processing at the plants.

PROCEDURE

Pasteurization efficiency was measured by the New York City field phosphatase test (1) modified by the use of a 30 minute incubation period as suggested by Roger (2), and by the Gilcreas and Davis phosphatase test (3), using a value of 0.04 mg. of phenol per 0.5 ml. of sample as the maximum amount permissible in an adequately pasteurized sample.

All bacteriological determinations were made according to the procedures outlined in the seventh edition of *Standard Methods for the Examination of Dairy Products* (4). The new standard milk agar was used for all plate counts. Violet red bile agar was used in determining numbers of *Escherichia-Aerobacter* organisms present, duplicate plates being poured in all cases. Direct microscopic counts were made on smears prepared by spreading 0.01 ml. of cream over an area of 1 square centimeter. The dried smear was defatted with xylol, fixed with alcohol, and stained with aqueous methylene blue. Individual cells, rather than clumps, were counted in each case.

The procedure recommended by Sommer (5) for determining the titratable acidity was used, and the results were expressed in terms of lactic acid. The pH measurements were made by the quinhydrone electrode method.

*Contribution No. 133, Department of Dairy Husbandry; Contribution No. 191, Department of Bacteriology.

RESULTS

Relative heat resistance of Escherichia-Aerobacter organisms and phosphatase in cream. In a study with ice cream mixes (6), the phosphatase enzyme was consistently more resistant to heat than were some of the more heat-resistant bacteria of the *Escheria-Aerobacter* group. No data, however, have been seen to show that this relationship necessarily holds true for cream. Knowledge of this relationship is essential to the proper evaluation of the significance of the *Escherichia-Aerobacter* group of microorganisms in adequately pasteurized cream.

To study this relationship, 24-hour litmus milk cultures of selected heat resistant strains of *Escherichia-Aerobacter* organisms were inoculated into samples of raw cream in such quantities that from 50,000 - 100,000 per ml. of the organisms were present in the unpasteurized cream. The cream was then pasteurized at a series of different exposures under controlled laboratory conditions. The phosphatase enzyme was more heat resistant than were the strains of *Escherichia-Aerobacter* organisms studied. This fact agrees with similar results reported for ice cream mixes. In the 104 trials, only one showed any survival of *Escherichia-Aerobacter* organisms. On the other hand, all of the cream samples pasteurized at 143.5° F. for 20 minutes were positive to both of the phosphatase tests used (Table 1). An exposure of 143.5° F. for 30 minutes was not sufficient to give negative phosphatase test in all samples. No positive phosphatase results were observed in any of the samples pasteurized at 145° F. for 30 minutes, 150° F. for 20 minutes, or at 150° F. for 30 minutes. These data would seem to justify the conclusion that cream which has been sufficiently pasteurized to yield a negative phosphatase test has also been heated sufficiently to destroy the *Escherichia-Aerobacter* organisms ordinarily present. The presence of these organisms in a sample of a cream negative to the phosphatase test would therefore be considered the result of contamination after pasteurization rather than of inadequate pasteurization.

Using the standard of 0.04 mg. of phenol per 0.5 ml. of sample as the maximum permissible for the satisfactory pasteurization resulted in several of the cream samples pasteurized at 143.5° F. for 30 minutes being evaluated as under-pasteurized (Table 1). Particularly was this true with the samples of 35 percent cream. Four of the 10 samples of 35 percent cream gave positive reactions to the Gilcreas and Davis test, and 2 of the samples were positive to the New York field test. Had a standard of 0.05 mg. of phenol as suggested by Gilcreas (7) been used as indicative of proper pasteurization for cream, none of the samples of 35 percent cream and only 1 sample of 20 percent cream would have been evaluated as under-pasteurized.

The data indicate that if the present standards for the phosphatase test, as used with milk, are used with cream, a pasteurization temperature somewhat in excess of 143.5° F. must be used to insure negative phosphatase reactions in all cases, at least under laboratory conditions. These results are in harmony with those reported by Giberson (8) who found that cream samples pasteurized in the laboratory at 143° F. for 30 minutes frequently gave phenol values indicating under-pasteurization.

Pasteurization treatment of milk and its relation to the phosphatase test results on cream separated from the milk. It has been reported that cream separated from pre-pasteurized milk may give a positive phosphatase reaction due to a concentration of residual enzyme in the cream during separation (7), even though the milk was thoroughly pasteurized. Previously published results have been based largely upon pasteurization exposures of 143° F. for 30 minutes or upon higher temperatures for shorter periods such as 160° to 180° F. for 15 seconds. The authors have seen no data showing the results on cream separated from milk pasteurized at a temperature of 150° or 160° F. for 30 minutes. In each of a series of 15 trials, 45 gallons of milk were divided into three portions and pasteurized separately in a 50-gallon glass-lined vat, using temperatures of 143°, 150°, and 160° F. for 30 minutes. The milk was cooled rapidly to 100° F. immediately following pasteurization, and separated. The resulting cream from each portion was divided and standardized to 20 and 35 percent fat, using skim milk from the whole milk from which the cream was separated. The two phosphatase tests were then performed on the milk before separation and on the resulting cream. The milk samples without exception were negative to the phosphatase tests.

When the milk was pasteurized at 143° F. for 30 minutes, positive reactions to the New York field test were obtained in 4 of the 15 samples of 20 percent cream and in 8 of the 15 samples of 35 percent cream. Similar results were obtained with the Gilcreas and Davis test, 3 samples of 20 percent cream and 7 samples of 35 percent cream being found positive. These data support the findings of Gilcreas (7) that cream separated from milk pasteurized at 143° F. may give positive reactions. The tendency for the enzyme to concentrate in the cream is indicated by the greater number of 35 percent fat samples which gave positive reactions than the 20 percent fat samples.

When the milk was pasteurized at 150° or 160° F., all the lots of cream obtained by separation following pasteurization were negative to the phosphatase test. This suggests the desirability of using somewhat higher pasteurization temperatures for milk that is to be separated subsequently for the production of market cream if the phosphatase test of cream is used as a measure of efficiency of pasteurization.

Phosphatase test results with commercial cream samples. When the 63 samples of commercial cream were tested for efficiency of pasteurization, 47 samples or 75 percent were negative, and 12 samples or 19 percent were positive to both phosphatase tests used. Of the other 4 samples, 3 were positive to the New

TABLE 1

Comparisons of phosphatase inactivation and destruction of Escherichia-Aerobacter organisms during laboratory pasteurizations of market cream samples

Number of trials	Percent fat in cream	Treatment of sample		Phosphatase test results				Test for the presence of *Escherichia-Aerobacter* organisms	
		Temp. (°F)	Time (min.)	New York Field Test		Gilcreas and Davis test			
				Number of samples		Number of samples		Number of samples	
				Positive	Negative	Positive	Negative	Positive	Negative
10	20	143.5	20	10	0	10	0	0	10
10	35	143.5	20	10	0	10	0	0	10
10	20	143.5	30	1	9	2	8	1	9
8	35	143.5	30	2	8	4*	6	0	10
8	20	145.0	20	0	8	0	8	0	8
8	35	145.0	20	0	8	1	7	0	8
8	20	145.0	30	0	8	0	8	0	8
8	35	145.0	30	0	8	0	8	0	8
8	20	150.0	20	0	8	0	8	0	8
8	35	150.0	20	0	8	0	8	0	8
8	20	150.0	30	0	8	0	8	0	8
8	35	150.0	30	0	8	0	8	0	8

* None of the samples in the group developed more than 0.05 mg. of phenol per 0.5 ml. of sample.

York field test only, and 1 was positive only to the Gilcreas and Davis test. To determine whether the available data would assist in suggesting possible causes for the positive phosphatase reactions observed, detailed data for the 16 cream samples positive to one or both of the phosphatase tests are presented in Table 2. The positive samples were divided equally between whipping and coffee cream. The degree of under-pasteurization as indicated by the quantitative phosphatase test results was generally greater for the coffee cream samples than it was for the whipping cream samples. This is possibly due in some instances to contamination of the coffee cream with raw or incompletely pasteurized milk during standardization.

Six of the 8 positive samples of whipping cream and 5 of the 8 positive samples of coffee cream were separated from pre-pasteurized milk. These results, when considered in relation to the pasteurization exposures used with the milk, suggest concentration of residual phosphatase from milk pasteurized at minimum temperatures as a possible cause for some of the positive results obtained. It is doubtful, however, that this factor alone was responsible for the indications of gross under-pasteurization observed in some of the samples.

The data indicate positive phosphatase tests are not necessarily associated with high plate counts (Table 2). Only two of the 16 positive samples had plate counts in excess of 60,000 bacteria per ml. *Escherichia-Aerobacter* organisms were present in all but 2 samples obtained from one plant. Neither of these samples was positive to both phosphatase tests. Whether the excessive numbers of *Escherichia-Aerobacter* organisms present in many of the other samples had survived faulty pasteurization or were present as contaminants could not be determined from the available data.

The data indicate that cream which would be considered entirely satisfactory on the basis of certain bacteriological criteria may show evidences of under-pasteurization by the phosphatase test. The value of using the phosphatase test in conjunction with other laboratory procedures for evaluating the sanitary quality of cream is apparent.

Standard plate count. The results of the standard plate count determinations are presented in Table 3. Fifty-two of the 63 cream samples were below the maximum of 60,000 per ml. plate count permitted for grade A pasteurized cream under the United States Public Health Service milk ordinance. Of the 11 samples exceeding this limit, 5 were whipping cream and 6 were coffee cream. Four of the latter were above 500,000 per ml. in plate count. Of the 16 samples with plate counts of 1,000 or less per ml., 11 were whipping creams and 5 were coffee creams. In other count groups, the differences in numbers between whipping and coffee cream were too small to be of significance. The logarithmic average plate count for the whipping cream samples was only a little over half that for coffee cream samples. The logarithmic average plate count for the samples of cream from milk pasteurized before separation was lower than for the samples of cream pasteurized after separation, despite the fact that cream separated after pasteurization is exposed to more contamination following pasteurization than is that pasteurized before separation. The reason for this condition will be indicated later.

Direct microscopic count. In Table 4 the distribution of samples according to direct microscopic count is shown. A direct microscopic count of 1,600,000 per ml. would be the maximum permitted under the provisions of the U. S. P. H. S. Milk Ordinance for raw cream to be processed for grade A pasteurized cream, and 8,000,000 per ml. would be the maximum for raw cream to be used for grade B pasteurized cream. Leaving a margin for changes in count and possible inaccuracies of estimate, a direct microscopic count in excess of 3,000,000 per ml. certainly should be considered excessive for raw cream to be processed for grade A pasteurized cream, and a direct microscopic count of 10,000,000 per ml. would

TABLE 2

Summary of data relative to the phosphatase-positive cream samples.

Sample No.	Fat %	Standardized	Past. before or after separation	Pasteurization exposure Temp. °F.	Pasteurization exposure Time min.	Pasteurization efficiency N.Y.F.	Pasteurization efficiency Gilcreas & Davis Mg. phenol	Pasteurization efficiency Gilcreas & Davis Evaluation	Bacteria count per ml. of sample E-A count	Bacteria count per ml. of sample Total count
				Whipping cream samples						
46	36.0	yes*	before	144.0	30	++	0.15	+++	86	16,900
39	39.0	yes*	"	142.5	30	+++			>150	>1,000,000
73	40.0	no	"	143.5	32	++	.....	not determined	120	<1,000
29	33.5	no	"	143.5	30	+	0.06	+	15	28,000
77	49.0	no	"	145.5	30	−	0.05	+	32	7,200
2	48.0	yes*	"	144.0	30	+	0.06	+	0	<1,000
43	44.0	no	after	143.5	30	+	0.02	−	3	7,600
32	38.5	yes**	"	150.0	30	+	0.05	+	>150	12,000
				Coffee cream samples						
40	25.0	yes*	before	142.5	30	+++	0.01	−		
45	25.0	no	"	144.0	30	++	>0.15	+++	>150	>1,000,000
72	24.0	yes*	"	143.5	32	++	0.15	+++	>150	40,000
28	33.0	no	"	143.5	30	+	0.05	+	20	1,910
1	26.5	yes*	"	144.0	30	+	0.06	+	5	6,200
84	21.5	yes**	after	155.0	30	+++	0.02	−	0	<1,000
54	24.0	yes**	"	152.0	40	++	>0.15	+++	1	4,200
42	22.0	yes*	"	143.5	30	+	0.07	+	3	9,400
							0.05	+	1	2,200

* Standardized after pasteurization.
** Standardized before pasteurization.

TABLE 3

Distribution of cream samples according to standard plate count.

Standard plate count per ml.	Number of samples in each count group: Whipping cream, Pasteurized before separation	Whipping cream, Pasteurized after separation	Coffee cream, Pasteurized before separation	Coffee cream, Pasteurized after separation	All samples: number	All samples: Percent
1,000 or less	7	4	3	2	16	25.4
1,010—3,000	3	2	3	3	11	17.5
3,100—6,000	2	1	4	1	8	12.7
6,100—10,000	1	2	2	3	8	12.7
10,000—30,000	3	1	1	0	5	7.9
31,000—60,000	1	0	0	3	4	6.4
61,000—100,000	1	0	0	0	1	1.5
101,000—500,000	0	2	1	1	4	6.4
500,000	1	1	1	3	6	9.5
TOTALS	19	13	15	16	63	100.0
Logarithmic average count per ml.	4,000	7,000	8,000	12,500	6,800	
		5,000		9,300		

be excessive for raw cream to be processed for grade B pasteurized cream. Using these lenient figures as a basis, 18 of the 63 samples (9 whipping cream and 9 coffee cream) failed to satisfy requirements for grade A pasteurized cream on the basis of raw materials, and 15 samples (7 whipping cream and 8 coffee cream) could not comply with the bacteriological requirements for raw materials for grade B pasteurized cream. The logarithmic average direct microscopic counts, as well as the distribution of the individual counts, indicate no appreciable difference between the quality of the raw materials used for the whipping cream and the coffee cream examined in this survey. The average bacteriological quality of the raw materials used for either coffee or whipping cream obtained from milk pasteurized before separation, was much better than for cream pasteurized after separation. This condition is probably the result of the separation of pasteurized grade A milk to obtain the one group of samples, while the other samples of cream may represent milk supplies of somewhat lower quality.

Some relationship was found between the direct microscopic count (indicating principally the quality of raw materials used) and the standard plate count (indicating something of the bacteriological condition of the finished product). This

TABLE 4

Distribution of cream samples according to direct microscopic count.

Direct microspocic count per ml.	Number of samples in each count group: Whipping cream, Pasteurized before separation	Whipping cream, Pasteurized after separation	Coffee cream, Pasteurized before separation	Coffee cream, Pasteurized after separation	All samples: number	All samples: Per-
100,000 or less	5	2	7	2	16	
101,000 to 316,000	8	0	4	1	13	
317,000 to 1,000,000	2	2	1	2	7	
1,010,000 to 3,160,000	2	2	1	4	9	
3,170,000 to 10,000,000	0	2	0	1	3	
10,100,000 to 31,600,000	1	3	2	2	8	
31,700,000 to 100,000,000	0	2	0	2	4	
Over 100,000,000	1	0	0	2	3	
TOTALS	19	13	15	16	63	
Logarithmic average count per ml.	330,000	2,700,000	340,000	3,700,000	810,000	
		770,000			850,000	

TABLE 5

Distribution of cream samples according to Escherichia-Aerobacter count.

Escherichia-Aerobacter count per ml.	Number of samples in each count group: Whipping cream, Pasteurized before separation	Whipping cream, Pasteurized after separation	Coffee cream, Pasteurized before separation	Coffee cream, Pasteurized after separation	All samples: Number	All samples: Percent
1.0 or less	4	7	2	7	20	31.8
1.1—3.0	2	1	4	2	9	14.3
3.1-10.0	1	0	1	1	3	4.8
11.0—30.0	4	1	3	1	9	14.3
31.0—100.0	5	1	3	1	10	15.9
100.0	3	3	2	4	12	19.0
TOTALS	19	13	15	16	63	100.1

relationship was not absolute because of the very high pasteurization efficiency obtained on some samples of cream with high initial bacterial population as shown by the direct microscopic count. Apparently a number of the high standard plate counts were the result of the use of raw materials of such poor quality that satisfactory pasteurization could not reduce the count to within satisfactory limits.

Escherichia-Aerobacter count. The distribution of the samples according to *Escherichia-Aerobacter* count is shown in Table 5. Although approximately one third of the samples contained one organism or less of this group per milliliter, many of the samples contained these organisms in large numbers. In those samples negative to the phosphatase test, and therefore to be considered as having been pasteurized properly, the presence of these organisms can be considered as an indication of contamination following pasteurization. In approximately 50 percent of the samples examined, the number of *Escherichia-Aerobacter* organisms was above 10 per ml., indicating extensive contamination. This was particularly true of those samples separated after pasteurization, indicating poor sanitary condition of the separator. Gross contamination of a number of the samples of cream pasteurized after separation also occurred. Contamination following satisfactory pasteurization appears to be a major problem in a number of the plants whose products were examined in this survey.

In order to facilitate determination of the causes of the high standard plate counts, additional data for all samples with counts above 60,000 per ml. are shown in Table 6. Except for whipping cream sample No. 21, which had quite obviously been partially neutralized, all of the samples were apparently normal from the chemical standpoint. One whipping cream and one coffee cream sample either had been pasteurized unsatisfactorily or had been standardized with unsatisfactory material following pasteurization. These two samples were obtained from the same processor and both had been pasteurized at 142.5° F., a temperature which is so low that any small error in control would have resulted in unsatisfactory pasteurization. The division of samples between those pasteurized before and after separation is almost exactly even, indicating that time of pasteurization was not an important factor in determining the high counts. Comparatively low pasteurization temperatures were used by most of the processors concerned, and these low temperatures with their somewhat lower pasteurization efficiency may have been a factor in causing the high counts. In five samples, the *Escherichia-Aerobacter* count indicated gross contamination as a major factor contributing to the high counts, and in three other samples considerable contamination occurred. Probably survival due to unsatisfactory pasteurization was at least partially responsible in two additional samples. In all but

three samples, the direct microscopic count was excessively high, indicating that raw materials of poor bacterial quality had been used. Standardization after pasteurization was the most common practice in this group, and unsatisfactory materials for use in standardization may have been a factor in increasing the plate count. In each sample, except that of No. 82, at least one factor which may have contributed to the high plate count was apparent as the result of laboratory examination. In numerous instances more than one cause undoubtedly contributed to the high count. Contamination from equipment seems to be the most important cause of high counts, followed closely by high count raw material.

The results of the bacterial determinations indicate that, although a general relationship exists between the various criteria of bacteriological quality employed, each method has its own particular significance. Much can be gained by using several methods together to permit more complete interpretation of laboratory data.

Acidity and pH values. No excessive acid development was apparent in any of the cream samples. None of the samples contained in excess of 0.13 percent acid, and in no instance was the pH value below 6.3. The abnormally low acidities observed in three samples of whipping cream and one of coffee cream indicated partial neutralization. All four of these samples contained less than 0.07 percent titratable acidity and all had a pH value of 6.9 or above. Two of the whipping cream samples even exceeded a pH value of 7.0.

If the sanitary quality of these four samples, suspected of neutralization, had been judged entirely on the basis of results obtained with the other tests used, no abnormalities in certain of these samples would have been indicated. These data indicate the possible usefulness of the acidity and pH determinations for detecting neutralization in market cream.

TABLE 6

Data relative to market cream samples with counts in excess of 60,000 per ml.

Sample No.	Fat %	Acidity Tit.	Acidity pH	Standardized	Past. before or after separation	Pasteurization exposure Temp. deg. F.	Pasteurization exposure Time min.	Phosphatase test N.Y.F.	Phosphatase test G. & D.	Bacteria count per ml. of sample Plate count	Bacteria count per ml. of sample E-A count	Bacteria count per ml. of sample Direct microscopic count
						Whipping cream samples						
39	39.0	.095	6.63	yes*	before	142.5	30	+++	no test	>1,000,000	>150	>100,000,000
81	41.5	.110	6.38	no	after	143.5	30	—	—	>1,000,000	>150	>100,000,000
21	38.5	.05	7.12	yes*	after	155.0	33	—	—	236,000	>100	15,000,000
79	39.5	.085	6.66	no	both	143.5-150	30	—	—	225,000	>15	5,400,000
85	36.5	.08	6.72	yes*	before	143.0	30	—	—	64,000	29	600,000
						Coffee cream samples						
40	25.0	.115	6.54	yes*	before	142.5	30	+++	+++	>1,000,000	>150	>100,000,000
51	19.5	.10	6.48	yes*	after	150.0	30	—	—	>1,000,000	>150	40,000,000
86	24.0	.09	6.64	yes*	before	143.0	30	—	—	>1,000,000	>150	20,000,000
80	27.0	.10	6.57	yes**	both	143.5-150	30	—	—	800,000	>150	60,000,000
82	30.0	.095	6.63	yes**	before	143.5	30	—	—	247,000	45	20,000,000
84	21.5	.095	6.67	yes**	after	143.5	30	—	—	142,000	>150	1,900,000
											0	

* Standardized before pasteurization

** Standardized before pasteurization

Comparison of certain laboratory results obtained with milk and cream from the same source. The relation between the phosphatase test, standard plate count, and *Escherichia-Aerobacter* count on pasteurized milk, and these same qualities on whipping cream obtained by separation following pasteurization was studied. Although only 2 of the 9 milk samples were positive to the New York field test and none were positive to the Gilcreas and Davis test, 4 of the resulting cream samples were evaluated as under-pasteurized by both tests. Standardization with raw or incompletely pasteurized products is suggested as a possible cause for the positive results observed in one comparison. In two other comparisons, incomplete pasteurization of the milk, together with a concentration of the enzyme during separation, may have been important contributing factors in causing the positive reactions, although contamination with raw products in standardizing might also be involved.

Six of the samples showed increases in the plate count ranging from a few thousand to over a million bacteria per milliliter. Such increases in the plate count may be attributed principally to contamination, although growth subsequent to pasteurization, or the breaking up of bacterial clumps by the agitation incident to processing may be factors.

This explanation is borne out by the observation that the milk samples contained few or no *Escheria-Aerobacter* organisms, and that only one cream sample did not contain considerable numbers of these organisms.

SUMMARY

1. In market cream pasteurized under controlled laboratory conditions, the phosphatase enzyme was found to be more heat resistant than selected heat-resistant strains of *Escherichia-Aerobacter* bacteria.

2. Laboratory pasteurization of 20 and 30 percent cream at 143.5° F. for 30 minutes was inadequate to insure negative phosphatase test results with all samples.

3. Cream separated from milk pasteurized at 143° F. for 30 minutes was frequently positive to the phosphatase test. When the milk was pasteurized at 150° F. or higher for 30 minutes, all of the resulting cream samples were negative to the phosphatase test.

4. Of 63 samples of cream collected from commercial plants, 47 were negative to both phosphatase tests. Of the 16 samples with a positive reaction, 12 were positive to both tests, 3 were positive to the New York field test only, and 1 sample was positive to the Gilcreas and Davis test only.

5. Fifty-two of the 63 cream samples had standard plate counts of 60,000 per ml. or less. The logarithmic average plate count for the samples of whipping cream was 5,000 per ml. as compared with an average of 9,300 for the coffee creams. Samples of cream from milks pasteurized before separation had appreciably lower average counts than did those samples pasteurized after separation.

6. The bacteriological quality, as shown by the direct microscopic count, of the raw materials used for cream pasteurized before separation, whether coffee or whipping cream, was much better than for the creams pasteurized after separation.

7. Contamination following pasteurization, as revealed by the presence of numbers of *Escherichia-Aerobacter* organisms, appeared to be a major problem in quite a large number of plants whose products were examined in this survey.

8. No excessive acid development was apparent in any of the cream samples studied. On the other hand, abnormally low acidities indicative of neutralization were observed in three samples of whipping cream and one of coffee cream.

9. As compared with the milk from which the cream was separated, the cream samples were found to show an increase in the number of phosphatase positive samples, an increase in the plate count and a marked increase in the numbers of *Escherichia-Aerobacter* organisms.

CONCLUSION

The results of the laboratory determinations used in this study indicate that no single test can be used as a satisfactory criterion for determining the sanitary quality of market cream. Each test has its own particular significance. Much can be gained by using several methods to permit more complete interpretation of laboratory data. The information revealed by the laboratory data can be of inestimable value in detecting faulty plant practices.

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(7) Gilcreas, F. W. Value of the phosphatase test as an indicator of pasteurization. *Amer. J. of Pub. Health*, **29**, 158-162 (1939).

(8) Giberson, E. M. A study of some factors affecting the phosphatase test for pasteurization. Cited by Burgwald, *J. Dairy Sci.* **22**, 853-871 (1939). (original not seen).

Rules of Practice for Federal Hearings in Food Control

Pursuant to the authority vested in the Secretary of Agriculture by the Federal Food, Drug, and Cosmetic Act, a detailed compilation of the prescribed rules of practice have been published by the Secretary in The FEDERAL REGISTER, volume 5, Number 124, pages 2379-2381, June 26, 1940.

Proposal.

On the initiative of the Secretary or any interested industry, he shall hold a public hearing upon any proposal to issue, amend, or repeal any regulation under certain sections of the Act. The notice must be published in the FEDERAL REGISTER, and the meeting will be held at designated time and place not less than 30 days thereafter. At the hearing, any interested person may appear and present his evidence in writing for or against the proposal. Opportunity will be afforded any person to examine submitted affidavits and to refute any admission or rejection of evidence. Testimony given at the hearing shall be reported verbatim and may be examined by any interested person upon payment of cost.

Proposed order. The Secretary, within a reasonable time after the filing of the record of the hearing, will issue his proposed order. This will be served upon the persons whose appearances were listed at the hearing. If no controversy obtained, the Secretary may omit this intermediate step. Exception against a proposed order may be admitted within 20 days after the issuance of the proposed order by any one whose appearance was filed at the hearing.

Final order. The Secretary will then issue his final order. A duplicate original will be filed with the Archivist of the United States, and published in the FEDERAL REGISTER.

Syllabus on an Educational Program for the Production of Safe Milk *

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Modern trends in public health work are not only in the direction of training the supervisory health personnel, but also of training in certain fundamentals in sanitation and hygiene the operators of food processing plants. The most outstanding example of the merits of such a program is what has been accomplished in the water works field. Some thirty odd states now conduct short schools and training programs for water plant operators, and some include sewage plant operators, swimming pool operators, and tourist court owners.

In the milk field the problem has been approached from several directions. The U. S. Public Health Service Sanitation Advisory Board in the 1939 Code "urged state milk control officials to survey their educational facilities for the purpose of a training program for pasteurization plant operators with a view to future licensing of such operators". The Joint Committee of Milk Supplies of the American Public Health Association and Conference of State Sanitary Engineers in 1938 recognized the need for better trained men in the field of milk sanitation. The Texas State Advisory Committee on Training likewise recommended such a program.

The production of safe milk would require a series of training or educational programs, namely:

First. Education of the consuming public.

Second. Securing the interest of the appropriating bodies.

Third. Training of the inspectors or rather the milk control officials.

Fourth. Training of the milk plant operators or pasteurization equipment operators.

Fifth. Training of the milk producers and distributors.

I. APPROACHING THE PUBLIC

(A) The health director of the community must have sufficient knowledge on the various phases of milk control methods and a publicity director of ability to interest the public through the medium of the press, radio, and motion pictures, stressing:

(1) Economics of milk control,
(2) Possibility of developing a local industry,
(3) Local benefits secured from employment, health, tax values, and some reference to the value of milk as a diet and the importance of grading.

(B) Then too, every housewife should receive certain definite instructions on the handling of milk in the home. One of the most useful circulars on the subject is entitled "What Every Housewife Should Know About Milk" as prepared by the U. S. Public Health Service.

II. INTERESTING APPROPRIATING BODIES

(A) City commissioners are interested in:

(1) Low mortality and morbidity rates,
(2) Development of milk and milk products plants,
(3) High rating of the milk supply,
(4) Listing the city for its milk supply in tourist guides,
(5) Recognition of its city personnel for outstanding work,
(6) Handling the city affairs on an efficient basis.

* Presented to the Missouri Association of Milk Sanitarians, May 1, 1940, University of Missouri, Eckles Hall, University Farm, Columbia, Missouri.

(B) No health officer should encounter any difficulty in selling the city administration on a well-rounded and balanced milk control program.

III. TRAINING OF MILK SANITARIANS OR MILK CONTROL OFFICIALS

The most important cog in a milk control machine is the sanitarian, supervisor, or control official. It is largely through his efforts, ingenuity, tact, and managerial ability that milk consumption can be increased, the public pleased, and the producers and manufacturers satisfied. Qualifications for such a man are many and exacting, but his ability to create goodwill is the most important one. This involves a fair knowledge of the various phases of milk production and a lot of personality. Personality may be developed, one factor being the creation of interest in his work and the setting of a goal for his advancement.

The training of the inspector might profitably include some of the following:

(1) The absorbing field for sanitarians—
- (a) Advancement of civil service status,
- (b) Licensed status,
- (c) Plant manager, administrator, or owner,
- (d) Teacher, writer, or inventor,
- (e) Manufacturer.

(2) Personality—approach, poise, Dale Carnegie specifications.

(3) Confidence—through study programs, bulletins, associations and contributions.

(4) Leadership—organization of programs of various groups (interesting, amusing, and educational).

(5) Diseases transmitted by milk—tuberculosis, typhoid, dysentery, undulant fever, septic sore throat, scarlet fever, diphtheria, and hoof and mouth disease.

(6) Health legislation.

(7) Milk ordinances.

(8) Interpreting milk analyses.

Assistant Surgeon General C. E. Waller of the U. S. Public Health Service in his paper entitled "The Use of Social Security Funds in Training of Milk Inspectors" (1) presented at the Louisville meeting of the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS (1937) had this to say:

> "The Public Health Service will approve budgets which contain items set up for paying living stipends and tuition for training milk sanitation personnel. The State health officer may select the school where he wishes to send such students." Some states are taking advantage of this offer.

IV. TRAINING OF PASTEURIZATION PLANT OPERATORS

The old pasteurization vat has evolved from a mere heating container to a very complicated mechanism embodying heat exchange between metal and liquids, thermostatic control, and automatic stop valves dependent upon their functioning on a minute drop in temperature. Vitamin D is added by means of an ultraviolet ray lamp, fat globules have been reduced by pressure and passage of milk through fine orifice, while former wastes are now converted into useful by-products.

Some managers looked with disfavor upon the promotion of training schools for milk plant operators. However, they changed their views when through a strike they endeavored to produce a quality product with new and untrained personnel. While some of our colleges have offered short courses to manufacturers and courses in dairy manufacturing to college students, there has been no regular curriculum set up for just the special training of pasteurization plant operators. Until the idea is sufficiently promoted, educational institutions will be slow to inaugurate them. A good start may be made, however, in cities supporting several plants by utilizing local facilities and drawing on assistance from state health and education departments.

The program in San Antonio, Texas, was organized about as follows:

(1) The interest of the plant managers was secured.

(2) A curriculum committee was appointed consisting of representatives from the managers, the operators, and the state and city health and education departments. State and local vocational facilities were utilized, and an active chairman, Dr. T. H. Butterworth, made the wheels turn.

(3) The course was divided into seven units, namely:

Unit No. 1—History and Significance of Pasteurization.
Unit No. 2—Bacteriology of Milk, Sterilization.
Unit No. 3—Elementary Dairy Chemistry.
Unit No. 4—Operation of Pasteurization Equipment.
Unit No. 5—Fundamentals of Equipment Cleaning.
Unit No. 6—Principles of Refrigeration.
Unit No. 7—Qualifications of Plants and Operators.

(4) Unit No. 8 which was not given but the value of which is appreciated by the curriculum committee is "Environmental Value of By-Products":

Use of skimmed milk—cottage cheese—milk desserts	4 hours
Powdered milk	2 "
Condensed milk	2 "
Disposal of wastes	2 "
Elimination of Cross Connections	1 hour
Examination	1 "

The surprising thing about this course was that the plant operators were more interested in bacteriology, sterilization, elementary chemistry, and principles of refrigeration than in the operation of pasteurization equipment. Another observation was the increased interest of the attendants at each session. The two hour schedule programs usually were extended to three and a half hours brought about by the discussion which ensued. The job status of the men has improved and the managers of the plants are highly satisfied. As a matter of fact, they are requesting more advanced work.

The teaching personnel was selected locally in San Antonio from plant managers, operators, refrigeration engineers, electrical engineers, health department personnel, and the like.

This type of program can be expanded to fit local conditions. There really is need for one full-time man to promote it. It could very easily be patterned after the water plant operators' program where we now use three full-time itinerant vocational instructors versed in their field to conduct these short schools. Teaching personnel could also be paid from vocational funds. With a few more schools held and interest developed, it will be a comparatively easy matter to have state educational institutions undertake organization and supervision of three to six months' short schools for pasteurization plant operators.

With the introduction of the merit systems in health departments, it is only a question of years before state regulations or laws will be enacted requiring the licensing of pasteurization plant operators. If it does not come by legislation or regulation, it may come by the requirement of the U. S. P. H. S. Milk Code.

In order that every piece of pasteurization equipment be carefully and safely operated, it is necessary that the operator be a qualified man. The setting up of qualifications and the methods by which they may be determined and attested, calls for a certification or licensing system. Such a system, compulsory in nature, has been in use for some four years at Oakland, Stockton, and San Jose, California, with apparent success. Dallas, Texas, has a regulation of its milk ordinance requiring the licensing of pasteurization plant operators, and Texarkana requires licensing of milk plant operators based upon successfully passing of a qualification examination.

Based on Texas's experience in the licensing of water and sewage plant operators, we should advocate consideration of the voluntary system to those states desiring to set up a licensing system. While we have no authority to speak for the Advisory Milk Committee of the U. S. P. H. S., it seems obvious that this Committee would favor granting additional points in the rating of a city that had incorporated into its milk control

activities the licensing of pasteurization equipment operators. As a means for furnishing discussion on the subject, the issuance of two grades of licenses might be considered with requirements as follows:

1. Senior or A grade:
   a. Graduate from 4-year course in in dairying or animal husbandry at an accredited school and six months actual experience with pasteurization equipment (this requirement may be satisfied by equivalent college work).
   b. Three years practical experience and successful passage of an examination designed to demonstrate the applicant's knowledge.
2. Junior or B grade:
   One year's practical experience in the operation of pasteurization equipment and the passage of an examination as under 1. b.

The Texas Water Licensing and Examining Board has functioned very nicely. The personnel is selected by the Texas Water Works Association with one representative from the State Board of Health. The Board consists of a Professor of Chemistry from one of the educational institutions, the Water Plant Operator from one of the larger towns, the Water Plant Operator from one of the smaller towns, and a representative from the State Department of Health. Whenever the licensing Board notifies the State Department of Health that an applicant has satisfied all the requirements for licensing, a certificate is issued which is signed by the State Health Officer, the President of the Water Works Association, and the Chairman of the Licensing Committee. It is, therefore, a non-political setup.

The granting of the certificate is given ten points in the rating of the city's water supply. Some cities have raised the salary of the operator when they progress to a higher grade, while other cities have given Civil Service status to their licensed men. Incentive to progress has been provided for men engaged in the business. Cities are receiving value in return and are actively supporting the system. A manual has been prepared for the use of the operators. Three itinerant teachers, provided by the State Vocational Education Division, hold night schools in the various cities, thus making instruction facilities available to the men desiring to improve their status.

A somewhat similar licensing system has been provided for milk inspectors in Texas and some 100 men have qualified. The first attempt at licensing pasteurization plant operators was the school at San Antonio, but the entire details of the licensing system have not been worked out.

The Texas Bar Association was successful in having an Act passed by the last session of the Legislature which would permit the Texas Bar Association to elect its own officials, promulgate rules and regulations which, if approved by the Supreme Court, would be given official status. In other words, the Bar Association has been placed under the wing of the Supreme Court. This is one of the newer trends and it might be applied in a similar manner to pasteurization plant equipment operators.

Reference material that might be used in a course for the training of pasteurization plant operators is listed as follows:

1. *Journal of Milk Technology, International Ass'n. of Milk Sanitarians.*
2. Standard Methods for the Examination of Dairy Products (7th Edition —1939), American Public Health Association.
3. *Journal of Dairy Science.*
4. Manual of Laboratory Methods, International Association of Milk Dealers.
5. Fundamentals of Dairy Science.
6. 1939 U. S. Year Book.
7. Market Milk, by Kelly & Clements.
8. Market Milk, by H. H. Sommer.
9. *Journal of Dairy Research* (English publication).
10. U. S. Public Health Service 1939 Milk Code and Ordinance.

11. *Milk Plant Monthly.*
12. *Milk Dealer.*
13. *Journal of Food Research.*
14. *Food Industries.*
15. *Canadian Journal of Ice Cream and Milk Products.*
16. *Ice Cream Review.*
17. *Journal of the American Public Health Association.*
18. College Extension Bulletins.

V. TRAINING OF MILK PRODUCERS AND DISTRIBUTORS

The next step in the training program is the training of the dairyman. It is rather difficult to secure compliance of any ordinance unless the dairymen are conversant with the economics and practical phase of each regulation.

It is comparatively easy to promote training schools for dairymen especially with the Chamber of Commerce and bankers supporting the program. These schools are usually night schools and subjects for discussion might be enumerated as follows:

1. How to make the dairying business pay.
2. Taking drudgery out of dairy farming.
3. The benefits to be secured from a testing, feeding, breeding, and marketing program.
4. Sales appeal.
5. The advantages of a Grade A County Dairy Association through mass buying, advertising, exhibits, bottle exchange, collections, and drive-in milk stands.
6. Quality production.
7. Sanitation and beautification.
8. "Stream lining" the dairy barns.

In planning such a course, federated clubs or parent-teacher associations are usually enlisted in the establishment of milk services at schools, essays, poster contests, dairy lunches, and the inspection of the dairies by groups of ladies. The matter of inducing the dairyman to serve lunch in the dairy barn is always good for a lot of wholesome publicity and gives the public further assurance of a clean product.

REFERENCE

(1) *J. Milk Technol.* 1, March 1938, p. 16

Pasteurization of Milk: Some Recent Aspects. H. D. Kay. *Nutrition Abstracts & Reviews,* 1939, v 9 1-11. *Bulletin of Hygiene, Vol.* 14, No. 11, November 1939, p. 821. Abstracted by W. G. Savage. *Pub. Health Engin. Abs.* xx, Mi, 30.

"After defining 'official' pasteurization and giving briefly the reasons why pasteurization is required the author discusses in some detail the effect of this process on the nutritive value of milk. The numerous comparative feeding experiments with calves and rats are mentioned, the observations on feeding of children with raw and pasteurized milk and the chemical and physical changes which have been recorded. The author sums up the nutritive changes as a 20 to 25 percent loss of vitamin B_1, a 20 percent loss of vitamin C, and a possible loss of 20 percent of the small iodine content of the original milk. All other known nutritive constituents seem to be unaltered. These changes are of less nutritional significance than the effects of winter conditions of production on the nutritive quality of milk, particularly as regards the large diminution in vitamins A and D.

"Considerable attention is then given to High-temperature Short-time pasteurization and the recent work on its efficiency under modern conditions, dealing both with its efficiency to destroy tubercule bacilli and the possibilities of its practical use and control. The need for special control over such plant is emphasized and with this proviso, it is considered that this type of pasteurization has reached the stage of engineering efficiency when it may seriously be considered as an alternative to the holder process. A temperature of 162° F. with a retardation time of 15 seconds appears to be the most satisfactory combination. The phosphatase test is discussed and its efficiency as a means of control stressed. The author also refers to the various investigations which have been published which show its adaptability to U. S. A. conditions (with a different temperature requirement) and also to the high temperature short time process."

Copied by R. A. C.

Common Causes for Intermittent High Bacterial Count and Positive Phosphatase Tests *

Milton R. Fisher

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I will not attempt to discuss all the problems that can occur under the subject. I wish to discuss some of the things that may occur daily in a plant although our records show that they appear occasionally. Now, we will ask ourselves two similar questions, one, a right-handed and the other, a left-handed one. First: Does a sample of milk or cream when collected at random give us a true quality picture on the plant's daily production? The answer is No. Second: Is it possible to have a satisfactory analysis on the sample collected and the other similar samples if analyzed would be unsatisfactory? The answer is Yes. A test when applied to a sample is a true picture only on that respective sample.

We shall combine these questions this way. When a sample of milk or cream is tested and the results are satisfactory, this does not necessarily mean that all of the bottles from that plant were of this quality, and when the collected sample was positive or unsatisfactory it does not mean that all of the bottles were of that quality. The positive test does mean that some of the milk or cream, as the case may be, was of this quality. Unfortunately, the test does not tell us how much. Therefore, we must have confidence in our tests and at least give them a chance to prove to us something is wrong. It is best not to criticize a test or substitute an alibi until we are sure everything is right. Positive reactions to the phosphatase test and high bacterial counts do mean much to us as health officials. Therefore, it is up to us to determine why this condition occurred.

For an example as to why these conditions happen, we shall review the operation of a small plant with a single vat installation of the thirty-minute holding type. The first question to be asked is "Where did this sample come from in relation to the total number of bottles filled?" Did it come from the first group of cases, or was it from one of the last to be filled, or was it in between the two? Now, it appears necessary to divide the filling period into three parts, first, middle, and last. If the respective sample was from one of the first cases to be filled, it can be positive to the phosphatase test and high in bacterial count because this milk was not subjected to the proper temperature for the required time. The common fault in operation here, usually, you will find to be a short holding time.

It is possible in observing the recording chart to pass it as a satisfactory daily run. Why? Because the holding period continued during the emptying and bottling time, and the outlet valve was opened before the thirty-minute holding time was completed. Therefore, it is necessary to know the emptying time on each vat if you are going to determine the true holding period.

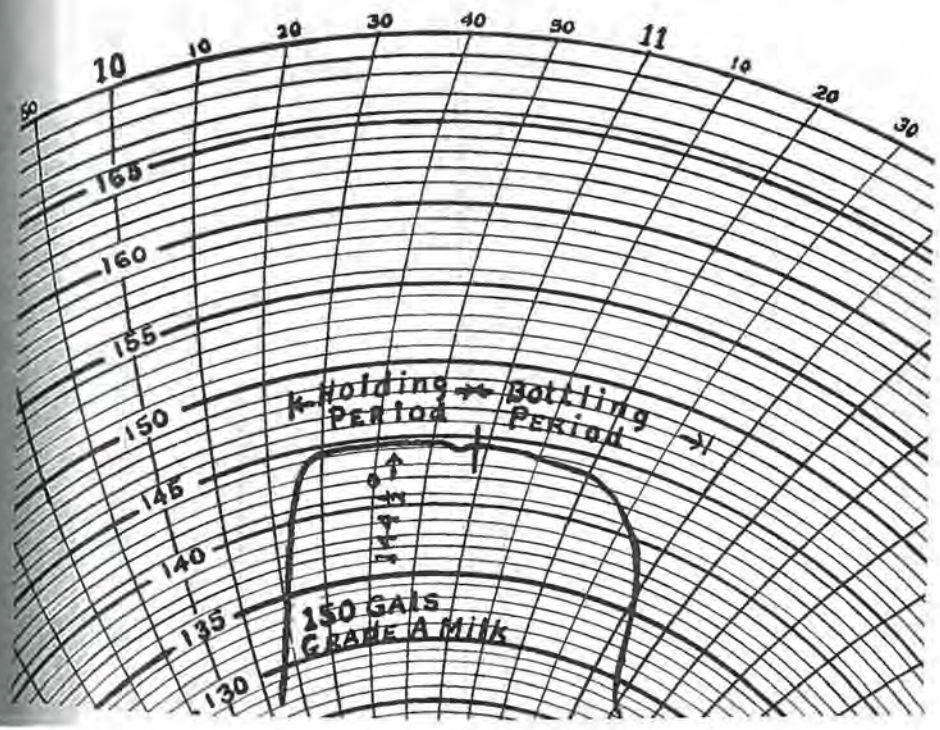
As an example, we will say, the operator opened the outlet valve of the pasteurizer after the milk was held for 20 or 25 minutes, and the filling operation started immediately. This milk will be positive to our tests. As time marches on, and the holding period continues this milk will become negative to the phosphatase and may become satisfactory to other tests. Now we see how it is possible for a positive test to correct itself automatically after a thirty-minute period has passed. So, it is possible for the first bottles to be unsatisfactory to our test and other bottles to be satisfactory.

We offered the following method as one satisfactory way to separate the holding time from the filling period. The operator should move the recording pen arm just before opening the outlet valve. (See illustration).

After this method is put into practice, the inspector can observe the two periods, holding and emptying, very easily. He will be able to observe the emptying period over a long time. This study should give added information on the daily operation. It is also good practice to have the operator make notations on the back of the recording chart when the emptying period continues for a longer time than usual. This notation should give reason why the holding period continued longer than necessary.

When a pasteurizer is used more than once, it is possible for one batch of milk to be pasteurized and the other unsatisfactory to our tests. In plants using two or more pasteurizers, it is possible for some of the milk to be satisfactory and other bottles unsatisfactory, due to the individual vats. The percentage of unsatisfactory milk can increase as the number of pasteurizers increase. In the larger plants where automatic control systems are used, the danger usually exists at the beginning of the day's run and especially when the controls can be operated manually. Milk piping or milk pumps used occasionally or intermittently during the processing period are ideal seed beds for certain bacteria, especially during the warm months. I suggest we follow this Golden Rule, "EACH PIECE OF EQUIPMENT SHOULD BE THOROUGHLY CLEANED IMMEDIATELY AFTER USING."

When you wish to check for certain bacteria that will build up during the processing period, it is best to divide the bottling time into at least eight parts and



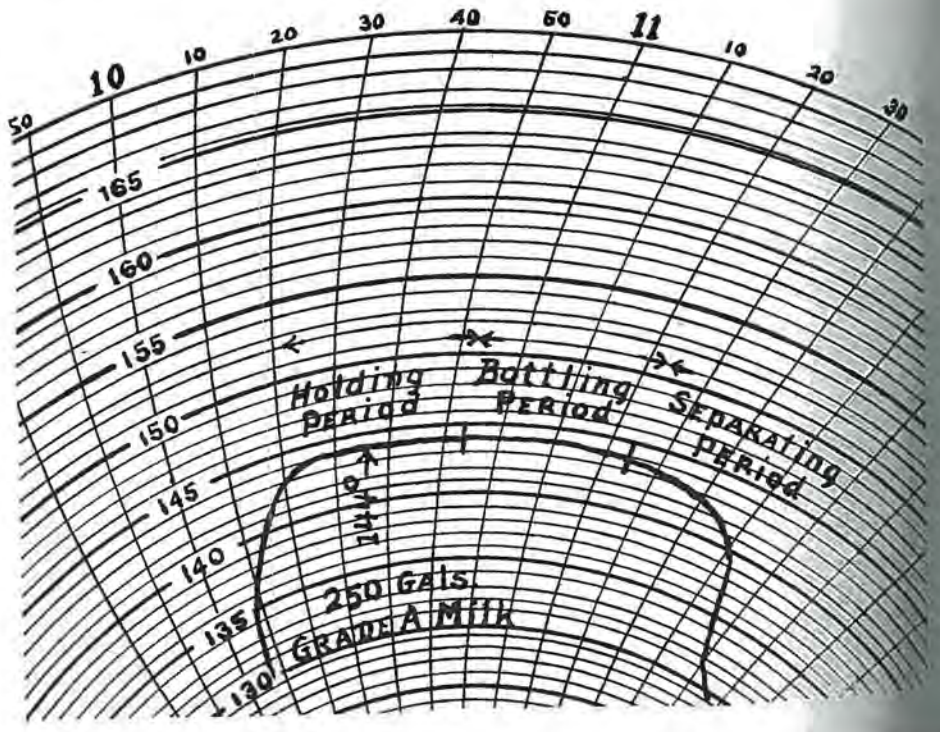
* Read at the Eighth Annual Convention of the Missouri Association of Milk Sanitarians, Columbia, Missouri, May 1-3, 1940.

a sample collected at each interval. This survey should indicate the approximate time when the unsatisfactory build-up is occurring. It may be necessary to recommend discontinuing processing at this point and thoroughly clean all equipment before resuming operations.

Raw products sometimes get into the pasteurized milk or cream by leaky inlet valves or failure to disconnect the inlet system properly. Sometimes raw skim or cream is used for standardizing purposes, and if this operation takes place after the holding period the test will be unsatisfactory.

In the small plant where the cream sales are not large enough for pasteurizing the cream separately, it is usually recommended that the pasteurized cream be obtained by separating pasteurized milk. We have found it good practice to recommend, and in some cases, demand if necessary, that the separation of cream take place after the bottling period. When the separation takes place before the bottling operation, we have found the cream to be positive to the phosphatase test and the milk negative. When we recommend the change to separation after bottling, this positive condition on the cream was eliminated. The operator should move the pen arm after the bottling or filling period and this will mark the separating period. Therefore, we have holding, bottling and separating periods. (See Illustration).

Vehicle samples must be taken to determine how well the milk is cared for during the delivery time. A satisfactory vehicle sample does not necessarily mean that all the milk or cream, processed by that plant, was of that quality. There are several things that can affect such a sample. The handling of the milk prior to going into the vehicle is important. We must take into consideration the production and plant processing. How long has the vehicle been enroute? Are the



temperatures satisfactory? The temperatures may be satisfactory at the beginning of the route and unsatisfactory at the end, or vice versa, when the products are iced enroute. The Sample Collector should obtain his own sample after inspecting the vehicle for unfavorable conditions as to the products thereon. If this is not done, the driver will get careless. In other words, if the worst bottle of milk and milk products, as per the physical inspection of the vehicle, is satisfactory to our tests, we can assume that all other similar products were satisfactory.

Milk bottle caps and the bottles or containers can cause trouble. However, I believe that this excuse is too often used as the answer to a high bacterial count. If we will trouble ourselves to investigate the case carefully and thoroughly, we shall find the cause other than the container. Just because the next sample collected at random was satisfactory, do not stop your investigation. Keep in mind, however, the possibility that part of the milk or cream may be unsatisfactory due to a daily routine practice. Check your charts and study plant for the true answer to that particular problem.

We let our bacteriological and chemical tests guide us to the direct cause. A positive phosphatase test or high bacterial count tells us something is wrong. However, it does not tell us what is wrong, so we must consider the facts in the respective case and make a positive diagnosis if possible. Always make sure that this condition is not a daily practice.

If we are going to control the intermittent high bacterial count and, occasionally, positive phosphatase tests and at the same time convince ourselves that this is not a common practice or possibly a daily routine practice, we shall have to collect plant samples. One of the first few bottles of milk coming from the filler will sometimes tell a story not contained in the bottles of milk after a short time. Therefore, it appears important to check the first few bottles from a vat occasionally.

New Federal Standard for Dried Skim Milk

On the basis of the information brought out at the hearing for receiving evidence on which to base a definition of skim milk powder, the Food and Drug Administration has published the following standard in the FEDERAL REGISTER, July 12, 1940, page 2543:

18.540 *Dried skim milk, powdered skim milk, skim milk powder—Identity.* Dried Skim Milk, Powdered Skim Milk, Skim Milk Powder, is the food made by drying sweet skim milk. It contains not more than five per cent of moisture, as determined by the method prescribed in "Official and Tentative Methods of Analysis of the Association of Official Agricultural Chemists", Fourth Edition, 1935, page 282, under the caption "Moisture—Tentative." The term "skim milk" as used herein means cows' milk from which the milk fat has been separated.

(Editor—A request by some Chicago milk interests for a rehearing on this standard has been denied by the Administration, who announces that the above standard becomes effective October 10, 1940.)

Trends and Results in Butter Technology *

M. E. Parker
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Buttermaking during the past few decades has been developed by artisans. Even today there are striking differences of opinion among buttermakers as to the best production practices involved in preparing cream for churning. These differences are not based upon mere whims or caprices, for seasonal and sectional influences make it necessary in processing different cream supplies to vary and adjust the degree and type of production practice. Therefore, the skill of the buttermaker is still a vital factor.

SCOPE OF TECHNOLOGY

Before proceeding with a discussion of the subject indicated by the title of this paper, perhaps it would be well first to attempt a definition of "butter technology". There is not a person engaged in the supervision or development of modern food production practices today who, in essence, is any other than a technologist. Technology is merely nothing more than applied science.

A vital transition has been taking place in the creamery industry during the past three decades. To offer only one concrete illustration, fishy flavors in butter have been recognized, identified, and brought under control, by the urge not merely *to see,* but *to see through* the phenomenon of storage defects. This situation is attributable to butter technology. It constitutes a vital step in our industrial advancement. The "why" is most important if we are really going to know or to learn "how".

Essential to the success of the newer knowledge has been the extension of observable phenomena through the use of laboratory aids. The chemical identification of fishy flavor as *trimethylamine* as well as the bacteriological incrimination of *Achromobacter putrefaciens* as a causative factor of socalled cheesy defects were both essential to the solution of the quality problems they are associated with.

NEED FOR MORE KNOWLEDGE

In spite of many technological advances, no one can successfully deny that far too much of the investigational work today is characterized by a lack of fundamental conception, a deficiency of vision and understanding, as well as a proneness to generalization which glorifies fancy and profanes fact. This trinity of profligate wastefulness is truly an intellectual inflation in which "much base coin passes for legal tender".

It is a sad commentary, indeed, to realize that only recently rollers were found to be an unnecessary accessory for the proper kneading of butter. We truly need more fundamental information about the "gathering" of butter granules in the churning of cream. Cinematic photography by stroboscopic means might supply the clue to a continuous method of buttermaking—the fondest dream of every buttermaker. The canners have found ways to cheat the detrimental effects of oxidation by effective deaeration while we go blissfully on occluding air in our product, both in the cooling and churning of cream and the working of butter. The coffee roasters have developed inexpensive methods of packaging that enhance the keeping quality of their product. All of these developments employ principles that could be applied to butter and buttermaking with obvious advantages.

We do not mean to imply that technology is our only salvation and that empiricism is necessarily a curse. We can not ignore empirical practices, but we can begin to adopt technological processes which will assure effective and efficient performance both in the creamery and on the consumer's table. Technology definitely is the fabric of modern food industries.

TASTE

Empirical methods play an important part not only in the manufacture of butter, but in the practice of scoring or grading butter for market. Furthermore, it must be granted that in judging the quality of a food product, the consumer is guided by the character of its taste, aroma, and appearance, as well as by its sale price. Thus in merchandising its product, the butter industry is confronted with consumer preferences which it cannot afford to ignore in passing judgment upon the results of its own labor.

We have made this reference to consumer preferences in an effort to caution against assuming that the expert knows all there is to know concerning butter quality—for let no one be deceived, the consumer is the ultimate judge.

The public health movement in this country has had an important bearing on the butter being made today. In its inception, this movement was motivated by the necessity to provide safety. Essentially it was an effort to combat infection and disease, to eliminate its ravages. Such a campaign was augmented by the discoveries of pasteurization and the development of sanitary practices. But what is really important to buttermakers is that all this resulted in health authorities becoming more esthetically minded in the *modus operandi* while the butter industry gradually recognized that economical forces were still at work—in fact, increasingly so. Increased burdens have been placed on the creamery as well as the rest of the dairy industry.

Coincident with a growing demand for sanitation, there has also developed a more insistent demand for milder flavored foods and for keeping quality. Today in butter we meet these demands by lower acidities than we used even five years ago for we have found that salt for example, which used to be used in amounts of 3½ percent to 4 percent or even higher and that now hovers around 2 percent, can actually increase the chances of butter becoming fishy if its acidity is ignored. To avoid this defect, and also to enhance keeping quality, we endeavor to maintain the acidity of salt butter at approximately pH 6.8. We have lowered the salt to the point where its presence is hardly discernible to the taste in our efforts to meet the growing demand for mild or perhaps we should say, more delicate or finer flavors. In unsalted butter, we still prefer higher acidities than are used in salt butter, but still lower than they formerly were for the same reason.

We use higher pasteurizing temperature for its insurance value of better keeping quality, and we also process the cream at lower acidities for milder flavor effects. We clean and we scour, not merely because "cleanliness is next to godliness", but for the sake of keeping quality as well as of avoiding possible off-flavor defects traceable to microbial development. Paradoxically, we are finding that with all this apparent cleanliness and purity, our product is apparently more susceptible to quality defects. We refer to the rather widespread experience in recent years with epidemics of so-called surface taints in butter, more accurately described perhaps as cheesy defects. Generally speaking, mold is the causative factor in some instances (notably with roquefort-like taints) while water bacteria are involved in others (having limburger and/or fruity characteristics). In fact, much of the cheesy taints in creamery butter during recent years have been traced to infection from chlorinated water supplies which, while safe from a public health standpoint, have often rendered the affected butter unsalable.

CONTAMINATION BY WATER

Where water supplies are infected with the bacteria responsible for surface taint, apparently cooler weather provides even

* Presented at the Conference of Dairy Manufacturers, University of Wisconsin, March 14, 1940.

more favorable conditions for their growth and maintenance. Accordingly, it becomes urgent that no untreated water come in contact with either the pasteurized cream or butter.

This means that chlorinated water must be used in the following steps:

(1) Water for rinsing down vats, pipe lines, or for cooling churns.
(2) All water used for washing butter—even the preliminary rinse for removing buttermilk from churn.
(3) Water added for bringing up final moisture on butter.
(4) Prevention of leaks of untreated water into cream from I. T. coolers, pumps, etc.

Water infected with surface taint bacteria is just as fatal to the quality of butter as drinking water contaminated with typhoid bacteria is to the public health, the main difference being that such drinking water can be made safe with considerably less chlorine than infected wash water requires. No butter is immune—its only protection is in wash water free from contamination. Wash water can be adequately treated by pasteurizing it, but ordinarily such treatment will be uneconomical.

It must not be assumed from the foregoing that infected wash water only is responsible for cheesy defects, for equipment often will harbor the responsible microorganisms in vats, pipe lines, sanitary fittings and valves, stuffing boxes, dead ends, etc. They can be perpetuated in cream cans and persist in their ravages if pasteurization is inadequate. It is essential to remember that pasteurization is a process in which time as well as temperature is essential. Pasteurizing at 180° F. can be ineffective if the rate of flow of cream through the flash pasteurizer is too rapid.

In the wash water, as well as that used for cleaning and rinsing equipment, it is important that it does not contain any appreciable taste and odor. This defect can even become a problem in connection with steam, particularly when it is used directly. For example, steam is used extensively in the practical sterilization of dairy equipment. It is also used for freeing milk and cream cans of the last traces of clinging milk solids in the more viscous products such as cream. The possibility of metallic as well as other types of contamination by water or steam suggests the advisability of more careful attention to their chemical character and treatments. There is considerable opinion that the chemistry of water and its possible relationship to the quality of dairy products is in urgent need of further development and wider application.

CLEANING OF CANS

In the cleaning of metal milk cans, there have been many advances during recent years both with respect to can-washing equipment and detergents. In this development, more and more attention has been directed towards the results obtained as measured by physical cleanliness and bacterial counts. Those interested in detergency recognize that to clean a surface you have to be able to wet it. Such an objective has directed more and more attention on the maintenance of the alkalinity of the washing solution. Automatic devices have appeared which perform effectively. Considerable attention has also been focused on the details of delivering a hot, dry can from the washer—hot so as to kill bacteria and dry so that the can would not develop an undesirable odor. This condition can result from the bacterial contamination contributed by the washing solution itself after an appropriate interval of accumulation of such bacteria as can and do survive heat and an alkaline reaction. Aside from checking the sanitation of washed cans for evidences of any visible dirt and for its total bacteria count, no one apparently has given much thought to the possible influence of such cleaned cans upon the quality of the milk or cream they subsequently transport. Invariably any moisture applied to these cleaned surfaces of these cans will often yield appreciable traces of alkali. Qualitative bacteriological methods will indicate why some milk or cream, at least gets a good husky flora of proteolytic and even lipolytic bacteria under presumably such perfect conditions of cleanliness. Cheesy and other flavors associated with staleness and even oxidation are traceable, no doubt, to infected cans.

BACTERIOLOGICAL CONTROL

While it is essential to maintain sanitation in any dairy operation, it is our unqualified opinion that to seek to impose market milk regulations to cream for buttermaking insofar as they involve the objective for low and lower bacterial counts would be a deplorable error for which the industry would have to suffer grievously. For example, perhaps there is a corollary to be found in the experiences that where market milk regulations with respect to low bacterial counts have been enforced, such supplies have been found unsatisfactory for making cheese of good quality. This is true not only in Ohio and Minnesota, but in that preeminent cheese state, Wisconsin, whose agriculture is peculiarly adapted to dairying. As a matter of fact, there are a good many experts who are beginning to wonder if a revision of the empirical method of evaluating quality in dairy products is not indicated in view of an urgent need for a broader viewpoint and more comprehensive appraisals than the mere number of bacteria per millimeter can ever provide.

In connection with the sanitary features of the quality control of dairy products, modifications of the Burri smear technique are proving of value in its applications to butter. There are reported instances where the Burri smear technique has isolated the foci of infection in many instances that plate methods would never have brought under suspicion. One of the most appealing features of this method which has found wide acceptance in Europe is that it can be applied to a variety of causative factors of quality defects by suitable variations in the cultural methods.

The report of G. W. Shadwick, Jr., on the application of the phosphatase test to creamery butter as an adequate method for attesting the thoroughness of the pasteurization of cream used in its manufacture was made two years ago to the American Butter Institute and the American Public Health Association. Last year, a similar report was made to the American Public Health Association by E. H. Parfitt, W. H. Brown, and G. W. Shadwick, Jr., in which they confirmed the original findings that only butter samples taken at the churn could provide the proper basis for attesting the thoroughness of the pasteurization of its cream.

Health officers are becoming increasingly curious concerning the quality of creamery butter. For example, the determination of yeasts and molds in butter is now an official method having just recently appeared in *Standard Methods for the Analysis of Dairy Products, Seventh Edition 1939* as published by the American Public Health Association.

PUBLIC HEALTH CONTROL

At the last annual meeting of the *International Assocation of Milk Sanitarians* in Jacksonville, Florida, Professor F. W. Fabian, Second Vice-President of that organization, deplored the fact that milk sanitation continued to receive primary consideration of municipal and state regulatory officials when, in his opinion, more emphasis upon the sanitation of ice cream, butter, and cheese, was not only desirable but essential to a well rounded public health program.

Other trends of the times must not be ignored. Many cities and states are now arranging for the special training of plant operators and public health inspectors, and the suggestion that only competently qualified plant operators, subject to regulation by registration and licensing, is being repeatedly voiced by public health officials. We can, therefore, anticipate that a college training or its equivalent in training courses already inaugurated by several cities and states might prove the necessary prerequisite for a full grade registered plant operator before he will be adjudged competent to operate pasteurizing equipment, for example. One encouraging note is that similar qualifica-

tions apparently are being recommended for official milk sanitarians and dairy inspectors.

QUALITY DEMANDS

We have confined our discussion largely to the causes and control of quality defects. There are many other phases of butter technology that could be outlined and profitably discussed but they appear not to be as vital for the moment as those primarily concerned with quality enhancement. This was deliberate on our part for the quality of food products has assumed, and will continue to assume, an ever-increasing importance. As the age of a consumer increases, his discrimination and quality preferences increase. In view of the fact that population trends indicate that the average age of consumers can only increase during the next few decades, the public demand for quality is on the rise. It is a well established trade axiom that a dairy product that is pleasing to the taste will extend the market by increasing the quantity consumed. Therefore, it is the responsibility of the butter industry to insure quality for unless it is provided, the necessity for more dairy products for more consumers, consistent with the objective of optimal public health, can never be attained. Technology will serve by finding out the "why" so as to make certain the proper control of quality, for as John Ruskin said:

> "Quality is never an accident. It is always the result of intelligent effort. There must be a will to produce a superior article."

Bacteriological Studies of Canned Milk Products. Agnes A. Nichols, *J. Dairy Res.* 1939, v. 10, 231-49. *Bulletin of Hygiene,* Vol. 14, No. 10, October 1939, p. 770. Abstracted by W. G. Savage, *Pub. Health Engin. Abs.* xx Mi, 33.

"A comprehensive study of 315 presumably sound and 150 presumably defective samples of evaporated milk, 252 of sound canned cream and 115 specials and 80 samples of sweetened condensed milk. Of the evaporated milk samples presumably sound only 16, or 5 percent, were unsterile; with the defective cans 59 were not sterile (39 percent). With canned cream the presumably sound showed 50 (20 percent) not sterile and the specials, selected for some abnormality, showed 30 percent not sterile. The non-sterile sound tins of cream were mostly associated with the use of the large 12 oz. cans and the majority occurred when this large tin was introduced for the first time. Spoilage due to non-spore formers was generally shown by a blown condition (here called 'bloats'), by curdling or by both together. Many kinds of bacteria were isolated but strains of the genus Escherichia were the commonest producers of gassy spoilage. Aerobic spore formers were isolated in about 80 cans both from sound and unsound cans. Of these 69 percent were B. subtilis strains and 15 percent strains of B. licheniformis. Some were associated with spoilage—clot, bitter flavours, etc. but others were from apparently sound tins. Cans inoculated with these strains showed in some cases no defects even up to 18 months, in others defects appeared. One outstanding defect resulted in some cases, i. e. the development of a bitter flavour associated with thinness. These aerobic spore formers were isolated from both evaporated milk and from canned cream. Only two cultures of anaerobic spore formers were isolated, both from sound cans. Some evidence was produced that B. licheniformis may produce a slight 'swell' in canned dairy products.

"Defects in the sweetened condensed milk samples were due to yeasts when the defect was a 'bloat,' 'Buttons' were due to various moulds, while progressive thickening had a varied causation."

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Time Required for Destruction of Bacteria at Different Temperatures of Pasteurization

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In the pasteurization of fluid whole milk, the principal goal is to destroy or devitalize the harmful bacteria, if present, and at the same time, not to destroy the cream line nor give the milk a cooked flavor.

HISTORICAL

Pasteurization of milk was introduced into the dairy industry during the period of 1890-1900. A number of laboratory workers carried on studies on this subject at that time. One of the earliest of these, Theobald Smith (1) inoculated milk with tuberculosis germs and then pasteurized it. He found that heating the milk for 20 minutes at 140° F. destroyed the tuberculosis bacteria. For commercial operation, a margin of safety is necessary so the time of heating was extended to 30 minutes.

From 1900 on, the pasteurization of fluid whole milk consisted in heating the milk at 140° F. for 30 minutes. From 1890 on for about 20 years, tuberculosis was considered as the most important disease transmitted in milk. For ten or more years after 1905, several serious outbreaks of septic sore throat due to milk occurred. In 1916 a serious outbreak of foot and mouth disease occurred among dairy cattle. A movement was started among sanitarians to favor increasing the pasteurizing temperature in order to have a greater margin of safety. In a number of cities the required pasteurizing temperature was raised to 145° F.

The bacteriological principle regarding the killing of bacteria by heat might be stated as follows: Within a certain range of temperatures, the higher the temperature, the shorter the time necessary to kill the bacteria. For fluid whole milk pasteurization, the practical range of temperatures is between 142 and 162° F. at corresponding time periods. In other words, milk can be pasteurized at any temperature within this range. This fact was soon recognized, and very shortly, flash heating was practiced. However, the engineering problems of dairy equipment were not worked out to the satisfaction of the sanitarians. Exposing every drop of milk for 10 or 15 seconds at 160° F. just could not be done with the equipment available. So for many years, this practice was not permitted for fluid milk by the sanitarians.

With the improvement in the equipment and the precision in control of time and temperature, high-temperature–short-time exposure is rapidly coming into common use. So we now have two accepted methods of pasteurization—low-temperature long exposure and high-temperature short exposure.* In the two methods, the temperatures are 142°-145° F., thirty minutes' exposure, and 160-162° F., fifteen to twenty seconds exposure.

As already stated, there are other combinations of time and temperature in the range between 142° and 162° F. for bringing about satisfactory pasteurization insofar as the sanitary quality only is concerned.

During the past year a study on this subject has been conducted in our laboratory. The results of this investigation are herewith presented.

METHODS

Milk used. Raw milk, aseptically drawn from a selected cow which had a low bacterial udder contamination, was inoculated with a 24-hour agar slope cul-

* Short-time high-temperature pasteurization not accepted in some states.

ture of *Esch coli*. The inoculated milk ranged in plate counts at different runs between one and four million colonies per cc. The butterfat of the milk was about 4 percent. The *E. coli* culture was a strain of heat-tolerant coliform organism.

Pasteurization method. About 3 ml. of the inoculated milk were put in a small, thin wall test tube. A certified thermometer was put in the milk in the test tube, and the latter placed in hot water in a large DeKotinsky water bath. To hasten the heating, the water was 10 degrees higher than the holding temperature. During the heating, the milk was stirred with the thermometer. When the milk reached the temperature at which it was to be pasteurized, the tube of milk was quickly transferred to another DeKotinsky hot water bath, thermostatically controlled. It required between 30 to 40 seconds to heat the milk up to the pasteurizing temperature. After the milk was pasteurized, it was quickly cooled in cold water.

For the cream-rising and flavor experiment, thin wall test tubes eight inches in length which held approximately 110 ml. were used. The tube containing the milk was heated in a water bath held at 140° F. until the milk reached approximately 140° F. (1 to 2 minutes). The tube was then transferred to a water bath held 10° F. higher than the holding temperature until the milk reached the desired temperature (approximately 1 minute). The tube was then transferred to a third water bath maintained at the desired temperature for the holding period and then the tube was cooled in ice water.

Bacteriological procedure. To test for viable organisms in the pasteurized milk, two fermentation tubes were inoculated, each with one cc. of the pasteurized milk. In a number of the runs, the agar plate method was also used.

Phosphatase test. The time was determined for the inactivation of the phosphatase enzyme at the different pasteurization temperatures, using Scharer's (2) modification of the Kay and Graham (3) technique. The phosphatase samples were incubated for one hour at 37.5° C. The amount of phenol was measured with the photoelectric cell setup of Hahn and Tracy (4).

RESULTS

To determine the heat required to pasteurize the milk, the following combinations of temperature and time were tested:

162° F.—5-10-15-20-25 seconds
161° F.—5-10-15-20-25 seconds
160° F.—5-10-15-20-25 seconds
158° F.—10-20-30-40-50-60 seconds
156° F.—20-30-60-90-120-180-240 seconds
154° F.—1-2-3-4-5-6 minutes
152° F.—1-2-3-4-5-6-8-10 minutes
150° F.—1-2-4-6-8-10-12 minutes
146° F.—5-10-15-20-25-30 minutes
143° F.—5-10-15-20-25-30-35 minutes

In most cases, 27 different samples of milk were subjected to each combination of time and temperature. From the results obtained from plates and tubes, the time and temperature combinations were secured for the destruction of the bacteria. In Figure 1, these points were plotted to form a curve. At 143° F., it required 25 minutes to kill all the bacteria. In regular pasteurization, the milk is held 30 minutes at that temperature. The five-minute interval is 20 percent of 25. In Figure 1, therefore, another curve is presented which represents a 20 percent increase in time exposure for each time and temperature combination. These results are considered the equivalents of 143° F. for 30 minutes. The same results are also presented in tabular form in Table 1.

TABLE 1

Time and Temperature Combinations Equivalent in Killing Property to 143° F. for 30 Minutes

Temperature ° F.	Time Exposure
143	30 minutes
146	18 minutes
150	8 minutes, 30 seconds
152	5 minutes, 56 seconds
154	3 minutes. 36 seconds
156	2 minutes, 24 seconds
158	1 minute, 36 seconds
160	0 minutes, 47 seconds
161	0 minutes. 30 seconds
162	0 minutes, 21 seconds

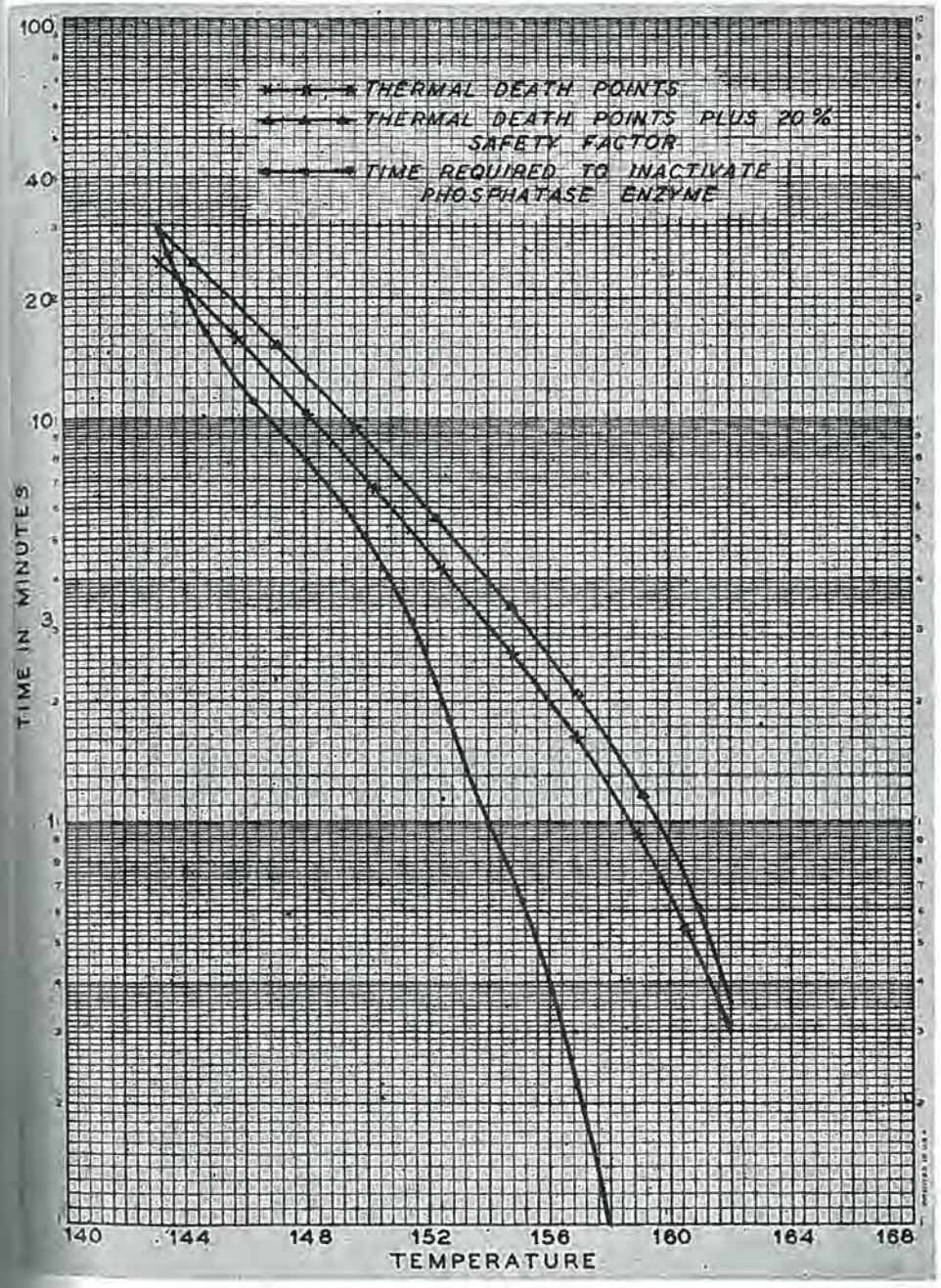

Figure 1

TABLE 2

Effect of Different Pasteurizing Temperatures on Flavor and on Cream Rising (Fat content of the milk—4.2 percent)

Temperature	Time	Intensity of cooked flavor	Percent cream volume after: 8 hrs.	24 hrs.	48 hrs.
Raw milk	.....	0	16.5	16.2	16.2
143°	30′	3½	17.4	16.7	15.45
146°	18′	3	16.2	14.7	14.7
150°	8′30″	2½	15.7	14.95	14.3
152°	5′56″	1½	11.5	11.75	12.5
154°	3′36″	½	11.0	11.75	12.5
156°	2′24″	2	10.3	11.5	12.1
158°	1′36″	1	10.55	11.5	12.1
160°	48″	0	11.3	11.8	13.2
161°	30″	0	10.75	12.2	12.9
162°	21″	0	9.8	10.75	11.75

0 =No cooked flavor
3½=Most pronounced cooked flavor

Pasteurization of milk under laboratory conditions presents real difficulties when high temperatures are used and the exposure is a matter of a few seconds. These findings are, therefore, in the nature of a preliminary report and are subject to change after further study. If these results are essentially correct, then the 10 or 15 seconds exposure of milk at 160°-161° F. as used in some dairies is not quite equivalent in killing properties to 143° F. for 30 minutes.

Dairy plants are always concerned about the cooked flavor and the cream line in pasteurized milk. The study on this phase of the problem has not progressed far enough for final conclusions. The results of two tests are here presented because, if correct, they will be of interest to the milk-plant operators. In test 1, milk having 4.2 percent fat was pasteurized at the combinations of time and temperature equivalent in killing property to pasteurization at 143° F. for 30 minutes, and the cooked flavor and cream rising were determined. The results are presented in Table 2. In test 2, milk having 4.1 percent fat was pasteurized for different periods of time at 143°, 156°, 160°, and 162° F., and the cream rising and the cooked flavor were determined. The findings are given in Table 3.

In test 1 the heating of the milk at 162°, 161° and 160° F. for 21, 30, and 47 seconds, respectively, produced no detectable cooked flavor, whereas it was noticeable when the milk was heated at 143° F. for 30 minutes. Even when the milk was held at 162° F. for 30 seconds, as in test 2, no appreciable cooked flavor developed.

On the other hand, the cream rising

TABLE 3

Effect of Different Time Exposures at 143°, 156°, 160° and 162° F. on Flavor and Cream Rising

Temperature ° F.	Time	Intensity of cooked flavor	Percent cream volume after 24 hours	Percent decrease in volume of cream 18.18=100%
143	15′	0	18.18	0
143	20′	0	18.18	0
143	25′	1½	18.18	0
143	30′	3	17.05	6.22
156	1′30″	0	15.15	11.17
156	2′	0	11.74	35.98
156	2′30″	1½	11.33	37.68
160	20″	0	13.63	25.03
160	30″	0	11.33	37.68
160	40″	0	10.94	39.20
162	10″	0	12.50	30.70
162	15″	0	11.74	35.98
162	20″	0	10.00	41.70
162	30″	0	9.47	57.91

TABLE 4

Time and Temperature Required to Inactivate the Phosphatase Enzyme to Give a Reading under 0.8 ppm. Phenol.

Temperature ° F.	Time
143	30 min.
146	10 "
150	5 "
152	2 "
154	1 "
156	25 sec.
158	5 "
160	Instantaneous exposure
161	" "
162	" "

was conspicuously affected at the higher temperatures. The percent of cream volume calculated on the basis of milk volume is shown in Tables 2 and 3. As the temperature was increased, the creaming of the milk was injured. For example, in Table 2 the volume of cream after 24 hours in milk heated at 143° F. for 30 minutes was 16.7 percent, while in milk heated at 162° F. for 21 seconds, it was 10.75 percent. The effect of high-temperature pasteurization on the cream rising is further shown in Table 3 in the last column. Here the volume of cream obtained when the milk was pasteurized at 143° F. for 25 minutes was taken as 100 percent, and the percent decrease in the cream volumes of the milk pasteurized at other temperatures was calculated. It is seen that even 10 seconds exposure at 162° F. caused 30.70 percent reduction in the cream volume.

Scharer's modification of the phosphatase test was run on duplicate samples of milk subjected to the time and temperature combinations given previously and on quadruple samples heated to 143°, 160°, and 162° F. for various periods of exposure. Using the photoelectric cell setup, it has been found in our laboratory that milk heated to 143° F. for 30 minutes will give a reading slightly under 0.8 part per million of phenol.

Table 4 shows the required exposures at the various temperatures to give a phosphatase reading equivalent to heating the milk at 143° F. for 30 minutes. The data indicate that at the higher temperatures, the phosphatase enzyme is more readily inactivated than are the *E. coli* organisms. For instance, at 143° F. it required 25 minutes to destroy all the *E. coli* organisms and 30 minutes to inactivate the phosphatase enzyme, and at 160° F. it required 40 seconds exposure to kill all the *E. coli* organisms whereas instantaneous exposure inactivated the phosphatase enzyme. The data also indicate that a negative phosphatase test on short-time–high-temperature pasteurized milk is meaningless when a one-hour incubation period is used. However, the phosphatase test will function properly on short-time–high-temperature pasteurized milk if the incubation period is sufficiently prolonged.

SUMMARY

It has been a well-known principle that milk for fluid milk trade can be pasteurized effectively at any temperature in the range between 142 and 162° F., and that as the temperature is increased, the time exposure may be shortened and satisfactory bacterial destruction obtained.

The findings in this study stress the fact that the killing effect on bacteria does not run parallel with the cream rising, with the development of cooked flavor, or with inactivation of the phosphatase enzyme.

If the above results are essentially correct, then properly pasteurized milk, when high temperatures and short-time exposures are used, will have a better flavor and smaller cream volume than milk pasteurized at lower temperatures and for longer time exposures.

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Comparative Studies Upon The Methylene Blue and Resazurin Tests *

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There has been considerable interest shown in the use of resazurin as an indicator in determining the sanitary condition of milk since its introduction by Ramsdell, Johnson, and Evans (1) in 1935. This dye was reported as being slightly more electro-positive than methylene blue, thereby requiring a shorter incubation period than methylene blue. These investigators also noted that when applying this test to pathological or physiologically abnormal milks, there resulted a characteristic reaction of an early initial reduction followed by a delayed final reduction. They also concluded that an incubation period of 1 hour gave results comparable with 5 hours using methylene blue, and that considerable information relative to the flora of milk was obtainable by observing the rate of color change over a period of hours.

Barrett, Rutan, and Keenan (2) reported that resazurin gave results in 1 hour that were comparable to the results obtained from the methylene blue test in 7 hours. They added, however, that a more accurate and reliable set of results were obtained when the samples were refrigerated at 40° F. for at least 4 hours prior to their incubation. They concluded that such tempering tends to put all the bacteria into the same state of activity whereby the dormant as well as the active ones (in the fresh sample) have the same start in the reduction of the resazurin dye. Frayer (4) and Warner (5), after making an intensive study of resazurin, observed no distinct advantage for it over methylene blue.

Ramsdell (8) studied the relationship between the reduction of resazurin and the leucocyte content of milk. He observed a general correlation, but was unable to demonstrate the reduction of either resazurin or methylene blue by washed leucocytes. Likewise, Strynadka and Thornton (9) were unable to demonstrate the ability of leucocytes in reducing methylene blue. They concluded that the abnormal udder conditions responsible for high cell content are responsible for abnormally high concentrations of reducing substances in milk.

Collins (6) compared the reduction times of resazurin and methylene blue, using various types of samples. He found the reduction times of methylene blue and resazurin to white to be approximately equal. Resazurin pink required approximately two-thirds the reduction time of methylene blue when used on fresh tank car shipments of good milk and slightly more than two-thirds of the reduction time of methylene blue when used on the same tank car shipments one day older. The reduction time of resazurin to pink, however, required approximately one-half the methylene blue time on patrons' shipments of raw milk. He also observed high correlation between resazurin pink and methylene blue reduction in selecting good and poor quality milk. A resazurin pink of 3 hours or more appeared to indicate as good quality milk as 5½ hours on methylene blue. Johns (14) concluded that the resazurin 1 hour test does not give as accurate results as the methylene blue reduction test. However, by continuing the incubation to the pink stage as the end point of resazurin reduction, the results are comparable to methylene blue, the reduction time being shortened. He observed poor correlation between resazurin color and cell content of milk.

* Condensed from a paper presented to joint session of Laboratory and Food and Nutrition Sections, American Public Health Association, October 20, 1939, Pittsburgh, Pa.

EXPERIMENTAL

In conducting these studies, an attempt was made to use a procedure and technique that could be duplicated under practical conditions without difficulty. Methylene blue solution was made up in the usual manner, using methylene blue thiocyanate. Eastman resazurin was used and a 0.05 percent stock solution was prepared and sterilized in an autoclave; then stored in a refrigerator. This solution was diluted 1 to 10 for the test, and 1 cc. of dye used for each test. In measuring both dyes into the test tubes, freshly washed but not sterile pipettes were used. The samples were taken from the weigh tank with a 10 cc. dipper. In reading the tests, the tubes were not inverted at each reading unless reduction had started and was not progressing uniformly throughout the tubes; in which case the tubes were inverted to bring the contents to the same color throughout. The tubes were incubated in an open water bath equipped with a DeKhotinsky electrical thermostatic control. The temperature was maintained between 97° and 100° F. The samples were protected from direct sunlight, but not from daylight.

DISCUSSION OF RESULTS

A preliminary series of trials was made to compare methylene blue and resazurin using 1200 samples of milk. These preliminary studies showed close correlation between methylene blue and resazurin, when the latter was incubated for 3 hours. However, 1 hour incubation with resazurin gave poor correlation with methylene blue reduction times. We also observed no advantage in refrigerating the samples before testing as suggested by Barrett, Rutan, and Keenan (2).

Methylene blue and resazurin tests and the direct microscopic counts were then made on 304 samples of milk. Table 1 shows the percentage disagreement of the results obtained with methylene blue and resazurin tests on these samples when compared with the microscopic counts. The resazurin results are tabulated for purple-pink and pink end points, each being obtained at the end of 1, 2, and 3 hours incubation, respectively. When comparing methylene blue (5 hours or less classed as reduced) with the microscopic count, 5.59 percent of the samples reduced methylene blue, but contained less than 200,000 bacteria per cc., whereas 6.25 percent of the samples did not reduce methylene blue but contained over 400,000 bacteria per cc. The total disagreement, therefore, was 11.84 percent.

TABLE 1

Summary of 304 samples tested with methylene blue and resazurin and the direct microscopic count, showing disagreement between methylene blue and the direct microscopic count and resazurin and the direct microscopic count.

Classification according to the microscopic count	Methylene Blue (5 hours or less classed as reduced)	Resazurin Test 1 Hour		2 Hours		3 Hours	
		Purple Pink	Pink	Purple Pink	Pink	Purple Pink	Pink
Good milk which reduced 200,000 bacteria or less	5.59	0.99	0.00	4.61	0.99	11.18	4.93
Poor milk, did not reduce over 400,000 bacteria	6.25	12.83	21.71	5.59	12.17	0.99	5.92
Total disagreement	11.84	13.82	21.71	10.20	13.16	12.17	10.85

TABLE 2

Summary 1434 samples tested with methylene blue and resazurin, showing the relative reduction times of methylene blue and resazurin purple pink multiplied by 2.

Expressed as percentage

	Hours Incubation						
	1	2	3	4	5	6	over 6
Percent of samples agreeing exactly	91.38	50.91	48.00	40.80	28.47	31.20	79.77
Percent of samples disagreeing 1 hour plus or minus	8.62	49.09	42.00	40.80	37.23	58.40	7.86
Percentage of samples with 2 or more hours plus or — disagreement	—	—	10.00	18.40	34.31	10.40	12.37

Good milk on methylene blue (6 hours or longer) 8.30%
Poor milk on resazurin (2½ hours or less) .....
Poor milk on methylene blue (5 hours or less) 4.46%
Good milk on resazurin (3 hours or longer) .....
Total disagreement 12.76%

This included good quality milk which had a satisfactory microscopic count but which did reduce methylene blue, as well as poor quality milk similarly tested but which did not reduce methylene blue and yet gave an abnormally high direct microscopic count. Comparing the resazurin results with the microscopic count, the end point and time which checked most closely with the microscopic count was purple-pink and 2 hours incubation, followed closely by pink at 3 hours. In this group 4.61 percent of the samples which reduced resazurin to purple-pink in 2 hours contained less than 200,000 bacteria per cc. while 5.59 percent which did not reduce resazurin similarly, contained over 400,000 bacteria per cc. The total disagreement in such instances was 10.20 percent. The other group, pink at 3 hours incubation, gave almost identical distribution with a total disagreement of 10.85 percent. Although both of the resazurin groups mentioned gave closer agreements with the microscopic count than did methylene blue, the disagreement among resazurin, methylene blue, and the microscopic count were of approximately the same degree.

Another series of tests including 1434 samples of milk were made comparing methylene blue with resazurin by reading the resazurin samples at 30 minute intervals for 3 hours and the methylene blue samples at hourly intervals for 6 hours. The results are summarized in Table 2. The top line shows the percentage of samples agreeing exactly for each hour's incubation. The percentage agreement decreases steadily from 91.38 percent at 1 hour to 31.20 percent for 6 hours. Possibly this could be partially explained by the change in bacterial flora of the samples during the incubation, inasmuch as the methylene blue samples were incubated twice as long as the resazurin samples, and consequently the flora of the sample at the time of the resazurin reduction would more closely approximate the original flora of the sample. As shown in the second line, there is considerable variation of ±1 hour between methylene blue and resazurin, but the cases where the tests disagreed by ±2 hours are relatively few, as shown in the third column.

While on the average the resazurin reduction time to purple-pink is approximately ½ of the methylene blue reduction time, there are numerous factors which cause the relationship of resazurin and methylene blue reduction times to vary. Of the 1434 samples, the average reduction time of resazurin to purple-pink was 0.452 of the methylene blue reduction time. For the first half hour on resazurin the relationship was 0.410 and increased to 0.530 of the methylene blue reduction time at 3 hours on resazurin. Therefore it seems that by using resazurin purple-pink as the end point of reduction, the results multiplied by 2 correlate closely with methylene blue yet the resazurin puts an accent upon the poorer grades of milk and gives slightly

longer reduction times the better grades of milk. Previous workers, Collins (6) and Johns (14) chose resazurin pink as the end point of reduction. In our preliminary studies, we observed that purple-pink at 2½ hours and pink at 3 hours gave very close agreements. Since purple-pink end points more nearly approximate one-half of the methylene blue reduction times, we decided this end point to be more desirable.

Frequently, we have encountered samples which would reduce resazurin to the purple-pink or pink stages rapidly, but would not reduce methylene blue until late in the incubation period, and in many cases not at all. It was noticed that although the resazurin tests were reduced to the initial stages early, they lagged after the initial reduction and were slow in reducing on to the white stage. It was further noticed that milk from certain herds gave this reaction consistently. Consequently 121 of these samples were examined under the microscope after the 3 hour incubation period on resazurin. In every instance, the samples contained over 500,000 cells per cc. or long chain mastitis streptococci, or both. Thus it was observed that resazurin is very sensitive to mastitis or abnormal milk, whether it be due to a high cell count or to mastitis streptococci or both, while methylene blue is apparently only very slightly affected by either. Furthermore, the fact that the resazurin dye lingers in the purple-pink or pink stage with mastitis or abnormal milk suggests that such a lag is a reliable index of such defects. Every sample examined which lingered in the purple-pink or pink stage contained a high cell count or mastitis streptococci or both. We did not, however, obtain data on all samples to determine the effectiveness of resazurin in detecting all the samples of mastitis or abnormal milk. Other observations have shown that in samples of perfectly normal milk containing a high number of poorly reducing bacteria, a lag will be encountered. It is probably logical to assume that with samples of very old milk containing a high number of dormant bacteria there will also be similar results. It was found, for example, that the addition of formaldehyde to milk gave the same reaction. Incidentally, when there is a high concentration of bacteria present (in addition to the mastitis streptococci or udder cells) these bacteria will reduce the resazurin on to the white end point without hesitation, thereby concealing the mastitis reaction.

This lag phenomenon indicative of abnormal milk was noted in the original work of Ramsdell, Johnson, and Evans (1) but apparently has been overlooked by subsequent workers. Our findings are in complete agreement with the work of Ramsdell (8), and of Strynadka and Thornton (9) who observed reducing properties for pathological and physiologically abnormal milk, but were unable to detect reducing properties in the washed leucocytes. Their conclusions were that the abnormal conditions of the udder responsible for high cell content are also responsible for high concentrations of reducing substances in milk to which resazurin is apparently sensitive.

Table 3 shows the results of the 1434 samples classified according to the resazurin coloration at the end of 2½ hours incubation. This classification gives close correlation with methylene blue, assuming that a blue coloration is good

TABLE 3

Classification of 1434 samples according to resazurin coloration after 2½ hours incubation compared to the methylene blue classification.

Resazurin coloration after 2½ hours incubation	Hours on Methylene Blue					
	1	2	3	4	5	6 and over
Blue			1.00	4.00	42.03	86.78
Purple pink			1.00	21.60	31.16	9.33
Pink	0.86	3.64	28.00	52.80	19.57	3.22
White	99.14	96.36	70.00	21.60	7.24	0.67
Number of samples	116	55	100	125	138	900

milk, purple-pink fair milk, pink poor milk, and white very poor milk. This method would simplify the technique considerably since the tests would have to be read only at the end of 2½ hours incubation. However, a more accurate and valuable set of results are obtained by reading the tests at 30 minute intervals. The one-reading technique is suggested only when it is imperative to abbreviate the tests as much as possible.

SUMMARY

1. Results comparable to those obtained with the methylene blue test on patrons' milk was obtained with the resazurin test by incubating the samples for one-half the time used for the methylene blue test, using purple pink as the end point of resazurin reduction. The resazurin results obtained under such conditions when multiplied by 2 appear to convert the results to methylene blue equivalents.
2. The correlation was best between methylene blue and resazurin tests for very bad milk, and decreased as the incubation period increased. The reduction time of resazurin to purple-pink was slightly less than one-half the methylene blue reduction time for very bad milk, but increased to slightly over one-half the methylene blue time for milk not reducing methylene blue in 6 hours. The average reduction time for resazurin to purple pink was 0.452 of the methylene blue reduction time.
3. Resazurin was found very sensitive to pathological and physiologically abnormal milks as indicated by a high cell count or mastitis streptococci or both, whereas the methylene blue test was found to be only very slightly affected by such factors. This apparently accounts for a considerable portion of the disagreement between resazurin and methylene blue for samples slow in reducing methylene blue.
4. Mastitis and abnormal milks were detected by resazurin (when not accompanied by a high contamination of other bacteria) by reading the tests at 30 minute intervals for an incubation period of at least 3 hours. Mastitis and abnormal milk apparently reduce resazurin early, with some lag in the purple-pink or pink stages.
5. The resazurin test checked slightly closer with the microscopic count than did methylene blue results. However, methylene blue and resazurin correlate more closely with each other than with the microscopic count.
6. The following advantages were noted for resazurin:
   (a) Shorter reduction time. The time required for the reduction of the resazurin dye is reduced by half and consequently the flora of the sample at the time of reduction should more closely approximate its initial condition. The time factor has consistently been advanced as a disadvantage of the methylene blue test.
   (b) The sensitivity of resazurin to pathological and abnormal milk is of value. Resazurin is not only reduced by many of the samples of pathological and abnormal milk that would not be reduced by methylene blue, but also offers a distinctive reaction that aids in their detection.
   (c) Resazurin is more sensitive to weakly reducing bacteria than methylene blue, thereby giving results which more nearly reflect the actual numbers of bacteria irrespective of their reducing ability.

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New Federal Standards for Dairy Products

On the basis of evidence received at hearings held in May 1939, pursuant to the provisions of the Federal Food, Drug, and Cosmetic Act, and published in the *Federal Register* for July 2, 1940, the following standards have been established for the respective dairy products:

CREAM CLASS OF FOOD

Cream is the class of food defined as "the sweet, fatty liquid or semi-liquid separated from milk, with or without the addition thereto and intimate admixture therewith of sweet milk or sweet skim milk. It may be pasteurized and if it contains less than 30 percent of milk fat . . . it may be homogenized. It contains not less than 18 percent of milk fat, as determined by the method prescribed in "Official and Tentative Methods of Analysis of the Association of Official Agricultural Chemists", Fourth Edition, 1935, page 277, under 'Fat, Roese-Gottlieb Method — Official' ".

LIGHT CREAM, COFFEE CREAM, AND TABLE CREAM

Definitions and standards for these products conforms to the above cream class of food except that they contain less than 30 percent of milk fat.

WHIPPING CREAM CLASS OF FOOD

Whipping cream is the class of food which conforms to the definition and standard of identity prescribed for the cream class of food except that it contains not less than 30 percent of milk fat.

Light whipping cream conforms to the standard for the whipping cream class of food except that it contains less than 36 percent of milk fat.

Heavy cream and heavy whipping cream conform to the standards for the whipping cream class of food except that it contains not less than 36 percent of milk fat.

EVAPORATED MILK

"Evaporated milk is the liquid food made by evaporating sweet milk to such point that it contains not less than 7.9 percent of milk fat and not less than 25.9 percent of total milk solids. It may contain one or both of the following optional ingredients:

(1) Disodium phosphate or sodium citrate or both, or calcium chloride, added in a total quantity of not more than 0.1 percent by weight of the finished evaporated milk.

(2) Vitamin D in such quantity as increases the total Vitamin D content to not less than 7.5 U. S. P. units per avoirdupois ounce of finished evaporated milk.

It may be homogenized. It is sealed in a container and so processed by heat as to prevent spoilage."

When the Vitamin D content is ar-

tificially increased, the label shall bear the statement, "With Increased Vitamin D Content" or "Vitamin D Content Increased", such statements to precede or follow the name "Evaporated Milk" immediately and conspicuously, without intervening descriptive matter.

Such milk may be adjusted by the abstraction or addition of cream or sweet skim milk, or by the addition of concentrated sweet skim milk.

The official methods for the determination of the milk fat and the total solids respectively are found on pages 280 and 279 of *Official and Tentative Methods of Analysis of the Association of Official Agricultural Chemists,* Fourth Edition, 1935.

The Vitamin D content may be increased by the application of radiant energy or by the addition of a concentrate of Vitamin D dissolved in a food oil; but if the food oil is not milk fat, the quantity added must not be more than 0.01 percent of the weight of the finished evaporated milk. The quantity of Vitamin D is determined by the method prescribed in the *"The Second Supplement to the Pharmacopoeia of the United States of America, Eleventh Decennial Revision,* pages 132-134 inclusive, and pages 136-138, with such modification of the method of feeding as is necessary for the evaporated milk instead of an oil.

CONCENTRATED MILK

Concentrated milk, plain condensed milk, conforms to the standards, definitions, and requirement for evaporated milk (as above) except that:

(1) It is not processed by heat;
(2) Its container may be unsealed; and
(3) Optional ingredients are not used.

SWEETENED CONDENSED MILK

Sweetened condensed milk is the liquid or semi-liquid food made by evaporating a mixture of sweet milk and refined sugar (sucrose) or any combination of this sugar with refined corn sugar (dextrose) to such a point that the finished sweetened condensed milk contains not less than 28.0 percent of total milk solids and not less than 8.5 percent of milk fat.

The composition of evaporated milk may be adjusted by the addition or abstraction of cream or sweet skim milk, or the addition of concentrated sweet skim milk.

DATE OF ENFORCEMENT

The foregoing requirements become effective on September 30, 1940, but the effective date for evaporated milk has been postponed to March 1, 1941.

It will be noted that all whipping cream must contain no less than 30 percent milk fat. The light whipping cream contains less than 36 percent milk fat whereas the heavy whipping cream contains not less than 36 percent milk fat.

There have been several important changes from the preceding standards. Under the Food and Drugs Act of 1906, evaporated milk was required to contain not less than 7.8 percent of milk fat and not less than 25.5 percent of total milk solids, and that the sum of the percentages of milk fat and total milk solids must be not less than 33.7 percent. Under the new standards, the composition is simply a minimum of 7.9 percent milk fat and not less than 25.9 percent total milk solids.

These same considerations hold in the case of sweetened condensed milk. The preceding standards required not less than 8.0 percent of milk fat and not less than 28.0 percent of total milk solids. The new order establishes not less than 8.5 percent milk fat and not less than 28.0 percent of total milk solids.

By omitting permission to use sodium bicarbonate in the manufacture of condensed or evaporated milk, the heretofore practice of neutralizing milk in such manufacture constitutes an infringement of the law.

Refined corn sugar (dextrose) may be used in the manufacture of sweetened condensed milk, provided that refined sucrose is also used.

J. H. S.

Milk: Whither Research? *

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As we look back upon the progress that has been made in the sanitation and nutritive value of milk, we cannot help but wonder what Dr. Coit and his pioneering collaborators would say if they could see the place of milk in our life today. The production of certified milk is certainly the greatest achievement yet witnessed in the application of sanitary practices to the production and handling of food. Time was when the careful microbiological control and cleanliness as practiced by the brewing trade were held up for the emulation of the food industry. We must have learned our lesson well as evidenced by the complete reversal of the picture: At the first food technology conference held at the Massachusetts Institute of Technology in 1937, Mr. Sippel (speaking as a brewing technologist) extolled the sanitary technology of the milk industry as an example of what the brewers should practice. All this has come about mostly through the influence of certified milk production. Your association blazed the way, and showed that dairy sanitation was practicable and beneficial, yes, and even profitable.

The actual volume of certified milk is relatively small—only about 1 to 2 percent of the total milk consumption. But the high quality of certified milk has greatly influenced the standards of the bulk of the regular milk supply. You gentlemen proved that greater care and cleanliness were possible in the production of fluid milk at large than had previously been thought to be possible. When new information became available, the certified milk dealers have been eager and aggressive to apply it to their operations. You have been foremost in applying sanitary ideals to practice, and have continually stimulated the rest of the industry to follow you. As we chemists put it, you have catalyzed the production of milk in the entire dairy industry. You are still maintaining your leadership, and your application of science, technology, and sanitation to the milk business is still in advance of the field.

Such a background of achievement and dependable performance places a great public responsibility on you as leaders in the continued development of the milk business. Furthermore, your professional affiliations and your social interest gives you the public and official ear, so to speak. Therefore, you are in a strategic position to "sell" desirable developments to the commercial interests, the regulatory authorities, and the public.

What are some of the needs of the dairy industry that require recognition and solution—diagnosis and treatment?

CONSTITUTION OF MILK

The first one is to ascertain what is milk. We know that it is a white liquid that contains several percent of butter fat, a little less protein mixture, about the same carbohydrate content, some minerals, a mixture of vitamins, and a number of enzymes. However, we know so little about their constitution and physico-chemical condition that no one can synthesize milk. We do not know as much about our product as the oil companies do about petroleum nor the steel industry about the properties of iron. Yet over several dozen agricultural experiment stations, scores of universities and colleges, and hundreds of plant laboratories in this country are turning out

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* Read before the Joint Conference of the American Association of Medical Milk Commissions, Inc., and the Certified Milk Producers' Association of America, Inc., New York, June 10-11, 1940. Published by permission of *"Certified Milk."*

papers by the thousand—and we still do not know what is the actual composition of the product that we are handling. No one can properly know a product until he can put it together in a laboratory. Without this fundamental information, our advance is by the slow and costly practice of trial and error. It is analogous in some respects to building a house without a blue-print: we get it completed some way but the effect is not so good.

Pressing the case a little farther, we need to know specifically the structure and properties of the milk proteins. We do know their relative biological value, and have ascertained that they are among the best nitrogenous foods that we have. But when we use our surplus milk to produce casein for glues, paper sizing, plastics, paint, and other such commodities in the heavy chemical field, we cannot help but feel that we are violating the conscience of humanity. How can we make casein into paint and billiard balls when half the world is starving for adequate proteins?—and also needed right here in this country, too. There should be developed attractive milk protein foods as substitutes for meat. The proteins in meat sell for twenty times the price of proteins in skim milk—a most attractive spread to stimulate research.

The lactose of milk—what is its physiological role? Milk is the only product that nature made exclusively to be a food when the growth demands of the animal are greatest. It contains lactose in particularly large amounts and the animal organism is peculiarly equipped to handle it. The animal body cannot synthesize it. Furthermore, it is an essential constituent of nerve and brain tissue. Some preliminary research has already shown that animals when fed on a diet containing 20 percent lactose showed a higher content of cerebrosides in their brains than those on a sucrose diet. These considerations seem to give it a uniquely essential nutritive value. It would seem that the young animal cannot properly develop without it. If this is true, then we ought to know it. Who will tell us?

VITAMINS

New vitamins are being found in milk as our knowledge in this interesting field grows. The loss of vitamin C from milk is glibly dismissed as a matter of minor significance, so we proceed to boost the citrus industry as an effective substitute. We found that vitamin D in milk is more effective than when used medicinally independent of milk. In other words, a smaller number of units of vitamin D in milk do just as effective an anti-rachitic job when it is consumed in a milk medium than when it is given independently. If vitamin C in milk possesses an analogous and favorable effect, then it is a matter of great importance whether we neglect its conservation in milk processing and production. Why should we continue to destroy a valuable nutritive constituent merely because we can secure vitamin C from other sources—in competitive products, for example? Researchers in one of our great universities are indicating how this vitamin can be conserved. The industry should awake to its significance.

ENZYMES

An almost neglected field is that of the enzymes. One might well ask, "What is the value of knowing what they are?" We do not know the full answer but one reason is the discovery of phosphatase—and thereby we speak volumes.

BACTERIA

There is need for information on the bacteriology of milk. The application of high-temperature–short-time pasteurization to milk has revealed that our bacteriological control was not as effective as we had thought. The mechanical engineering of pasteurization has progressed much farther than the bacteriology involved. The improvement in our quality control when we changed to the new tryptone-glucose-skim milk agar medium is further indication that the bacteriological field is still yielding to new research. We hope (and expect) that some one will find a method for estimating the number of organisms present without using any of the relatively costly equipment and time-consuming labor now required. The chemists have done this in their field; the bacteriologists will have to come to it.

What is the effect of bacterial growth on milk? The literature carries numerous references to isolated studies, all showing qualitatively that measurable effects are found. No one has taken up this clue and followed it persistently to ascertain its extent or significance. Enough has been done to indicate that this field could profitably be further explored.

TECHNOLOGY

With regard to the technology of milk, we are now witnessing great developments in transition. Ten years ago it would have taken a hardy visionary or independent thinker to say anything favorable regarding the utilization of flash pasteurization. Now we see high-temperature–short-time pasteurization, conveniently termed "high-short", undergoing extensive study and development. We need to integrate its bacteriology, chemistry, and technology.

We thought that our surface coolers were good, and that our internal tubular equipment was effective—but now look at the cabinet coolers and the plate types. Shall we stop here and call this book closed? We ought both to heat and cool more quickly.

Pasteurization equipment is in great need of improved development. There have been some new types of bulk equipment, but they are new only in relatively minor details. No fundamentally new principle of design or power has been forthcoming since the somewhat bungling use of the electric current led to the entrenchment of steam heating. A public health contribution of great value would be a unit to pasteurize economically small batches of milk.

Experience in other aspects of the food industry has shown generally that large batches of foodstuffs cannot be processed to yield as fine a flavored product as small batches, especially when cooking and heating are involved. This is the bane of "factory foods". The organoleptic difference between the aroma of fresh milk and that of stale or old milk indicates the possibility in this direction.

How does heating effect milk? We know that some changes in physical-chemical equilibrium are brought about. We cannot design equipment and processing to reduce these effects until we have a method of measuring them. The engineer must wait for our data—or proceed haphazardly by trial and error.

The preservation of milk needs much study. The good results achieved in the preservation of human milk by quick freezing is a pointer to show what is possible in this field. However, we need data on the effects of refrigeration on milk, both in the liquid state as well as in the frozen one. Why does freezing break the fat emulsion? Does it denature the protein? Is there a combination between any hydrolyzed carbohydrate and protein? Where do the off-flavor effects come from? If we knew the latter, we should be in a good position to work out a preventive.

The commercial distribution of milk may well be studied. Much is said about the present high cost of delivering milk to the householder. Very little seems to be done to find a solution—except buying companies, exchanging customers, and consolidating routes. Conditions of living are changing much faster than our distribution practices.

RESEARCH POLICY

In the above rapid survey of a few of the fields that need research, we have not mentioned any studies in the chemistry and technology of butterfat. We now call attention to the program of the U. S. Department of Agriculture in its research in this field. Here is a subject that has needed fundamental investigation. It is the basis of the buttermaking industry. Numerous investigators have made contributions to our knowledge in this field, but here is a group who are living with the problem, continuously, persistently, refusing to be di-

verted. One of our great state organizations is doing the same with the bacteriology of butter. This is the type of research that we need, one that does not stop with the publication of a paper but is based on a long view of the problem, that stays with the study long enough to reach a conclusion that has some degree of finality and completeness to it and that may not be easily refuted by a superficial paper published from some other group.

Most of the organizations that are interested in and capable of conducting investigations in the science and technology of the milk industry are state or commercial laboratories. They must work on problems that impress their supporters. Many a good scientist is kept grinding out bulletins when he would better be expending his energies in the laboratory seeking facts. Administrative officials are only too prone to gage the productivity of a laboratorian by the list of his publications. This creates a false sense of values. It makes the publication more important than the problem. Moreover, it floods the literature with a mass of papers which lack depth of treatment. The researcher is compelled to publish quickly before he has had time to do a thorough job. He may flit, so to speak, from one problem to another. He has time only to make bricks; he has not the time to build an edifice.

The state experiment stations and some of the government laboratories are in this class. The legislators want to justify their appropriations, and the people want action. There is some justification for many of the quick laboratory investigations—sometimes erroneously called researches—that deal with immediate and local problems. However, a perusal of the current dairy literature shows relatively too great a number of papers called research but only investigational in scope. We need more quality and less quantity.

NEED FOR MORE KNOWLEDGE

The dairy industry cannot hope to make great new strides without new fields of knowledge being opened up. We are now suffering from a lack of this. Our industry has caught up with our laboratories, and both our technology and our science are at about the same level. This speaks well for our technology but not so well for the state of our science. The proper and healthy state of things should place the discoveries of science well in advance of our technology. Both science and technology lose perspective because one is pushing the other, crowding it, so to speak, and "cramping its style". Science, to develop properly, must be unfettered—but directed. It must lead; it cannot be driven.

One of the great needs of the milk business is to interest a group of properly trained scientists in its problems, provide them with adequate facilities, and then forget them for five years. Give them a chance to do something. Just as sure as such a staff is disturbed by interrogations as to what have you new, or how soon will you publish, or why do you need this or that apparatus, or you spend too much time in the library, so surely will their enthusiasm be weakened, their energies dissipated, and their vision obscured.

Well might it be asked as to what are the prospects of research being productive. No one can answer this definitely. However, it is interesting to note that Kay and Graham's recent discovery of the basis for the phosphatase test that is so useful in determining the proper heat treatment of milk came as a byproduct of their investigations on the enzymes in milk. They were engaged in a strictly "high-brow" (if I may so call it) research—and they stumbled onto this. In general, that is the normal course of the kind of research that opens up new fields.

If the motor transportation industry had left development in its field to the engineering laboratories of the state colleges and universities, how far would it have progressed? If the electric companies had done likewise, where would they be now? Rubber, glass, pharmaceuticals, steel, photography, communications—their names personify present-day progress. Industry established its own research and development program—one that it controlled and directed. This gave permanence and objectivity to a long-time course of investigation. These industries paid the price and are reaping the dividends.

CENTRAL RESEARCH INSTITUTE

The dairy industry is too large to be content with hit or miss research. It should be interested in and capable of opening up new fields for the sale of dairy products. In united effort, there is strength.

The dairy industry should have its own central research laboratory. Such an institution, owned, directed, and controlled by the dairy industry itself, is certain to pay for itself over a number of years. Those of other industries have yielded undreamed-of results. Why should the great dairy industry, as large in financial transactions as the steel industry, sit on the banks and watch the procession go by! Such a program would correct the present near-stagnation and open up new fields of development and usefulness. It should constitute insurance against loss of position to competing industries, and furnish the best prospects for creating new products for new markets.

Obviously, the scope and type of work of such an industrial institute would have to be confined to the interests of the dairy industry as a whole. The first immediate task would be to assemble, select, and interpret the great mass of literature that is now being published every year. The data should be put in usable form for the busy industrialist, and strongly documented for the researcher. This one feature would capitalize on the immense expenditures for investigations that now are largely wasted by remaining obscure.

Another project would be to foster interest in milk research among present highly trained investigators in well-equipped laboratories. This would enable us to utilize present personnel and plant that others have paid for. Such work would minimize duplication and serve as a clearing-house for information among interested groups.

Numerous other projects would make such an organization useful and profitable. After once established and functioning along these and other practical lines, it would be largely, if not entirely, self supporting financially.

SUMMARY

So in summarizing the foregoing presentations, we consider that the professional standing and accomplishments of your two organizations place you in a strategic position to take the lead in organizing a central research institute for the dairy industry. This great business is in need of new knowledge. The latter can be secured most effectively by interesting properly trained men and encouraging them to work undisturbed by immediate commercial considerations. The individual companies can take care of applying the data. Unless the dairy industry arouses itself, it will find its present markets invaded by competing products. Yesterday's victories are history. Present needs require present remedies. Since coordinated research is the surest basis for progress, then this great industry should get busy.

Illustration of reason for keeping pasteurized milk in plants covered, and in bottles lip-sealed.

Infection of Air by Sneezing*

Notes on the Accompanying Photograph of a Sneeze.

Sanitarians recognize the dangers of the spread of respiratory infections by microorganisms from the mouth and respiratory passages, introduced into the air in the droplets given off in coughing and sneezing. Since most of such droplets are not visible under ordinary conditions, the risks of infection by this means have not been appreciated by the lay public.

The enclosed photograph, taken by Prof. M. W. Jennison, Department of Biology and Public Health, Massachusetts Institute of Technology, shows graphically the expulsion of droplets in a sneeze. The droplets are "stopped" in full flight.

The picture was taken using the Edgerton technique of high-speed photography, which substitutes an instantaneous flash of light for the opening and closing of a camera shutter. This stroboscopic light illuminates the object to be photographed with an intense flash of short duration. This technique "stops" objects in motion by providing a duration of flash (exposure time) so short that the object does not move any appreciable distance during exposure. The light was placed in such a position that the droplets were illuminated with a dark-field effect, thereby standing out sharply even in daylight, and giving photographic images larger than actual droplet size. The time of exposure was about 1/30,000 of a second.

The photograph shows a violent, unstifled sneeze. In such sneezes, the numbers of droplets expelled are in the thousands, varying with the intensity of the expiratory effort. The number of bacteria per sneeze may be in the thousands. Most droplets are under 2 mm. in diameter, and many are less than 0.1 mm. The "muzzle velocity" of some droplets is as great as 150 feet per second. Large droplets may be expelled to distances of 12 feet, but the majority do not travel more than 2 or 3 feet.

The involuntary closing of the mouth near the end of a sneeze tends to form a restricted orifice, resulting in the production of more and smaller droplets. The number of droplets issuing from the nose in an unstifled sneeze is insignificant compared with the number expelled from the mouth. Cough droplets are, in general, fewer in number and larger than sneeze droplets. Some droplets fall to the ground; others evaporate, leaving their bacteria suspended in the air, through which they may be disseminated by air currents. Covering the mouth in coughing or sneezing is effective in preventing introduction of droplets into the air.

For a brief preliminary scientific paper on this subject see: M. W. Jennison and H. E. Edgerton. "Droplet Infection of Air: High-speed photography of droplet production by sneezing." *Proceedings of the Society for Experimental Biology and Medicine,* **43,** 455-458, (1940).

* Published through courtesy of the Department of Biology and Public Health, Massachusetts Institute of Technology.

Popular Leaflet on Bread and Milk Reaches Million Mark

An attractive folder entitled "Bread and Milk—An Ideal Food Combination", has carried its message to approximately a million American consumers. It has been requested recently for translation into Portugese for wide distribution in Brazil.

The leaflet, written and signed by Dr. James A. Tobey, recommends bread and milk as "the first foundations for buoyant health." Milk, it explains, is "foremost of the protective foods," while bread is "the best of our energy foods . . economical . . satisfying . . digestible and nourishing . . a good source of valuable protein, of carbohydrate for necessary food-energy."

The authoritative aspect of the leaflet makes it of value in combatting erroneous impressions sometimes foistered on the public by food-faddists whose favorite theme is "don't eat bread."

Favorite publicity of this type for bread and other bakery products is part of the extensive work being carried on today by the Department of Nutrition of the American Institute of Baking.

Companies wishing to distribute copies of "Bread and Milk," may obtain these leaflets in quantity at cost, with or without imprint, by writing to the American Institute of Baking, 9 Rockefeller Plaza, New York, N. Y.

New Books and Other Publications

The Structure and Composition of Foods, by A. L. Winton and K. B. Winton. Volume 3, Milk, Eggs, Meat, Fish. John Wiley & Sons, Inc., New York. 1937. 524 pages. $8.00.

The subject of milk and dairy products is covered in 209 pages of this volume. It is a veritable mine of information on the literature of human and other animal milk. It has assembled information from a wide variety of sources and tabulated it in conveniently arranged tables. However, there does not seem to be as much emphasis upon some of the modern work as its importance would warrant. It discusses alkaloids in milk and dissolved gas, devotes nine pages to enzymes, and gives several pages to mineral constituents. It carries no mention of vitamins in the index. It refers to ascorbic acid in two short paragraphs and gives occasional mention in the text of some of the other vitamins. It has not been as carefully edited as it might be as evidenced by the lack of consistency in expressing less than a milligram as "mgs." in some places and "mg." in others.

The book is arranged well, is well printed, and should be very helpful as a reference book on the composition of milk and dairy products to those who need quickly available a breadth of information which is not always the latest nor even nearly complete.

J. H. S.

Vitamin D — Chemistry, Physiology, Pharmacology, Pathology, Experimental and Clinical Investigations, by C. I. Reed, H. C. Struck, and I. E. Steck. The University of Chicago Press, Chicago, Ill. xii + 389 pages. 1939. Price $4.50.

This book on one of the most important members of the vitamin group was written to give the intelligent public, especially scientists, teachers, industrialists, druggists, and physicians, reliable information on the present status of information on vitamin D. Some idea of the amazing complexity of studies in this field is indicated by the fact that the authors describe ten forms of vitamin D known to be chemical entities, each different from the others, and in addition two other forms of uncertain constitution. They also seem to be impressed with the weight of experimental evidence that the vitamin from animal sources is no more potent than that from plant sources, and refer to Jeans' well-known opposite conclusion as "interesting."

From the chemistry and bioassay technique of vitamin D, the authors proceed to a study of its role in rickets. Most of the advance in our knowledge of this disease is in the field of its chemistry. They report that the disease is not disappearing but is still widely prevalent, particularly among urban children in the low-income groups. Data are presented to show that vitamin D seems to improve ability to withstand fatigue and possibly counteract some of the debility of adult life, thereby holding an important place in adult nutrition. The authors state: "It is even possible that the newer generating reaching adult life may need even higher supplements of vitamin D . . .", judging by the findings of biometricians that growth standards for high-school and college students have been improved. It appears that the use of vitamin D is not as definitely and exclusively the preventive agent in tooth decay. The authors do quite definitely show that the fears of harmful effects from massive doses of the vitamin are not substantiated.

From the chance observation of the helpful role of vitamin D in the treatment of arthritis, this therapy has been tried out in numerous other disorders such as pollinosis, ocular conditions, psoriasis, acne, cutaneous ulcers, trichinosis, lead poisoning, radium poisoning, pregnancy, obstructive jaundice, and others. Of course it is clear why vitamin D has been thought to be worth trying in the treatment of some of these diseases, but it is also noteworthy that the less we know about the actual pharmacology of a product, the more broadly are we inclined to try it. The authors have done an excellent job in reviewing the vast amount of work done in this field, and in showing that in spite of hundreds of researches, our knowledge of the role of vitamin D in physiology, therapeutics, and pharmacology is uncertain and fragmentary. We observe many facts but we understand few.

The subject is presented in good balance. Over nine hundred references support the discussion. The presentation is clear without beclouding the subject under too great a mass of detail. While it is technical enough to be interesting and stimulating to the specialist and physician, it is not too much so to preclude its usefulness to the intelligent milk sanitarian and technologist. The book is well printed and adequately indexed. It is a valuable contribution to this rapidly developing field.

J. H. S.

The Chemistry of Milk, by W. L. Davies. Second Edition. Published by D. Van Nostrand Co., Inc., New York. 1939. 534 pages, price $8.00.

The second edition of this well-known monograph, following only three years after the publication of the first edition, bespeaks the character of the latter's reception. The new edition possesses all the quality of the earlier book, and in addition a new feature of value, namely, a section on milk technology.

This book is a veritable mine of information on milk for workers in pure and applied chemistry, physiology, nutrition, foods, medicine, dairy science, and the technology of dairy products. About 1,400 references support the text. However, an examination of over half the book reveals only several references as late as 1937, and the important subject of vitamins carries only one 1937 reference, none later.

Methionine is listed as not being essential to life in young animals, although this amino acid is now considered to be one of those needed.

It is regretted that the author classes high-temperature, short-time pasteurization under "flash" pasteurization. In this country, the term "flash" possesses such an odious connotation in connection with safe pasteurization that many of us feel that high-short pasteurization should not be forced to inherit the opprobrium of the old-time flash treatment.

Regarding the important developments in the use of the phosphatase test, no work is shown later than that of Kay and Graham in 1935, together with critical studies on their findings by Anderson *et al.* in 1937. He gives Gould's work equal emphasis as a means to control pasteurization, although no work has been seen by this reviewer that substantiates Gould's claims, and such a well-known careful worker in this field as Gilcreas could not substantiate Gould's results.

The United States federal standards for evaporated milk are given as 28 percent total milk solids and 8 percent milk fat, whereas they have been 25.5 and 7.8 percent respectively, (recently changed to 7.9 and 25.9 percent—see page 279).

The findings in 1905 that milk supplied the necessary supplement to the demonstrated inadequacy of a diet of proteins, fats, carbohydrates, and mineral matter could scarcely be called the starting point of vitamin chemistry, *vide* Eykman's work in 1897. The unpleasant taste caused by over-irradiation with ultraviolet light is attributed to fat-peroxides rather than to any protein effect as held by others.

The above shortcomings are relatively minor in view of the great value of the author's coverage of the field. He cites in good balance much of the older literature, as well as that which is relatively recent. He gives a perspective to the whole field of the chemistry of milk that is unified in form and style of presentation.

J. H. S.

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2nd Vice-President, E. M. Giberson, Wenatchee, Washington.
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PENNSYLVANIA ASSOCIATION OF DAIRY SANITARIANS

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Secretary-Treasurer, G. C. Morris, P. O. Box 141, Troy, Pa.

TEXAS PUBLIC HEALTH ASSOCIATION—MILK SECTION

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2nd Vice-President, Taylor Hicks, San Antonio.
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WEST VIRGINIA ASSOCIATION OF MILK SANITARIANS

President, W. P. Gainor.....Fairmont, W. Va.
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2nd Vice-President, S. W. Frame, Martinsburg.
Secretary-Treasurer, (Acting) J. B. Baker, Charleston W Va

ASSOCIATION NEWS

California Association of Dairy and Milk Inspectors

The California Association of Dairy and Milk Inspectors will hold their twenty-fourth annual convention in San Diego, California, September 16 to 18, 1940. A large attendance is expected as the League of California Cities meets at that city during the same time. The headquarters will be at the U. S. Grant Hotel.

An interesting program has been arranged by Mr. H. E. Ball, of Lodi. This will include talks on dairy buildings, general inspection, and dairy legislation, with general discussion on each topic. There will be a joint session with the health officers. Pictures showing a roadside improvement program will be a feature of the convention. Roadside improvement programs have been successfully conducted in several California cities, and are to be adopted by more cities as a very effective way of increasing consumer interest as well as creating a friendly rivalry among dairies in maintaining attractive environment.

Since adopting the JOURNAL OF MILK TECHNOLOGY as its official organ, membership in the Association has been steadily growing. A campaign to boost the membership to 100 will be conducted at the convention.

At the last session of the Legislature of the State of California, a section was added to the dairy laws making it mandatory for the Department of Agriculture to institute training courses for dairy and milk inspectors. Three sessions, conducted by Mr. O. A. Ghiggoile, Chief of the Bureau of Dairy Inspection Service, have been held to date: at San Francisco for inspectors of northern California; at Fresno for inspectors of the San Joaquin Valley area; and at Los Angeles for those of southern California. These sessions lasted two days each, and dealt with all phases of the California dairy laws and enforcement regulations. One of the surprises of the Institute was an examination given on the dairy laws and regulations.

ADDRESSES AND PAPERS PRESENTED AT

23rd ANNUAL CONVENTION
CALIFORNIA ASSOCIATION OF DAIRY AND MILK INSPECTORS
U. S. GRANT HOTEL—SAN DIEGO
SEPTEMBER 16-18, 1940

Address of Welcome by Dr. Alex M. Lesem, Health Officer, San Diego.

Response and Introductory Remarks by John J. Garland, president, California Ass'n of Dairy and Milk Inspectors, Redwood City.

"Revision of the Milk Score Card," by Dr. C. L. Roadhouse, Professor of Dairy Industry, University of California, Davis.

Report on Dairy Code Revision, by Mr. E. P. Bernard, San Jose.

"National Dairy Promotion Plan," by Sam H. Greene, Manager, California Dairy Council, San Francisco.

"Past, Present, and Future Status of the California Association of Dairy and Milk Inspectors," by H. C. Eriksen, Deputy Health Officer, Santa Barbara.

"What an Inspector Should Look For in Making Dairy Cattle Physical Examinations," by Dr. C. U. Duckworth, Administrator, Division of Animal Industry, Sacramento.

Discussion and Summary of Inspectors' Conferences by O. A. Ghiggoile, Chief, Dairy Service, Sacramento.

"The Milk Inspector as a Law Enforcement Officer," by Mr. Eugene Elson, Deputy Attorney General, Los Angeles.
(Rest of day for sight-seeing trips.)

Discussion of Dairy Code Amendments by the Legislative Committee.

Business Meeting.

Joint Meeting with Health Officers.

"Roadside Improvement Campaign" with colored pictures, by Mr. Marcus Dey, Golden State Co., Los Angeles.

(Also program arranged by Health Officers.)

L. E. NISSON,
Secretary-Treasurer.

Chicago Dairy Technology Society

The objectives of our society are as follows:

1. To be of mutual benefit to all its members.

2. To broaden their knowledge and to stimulate a greater interest in the scientific aspects of the dairy industry.

3. To broaden and inculcate principles of justice and equity in the dairy industry.

4. To foster industrial and university relationship.

Once each year in June, we have a social affair in the form of a dinner and dance for the members and their ladies. For our speakers, we try to select some outstanding authority on scientific dairy subjects, alternating the topics to cover the five major divisions of the dairy industry. The growing and interested membership now totals 200.

Professor R. B. Stolz of the Ohio State University was the speaker at the meeting on September 10th.

O. H. AUSE,
President.

Connecticut Association of Dairy and Milk Inspectors

The active Connecticut Association of Dairy and Milk Inspectors is planning as usual for a year of advance in the dairy field. The agenda for the coming season is as follows:

October 8. Meeting at Bridgeport:
"Electro-Pure versus Vat Pasteurization."
"Efficiency of Various Methods of Milk Bottle Washing."
"Qualifications for Milk Pasteurizing Plant Operators."

January 14.
Morning session—Sectional
Section 1. Dairy Farm.
Section 2. Milk Plant.
Section 3. Laboratory.
Section 4. Food (other than milk).
Afternoon session
"Comparison of Results of Long-Hold and Short-Time Pasteurization, with Demonstration of Laboratory Research Methods." Discussion led by Dr. T. W. Workman.

May 13.
"The Connecticut Standard Moves Forward with New Legislation and New Rules of the Milk Regulation Board." Dairy and Food Commissioner.
"Bacterial Limits Tightened."
"Laboratory Pasteurization."
"Frozen Desserts Sampling and Quality Control."

This Association welcomes the attendance at its meetings of any of the many dairy sanitarians and technologists in this area.

H. C. GOSLEE,
Secretary-Treasurer.

Massachusetts Milk Inspectors' Association

The Massachusetts Milk Inspectors' Association has held three meetings thus far in 1940. The January meeting is our annual convention with a two day program. The spring meeting was held in the latter part of March in Boston, mostly to change the By-Laws to provide for the election of a representative from the Associate Members to serve on the Executive Committee in 1941.

The summer meeting was held at Wilton, N. H., on July 19, in the form of an outing for the families and guests of the members. About 200 were present.

The next meeting of the Association will be held in the fall in the western part of the state, probably at Springfield. The program will be arranged by the Executive Committee in September. At this fall meeting, legislative matters will be discussed because the legislature meets in 1941. Nominations for new officers will be made, for election at the January meeting.

R. E. BEMIS,
Secretary-Treasurer.

Metropolitan Dairy Technology Society

The Metropolitan Dairy Technology Society has closed a very successful year. For the first time, we attempted a symposium on milk bottle closures, a subject of wide and current interest to dairy technologists. The speakers were Mr. Abraham, of the New York City Department of Health; Mr. A. J. Powers, of the Borden Company; Mr. F. M. Scales, of Sheffield Farms, Inc.; and Dr. David Levowitz, of the New Jersey Dairy Laboratories. This was a most successful meeting.

Other meetings of especial interest featured a discussion of "The Manufacture of Sugar" by Mr. Stroud Jordan;

"Quick Freezing of Foods" by Dr. Gerald Fitzgerald; "Fortification of Foods" by Dr. F. M. Parker; "New Research on Cocoa and Chocolate Milk Drinks" by Dr. M. S. Mueller; and "Vacuum Pasteurization" by Dr. E. S. Guthrie.

For the fall meetings, we have scheduled Mr. F. M. Scales to talk on "Quick Freezing of Cream", and Mr. Washington Platt to discuss some new phases of dairy research.

O. F. GARRETT,
Secretary-Treasurer.

The Michigan Association of Dairy and Milk Inspectors

The Michigan Association was organized in 1928. It has been a member unit of the Michigan Allied Dairy Association since its organization. The Allied is made up of all the branches of the dairy industry. Each winter a convention is held at which time each unit holds its own meetings and all units combine for an afternoon program. A machinery show is held in connection with the convention. The dairy inspector's association usually has a two day session with presentation of scientific papers and the annual election of officers.

For a number of years the officers felt that one meeting a year was not sufficient to accomplish much. In 1939, through the generous help of Michigan State College, a three day short course or summer conference was inaugurated. The idea of the short course was to combine lectures with laboratory work, a general get-together and recreation in the form of golf, a ball game, and a banquet with entertainment.

In July, 1939, our first summer conference was held with outstanding success. The laboratory work included microscopic examination of milk for quality, plate counts and their interpretation, and the phosphatase test. The courses were so held that everyone regardless of his training was given a chance to "get his feet wet" and perform the laboratory tasks. Laboratory sections were held in the afternoon, and lectures in the forenoon.

This year on July 18, 19, and 20, our second annual short course was held at East Lansing. The success of the two short courses convinces us that there is a need for such a program. This year additional laboratory courses were added such as the detection of off flavors in dairy products, testing for acidity, chlorine residual, etc. The attendance at the three day conference was more than 100.

The Association has two long-range objectives under way. The first is the standardization of requirements for dairy farms, dairy plants, ice cream, and creameries or butter making plants. A committee of five for each of the above branches of dairy products sanitation have been working for a year. The entire committee is known as the "Standards Committee," and has as its Chairman, Doctor E. F. Meyers of Grand Rapids.

The idea of the Standards Committee is to adopt for state wide use certain essential requirements, and to eliminate overlapping requirements and ambiguous situations now in existence. All committees have made two progress reports and will continue with the original personnel.

The second long-range objective is the licensing of milk inspectors. The summer short course is the preliminary or stepping stone to the licensing of milk inspectors on a state wide basis. Our feeling is that the efficiency in milk sanitation depends very largely upon the training and qualifications of the inspector.

Membership in the Michigan Association is made up largely of city, county, and state milk inspectors. A number of field men from the larger dairies are active in its affairs and several members of the Michigan State College faculty are loyal members.

A news letter is published every other month by the Secretary. The news letter serves as a means of stimulating interest.

The program of the last short course is presented herewith:

Summer Conference
July 18

The Detection of Mastitis, by C. S. Bryan, Michigan State College.
What Practical Action Should be Taken for Control of Mastitis, by B. J. Killham, Michigan State College.
Lunch on College picnic grounds.
Suggestions on Dairy Plant and Farm Inspection, by Earl Weaver, Michigan State College.
Laboratory sections:
1. The Use of the Microscope in Determining Quality and Mastitis in Market Milk, by C. S. Bryan, Michigan State College.
2. The Method of Making Plate Counts and Their Interpretation, by F. W. Fabian, Michigan State College.
3. The Method of Making Residual Chlorine, Alkali and Other Determinations at the Plant, Phosphatase Test for Milk and Dairy Products, by I. A. Gould, Michigan State College.

Golf Tournament at 4:00 P. M.
"Bull Session" at 8:00 in Mason Hall Lounge.

July 19

Principles of Refrigeration, by J. E. Walker, Detroit Department of Health.
Plant Arrangement for Sanitation, by G. H. Tellier, Cherry-Burrell Co.
Common Sense Applied to Milk Inspection, by W. L. Mallman, Michigan State College.
Laboratory sections:
1. Continuation of microscopic work started at previous session, by C. S. Bryan.
2. Testing and scoring milk and dairy products by I. A. Gould and G. M. Trout.

Baseball game at 4:00 P. M.
Banquet at 6:30 P. M.

July 20

Report of Coordinating Committee.
Bay City's Milk Control Program, by R. F. Hall, Director, Bay City Department of Health.
Tracing Milk-Borne Epidemics, and Discussion of food-handlers' education project for Ann Arbor, by H. E. Miller, University of Michigan.

H. J. BARNUM,
Secretary-Treasurer.

Missouri Association of Milk Sanitarians

In 1932, immediately following a Milk Control Short Course given by the Dairy Department at the University of Missouri, a meeting was called to discuss plans for the organization of a state-wide association for milk inspectors, control officials, and others interested in milk sanitation work. This meeting resulted in the formation of "The Missouri Association of Milk Sanitarians".

The purpose of the Association, as stated in the constitution and by-laws, is to promote acquaintanceship and contact among those engaged in, or interested in, milk inspection in Missouri and to aid in the dissemination of knowledge pertaining to milk inspection among the members of the organization, in order to develop uniform and efficient inspection of the production, processing and distribution of milk and its products.

Since the organization of the Association, a meeting has been held each year in connection with the annual Milk Control Short Course given by the Dairy Department of the University of Missouri at Columbia, Missouri, and in cooperation with the University Dairy Department and the Missouri State Board of Health. Membership in the Association includes milk inspectors from all cities in the state that are doing milk control work, State Board of Health and University Dairy Department personnel, and others associated with the dairy industry in Missouri.

The Association has shown a steady growth since its first meeting, both from the standpoint of members and from the interest shown by its members. Each year speakers of national reputation appear on the program to discuss problems of public health interest to milk sanitarians as well as problems of interest to the dairy industry. At the 1939 annual meeting a resolution was adopted to ask the State Board of Health to request the Public Health Service to hold a seminar on milk control work somewhere in the state. This resolution resulted in the Public Health Service conducting a Milk Control Seminar in St. Louis in November, 1939, which was attended by 145 milk sanitarians representing 13 states. At the same meeting, the Association took

the necessary steps to become affiliated with the International Association of Milk Sanitarians and subscribed to the JOURNAL OF MILK TECHNOLOGY, which has been designated as the official organ of the State Association.

The 1940 meeting of the Association was the most successful and best attended meeting that has been held. At the annual meeting, the membership expressed themselves as highly pleased with the JOURNAL OF MILK TECHNOLOGY and 16 members made application for associate membership in the International Association, and one member for active membership. Several other members of the State Association have been, and are, members in the International Association.

The Milk Sanitarians Association is a member of the "Missouri Dairy Industries Council" which is an organization composed of all other dairy organizations in the state. This "Council" is active in all phases of the dairy industry and was largely responsible for the new dairy law which was recently enacted. The Secretary-Treasurer of the Milk Sanitarians has been designated to represent the Association at the Council meetings.

G. M. YOUNG,
Secretary-Treasurer.

New York State Association of Dairy and Milk Inspectors

The members of the New York State Association of Dairy and Milk Inspectors have the very unusual opportunity this year of attending a joint meeting with the International Association of Milk Sanitarians at the Hotel Pennsylvania in New York City scheduled for October 17, 18 and 19. The attendance at annual meetings has increased from 7 at the organization meeting in Ithaca in 1923 to 420 at the meeting in Syracuse in 1939. A record attendance is expected in New York City this year.

Members of the State Association as well as the International Association of Milk Sanitarians are requested to bring their wives as special arrangements are being made for the entertainment of the ladies. The local committee under the chairmanship of Dr. Clyde L. Kern and the ladies' committee under the chairmanship of Miss Vera McCrea are planning an interesting program.

The members are reminded that the Dairy Industries Exposition is scheduled to be held in Atlantic City, New Jersey, during the week following our meeting, that is, the week beginning Monday, October 21. Also the World's Fair is scheduled to be open until the end of October.

W. D. TIEDEMAN,
Secretary-Treasurer.

Pacific Northwest Association of Dairy and Milk Inspectors

The twenty-eighth annual convention of the Pacific Northwest Association of Dairy and Milk Inspectors was held at Astoria, Oregon, June 28 and 29, 1940, with about 40 in attendance for the sessions. Those who took part in the program and their subjects were as follows:

"A Uniform Milk Sanitation Program"
J. D. Mickle, State Department of Agriculture, Salem, Ore.
"The Phosphatase Test"
Ebert M. Giberson, Chelan County Health Department, Wenatchee, Wash.
"The Practical Application of the Phosphatase Test"
George Steel, State Department of Agriculture, Olympia, Wash.
"Discussion of Milk Plant Operators School"
V. C. Morgan, Bureau of Health, Portland, Ore.
"The Relationship of Milk to Communicable Disease Control"
Dr. William Levin, State Board of Health, Portland, Ore.
"The Significance of Organisms of the Coliform Group in Pasteurized Milk"
Stanley Gilmore, Bureau of Health, Portland, Ore.
Demonstration of Testing Can and Bottle Washing Solutions and Discussion.
B. B. Baker, J. B. Ford Co., Portland, Ore.

Many of the delegates participated in the annual Dairy Day program in Astoria and Clatsop County on June 27, arranged by Eugene Chadwick, local dairy inspector. This program included visits to four city distributing plants and a number of dairy farms located in the producing centers of the county.

The new officers for the coming year are listed on the Association page. The 1941 convention of the association will be held at Walla Walla, Wash.

F. W. KEHRLI,
Secretary-Treasurer.

Pennsylvania Association of Dairy Sanitarians

The Executive Committee is expected to meet in October to consider the program for 1941. The annual meeting will likely be held with the other branches of the Dairy Industry sometime next spring. For the past two years, these joint meetings were attended by about 700 persons.

G. C. MORRIS,
Secretary-Treasurer.

Texas Public Health Association—Milk Section

The Texas Section of the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS, organized in 1939, is planning an active program to help build the JOURNAL OF MILK TECHNOLOGY and to secure increased subscriptions.

Milk supervisors, assigned by the State Health Officer, cooperated during the year with the Texas A. & M. College, College Station, and the Texas Technological College, Lubbock, in conducting short schools of instruction on the Standard Milk Ordinance. These courses were attended by a good number of milk sanitarians of whom 52 applied for examinations for registration with the State Health Department as Registered Milk Sanitarians. The Department now has a roster of 165 such names from which the city health departments can select their milk sanitation control officials. Our Association has enthusiastically supported this movement, and we expect to secure several subscriptions to the JOURNAL OF MILK TECHNOLOGY from this group.

The State Health Department, cooperating with the State Board of Control officials and the officials of one of the state eleemosynary institutions, has recently conducted a short course at the institution during which demonstrations were given in the dairy and creamery. This school was attended by 31 dairy and plant operators from the dairies owned and operated by Texas eleemosynary institutions. During the year several short training schools have been held over the state for dairymen and pasteurization plant operators.

E. A. GRIST,
Secretary-Treasurer.

West Virginia Association of Milk Sanitarians

The most outstanding accomplishment of the milk sanitarians in the State of West Virginia this past year has been a standardization of milk grade announcements. The entire State works under the Standard Milk Ordinance. Grades in some localities were not being announced strictly in accordance with the provisions set forth in the milk regulations. In order to have Grade A milk mean the same in all localities, it was decided to announce milk grade on all pasteurized milk from the central office under the supervision and inspection of one man. This policy did not interfere with the activities of the local health departments other than that their work was coordinated and made as standard as possible.

Although this program has not been in operation for a whole year, a great improvement has been found in all pasteurization plants throughout the State, and a direct result has been the improvement of most of the retail raw milk dairies. Most of this creditable work was done by the local and district milk sanitarians. The industry as a whole also seems well pleased with the results and is cooperating almost one hundred percent.

One important feature is to be added to the milk program this coming year, and that is the inspection of plant producers and retail raw milk dairies at milking time. While it is recognized that this will make inspection work more difficult, it is expected that the results will be beneficial.

J. B. BAKER,
Acting Secretary-Treasurer.

Tentative Program of the Joint Annual Meeting

INTERNATIONAL ASSOCIATION OF MILK SANITARIANS and the NEW YORK STATE ASSOCIATION OF DAIRY AND MILK INSPECTORS

October 17, 18 and 19, 1940.

Deaeration of Milk, by Paul F. Sharp, Cornell University, Ithaca, N. Y.

Farm Sewage and Milk Plant Waste Disposal, by C. C. Agar, New York State Department of Health, Albany, N. Y.

Detergents, by Charles Swartz, The Hall Laboratories, Pittsburgh, Pa.

Control of Mastitis, by L. E. Bober, The Babson Company, LaGrange, Ill.

The Leucocyte Count and the Chlorine Content of Milk from Mild Cases of Streptococci Infection of the Bovine Udder, by J. F. Cone, U. S. Department of Agriculture, Washington, D. C.

Instantaneous Heat Treatment of Milk, by G. C. Supplee, The Borden Company, Bainbridge, N. Y.

Approved Milk for New York City, by John Rice and Sol Pincus, New York City Department of Health, New York, N. Y.

High-Temperature, Short-Time Pasteurization and Its Practical Application to the Dairy Industry, by Henry Leber and J. L. Hileman, Dairymen's League Cooperative Association, New York, N. Y.

Paper Containers for Milk, by C. N. Stark, Cornell University, Ithaca, N. Y.

Educational Phases of Milk Sanitation Work, by K. M. Brenner, Lubbock, Texas.

Application of the Resazurin Test in Determining the Quality of Pasteurized Cream, by M. A. Collins and W. H. Chilson, United Farmers' Cooperative Creamery Association, Inc., Morrisville, Vt.

Question Hour, by G. J. Hucker, Agricultural Experiment Station, Geneva, N. Y.

Education and Training for Milk Sanitarians (Report), by H. E. Miller, University of Michigan, Ann Arbor, Mich.

Communicable Diseases Affecting Man (Report), by H. N. Parker, Department of Health, Jacksonville, Fla.

Sanitary Procedure (Report), by W. D. Tiedeman, New York State Department of Health, Albany, N. Y.

Chocolate Milk (Report), by Sarah Vance Dugan, Kentucky State Department of Health, Louisville, Ky.

Applied Laboratory Methods (Report), by T. H. Butterworth, Department of Health, San Antonio, Texas.

A New Microscopic Procedure for the Detecting and Locating of the Source of Thermoduric Organisms in Milk, by W. L. Mallmann, and C. S. Bryan, Michigan State College, East Lansing, Mich., and W. K. Fox, Lansing Health Department, Lansing, Mich.

The Frozen Desserts Code Recommended by the Public Health Service, by C. W. Fuchs, U. S. Public Health Service, Washington, D. C.

Factors Affecting the Survival of *Streptococci pyogenes* in Cheese, by M. W. Yale and J. C. Marquardt, Agricultural Experiment Station, Geneva, N. Y.

The Resazurin and Rennet Tests for Determining the Quality of Milk, by F. L. Schacht and R. Nichols, New York State Department of Health, Albany, N. Y.

The Present Status of Homogenized Milk from the Physician's Point of View, by I. J. Wolman, The Children's Hospital, Philadelphia, Pa.

The business meeting of the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS will be held after the program on October 17. On the following afternoon the NEW YORK STATE ASSOCIATION OF DAIRY AND MILK INSPECTORS will hold its annual meeting.

There will be a joint banquet of both associations on the evening of Friday, October 18, for which a very entertaining program is being planned.

The Metropolitan Dairy Technology Society will hold an interesting joint meeting with the two associations at the Friday afternoon session, and will attend the banquet and entertainment in the evening.

The Committee on Local Arrangements is making elaborate plans for the entertainment of ladies who may attend the meeting—tours around the island, teas, trips behind the scenes of a big department store, and other entertainment features.

The World's Fair will be in full swing at the time of the meeting. Saturday afternoon, October 19, and Sunday will be good days to take in this exposition.

NEW YORK WORLD'S FAIR

ATMOSPHERE. Basic formula for the World's Fair of 1940 in New York is an atmosphere of gay informality. The same formula as that of the warm-hearted county fair. And on the same price basis as the county fair. Plenty of good fun and serious entertainment, a feeling of ease and jollity cap the parade and pageantry of nations, industry, science and education in the multi-million dollar show.

PRICES. From all angles the price revision is downward. For fifty thrifty cents adults see the Fair of 1940. The 1939 edition was 75 cents. Children see the Forty Fair for 25 cents. One day each week admission for them is a dime. Parking from as early as 9 a. m. one day until 2 a. m. the following day costs only 25 cents. Food costs are way, way down. For instance, there is a "5 and 10 cent restaurant" with no catch to it. There'll be beef stew at 10 cents and meat balls at five cents a ball. And no end of sandwiches at a dime apiece. Restaurant contracts provide that charges cannot exceed those made during the last month of the 1939 Fair.

Photo by Courtesy of Convention Bureau

Theme Building of New York World's Fair, 1940

Photo by Courtesy of Convention Bureau.

United States Line Boat Washington Leaving Harbor

HOUSING. Mayor La Guardia has established the Mayor's Official World's Fair Rooming Bureau. This bureau guarantees accommodations for 600,000 guests daily at rates within the purse of every visitor. Of this number, hotels can care for some 80,000 at prices between $1.50 and $3 per person per day, and for 170,000 more between $3 and $5. There are accommodations for 200,000 more in registered and inspected private rooms at $1 to $1.50 per day per person.

AMUSEMENTS. America's master showmen, the men who make the nation's entertainment, have provided the World's Fair of 1940 in New York with a new and dazzlingly brilliant entertainment area. This is the "Great White Way." This zone of fun and frolic, of pageant and extravaganza, of gaiety and laughter contains diversion for every age, sex, and taste.

Billy Rose, whose startlingly successful opus was a high mark of the '39 Fair, reveals his beauties from behind a gigantic, shimmering towering water curtain this summer. His brand new aquacade with its new sets, costumes, music with its comedy water acts and its glittering chorus stars Aquabelle Eleanor Holm a second time. The program of Michael Todd, youthful producer who came out of the west last year to set Broadway and Fair visitors by the ears with his "hot" rendition of Gilbert & Sullivan "Mikado," encompasses a total of four shows for 1940.

At the head of the "Great White Way" in the Fair's million-dollar music hall, Todd offers "Streets of Paris" with Gypsy Rose Lee as star. Across the street, "Gay New Orleans," a second Todd production, sets a gay southern note with the romance and flair of the Creole city. Other shows are the "Dancing Campus" with its name bands, college atmosphere and under-graduate high-jinks, and "Uncle Todd's Opry House," where cheer-the-hero and hiss-the-villain drammers will be presented and beer and pretzels served.

Leon Leonidoff, master showman of Radio City Music Hall, is staging "American Jubilee," the pageant of America, a story in song, which tells the story of the growth of a nation. Produced by Albert Johnson, "American Jubilee" employs a cast of upwards of 300 and a technical staff of 50. It is housed in a brand new outdoor theatre equipped with the world's largest revolving stage. Lucy Monroe, star of radio and the concert stage, is the star of the show. This production represents an outlay of some $500,000.

These few are only a scattering of the scores of entertainment items to be found on the Great White Way. From miniature babies, "preemies" whose lives are saved through expensive equipment and constant care of trained experts, to the million-dollar "Odditorium" of Robert Ripley, attractions along "The Great White Way," the play street of America, supplies diversions for tens of thousands at a time. The Parachute Jump, thrill ride of the 1939 show, has been moved to a more central location along the Great White Way, and the number of 'chutes has been increased to 12.

EXHIBITS. America's industrial showmen proved conclusively in the 1939 Fair that American business and industry can put on an intensely interesting show, and no pains have been spared to retain that well-earned reputation. From the singing trees and flaming cactus of Gas Wonderland to the 16,000 animated miniature autos of the Futurama, the exhibit area has been renovated, revamped, and intensified.

Photo by Courtesy of Convention Bureau.

U. S. Government Building at the World's Fair 1940

A newcomer to the World's Fair is the American Legion which will take over an entire building of the Court of States for a comprehensive exhibit of "Americanism." Moving over into the Exhibit Area proper, Voder, the machine that talks when a keyboard is played, sings in the A. T. & T. exhibit this year. And from the Bell System exhibit, scores of lucky visitors each day call any point and any person they wish in the United States. Two intricate machines in the American Tobacco Company exhibit make 1,900 "Lucky Strike" cigarettes every minute.

"Elsie," the cow, bovine hit of the 1939 Fair, lives in an especially built boudoir during the Forty Fair. She reigns over the Borden exhibit with its "milking-merry-go-round," cooking school for men, and dozens of sets of twins. A "Cold Dog Stand" for tired tootsies, atmosphere testing canaries and a body-system air conditioning plant have been added to the Carrier Exhibit.

The first three-dimensional, techni-color movie is headline attraction at Chrysler Motors' exhibit. In Dupont's "Wonder World of Chemistry" stockings are manufactured from coal, air and water. In Firestone's Transportation Area exhibit, every step in making an auto tire, from rubber plantation to final wrapping is strikingly illustrated. A dramatic presentation showing the motor industry through horse's eyes, and the "Road of Tomorrow" are found in the comprehensive exhibit of the Ford Motor Company. The oldest collection of glass in America, excavated at Jamestown, Va., is on display in the Glass Center, the exhibit building built almost entirely of glass block, plate and structural glass. With Neil H. Oldfield, nephew of Barney Oldfield, as track master, the B. F. Goodrich Company again presents its Death Dodgers with their hair-raising tests of auto tires on a specially built speed track.

Vegetables, fruits, and flowers will grow without soil in the H. J. Heinz exhibit. The modern wonders of television are featured by RCA in eleven individualized living rooms. Refreshments at the Fair has taken over an entire building for the 1940 Fair and features an actual Coca-Cola bottling plant turning out 140 bottles a minute. Added to the Westinghouse Tower of light is a 120-foot waterfall of color. Selected typical American families live in specially constructed houses at the World's Fair as guests of the Fair during the summer. Each family is representative of a particular trading area and comes as guests for the period of one week. The site for the two houses is near the Town of Tomorrow in the Exhibit Area.

FOREIGN PARTICIPATION. Foreign nations are playing an imposing part in the Forty Fair. There is particular interest in the displays of the six "orphan nations." These are, of course, Czechoslovakia, Poland, Finland, Denmark, Norway, and France. And no matter the state of their flags in their respective homelands, the flags of these nations fly bravely over their pavilions and exhibits at the World's Fair. One flag which does not appear is that of USSR. The pavilion which last year told the story of the Soviet Republic has long since been torn down. In its stead there is the "American Common," an area devoted to great Americans of foreign extraction, and to their national groups which have helped to make America great.

TRANSPORTATION. The huge transportation systems on the grounds at the World's Fair of 1940 in New York have been perfected and simplified so that this summer's inflow of guests can travel comfortably and quickly.

There are two new 10 cent bus routes, one leading directly to the south entrance of the Great White Way and another providing a two way traffic along the Avenue of Labor with a station at the New York State Building are facilitated by new arrangements for both bus and launch traffic. Greyhound has 100 buses and 30 tractor trains in operation for the 1940 Fair. These operate over the seven

ten cent routes which checkerboard the Fair and have 38 stations, over sightseeing tours which take about 45 minutes, and over sightseeing tours which are shorter.

The three-quarter hour sightseeing tour costs 50 cents and the buses start from seven different points on the Fair grounds. The tractor trains leisurely traverse the grounds over a total route of about seven miles. The fare is 25 cents for adults and 15 cents for children.

Rates on a time basis are as follows: Single seat guide chairs—25 cents for first 10 minutes; 15 cents for each additional 10 minutes; double seat guide chairs—50 cents for first 10 minutes; 30 cents for each additional 10 minutes. Motor guide chairs—75 cents for first 10 minutes; 45 cents for each additional 10 minutes. Motor guide cars hold three persons.

OF SPECIAL INTEREST TO WOMEN. World's Fair of 1940 has become the fashion capital of America this summer. The World of Fashion, occupying an entire building, displays the efforts of outstanding designers of America. Colorful exhibits of furs, coats, frocks, and all accessories are on exhibit. Fashion parades, carefully tailored to appeal to the average woman, are scheduled for the Fair period. A free theatre in the building shows films and presents entertainment related to the exhibits.

A feature of the World of Fashion is a modest-priced Fashion Parade restaurant with a low over-all price for luncheon, tea, and dinner served from perambulating buffets. Mary Lewis, famous Fifth Avenue style authority, is director of fashion for the Fair.

"America At Home," an entirely new kind of exhibit of American home furnishings and decorative arts, has been added to the big industry shows of the Fair. Its contents are judged for quality by a jury of men and women acknowledged as national authorities in art, merchandising, and education. All articles accepted for exhibit bear a gold seal of merit. The exhibit includes forum facilities for 300 people, a moving stage on which a constantly changing show called "Furniture on Parade" presents many new ideas, an "Ailing-Home" clinic, and a home furnishings information center. In addition to a series of specially designed rooms, there is a dramatic presentation of coordinated home furnishings.

WOMEN'S PARTICIPATION. Women's participation in the Forty Fair exceeds anything ever known in previous exposition history. This phase of the Forty Fair has been in operation for many months. The Fair has a National Advisory Committee on Women's Participation, with committee members in every state. The Committee is headed by Mrs. Oswald B. Lord of New York.

The Effect of Commercial Drying and Evaporation on the Nutritive Properties of Milk. K. M. Henry, J. Houston, S. K. Kon, and L. W. Osborne. *J. Dairy Res.* 1939, v. 10, 272-93. *Bulletin of Hygiene,* Vol. 14, No. 11, November 1939, pp. 821-22. Abstracted by W. G. Savage. *Pub. Health Engin. Abs.* xx, Mi. 30, "The authors record a long series of experiments with two types of dried milk and one of evaporated, all prepared simultaneously from one bulk of raw milk. The comparative results obtained, as well as the estimations made are summarized in the table overleaf (p. 822).

"The biological value of the proteins (nitrogen), vitamin B_1 and the growth promoting properties of the milks were measured by tests on rats. Vitamin A and carotene, riboflavin and vitamin C were measured by physical and chemical methods at intervals in the course of storage for a year. The content of vitamin A, carotene and riboflavin remained unaffected by storage for a year. As regards vitamin C, apart from an initial loss of 30 percent, for roller dried milk there was little further change with storage. Spray dried milk only lost 20 percent vitamin C initially but the content declined slightly after 7 months' storage. With evaporated milk in addition to the initial loss of 30 percent there was a definite and gradual loss with storage, the final figures falling in one case to half the original value."

"Doctor Jones" Says —

"Here in my collection, somewhere, I've got some shells I picked up over in France ten years after the World War. Of course they'd been exploded a long time—which made 'em more interesting as relics, as well as safer to have around.

"Something else I've got scattered around here in various places: I've got some of the old arguments against pasteurization of milk. I s'pose, in their day, they killed off a good many prospective pasteurizing ordinances and so on. But now they're perfectly safe to handle because, the same as those shells, they've been exploded.

"There's one of 'em—I was looking 'em over the other day—it said pasteurization killed the good bacteria as well as the bad ones: it killed off the souring bacteria, so the milk'd keep 'til it spoiled.

"Well, sir, you know I can remember, years ago, hearing one of the old docs that did surgery—he was talking about what he called 'laudable pus.' What he meant was—that was before they knew anything much about bacteria and surgical asepsis and all that: they expected every operation wound to have pus in it and if it didn't they thought it was a bad sign. And it was, a good many times, because all the operation wounds were infected and if they didn't get pus in 'em it meant nature wasn't putting up any fight. Now, of course, they get rid of the bacteria before they start operating.

"This milk business—it's more or less the same. You see, the bacteria that make milk sour—they don't belong there: they get into it along with dirt, one place or another. They're relatively harmless, so far's we know, but calling 'em 'good bacteria,' that's being a little too generous. The cleaner milk is the longer it takes it to sour—pasteurized or not. But back in the old days practically all the milk was dirty and if it didn't sour right away they thought there was something wrong with it. The truth of the matter is: pasteurization don't kill all the souring bacteria. It'd be just as well if it did, but the heat it'd take to do it—it'd give it that 'cooked taste' they object to.

"It makes me think of Old Dr. Williams. He advised Purley Adams to have his boy's nose operated on—deflected septum or something. Purley raised various objections—finally said he'd heard of somebody that, after a nose operation, lost his smell. 'Well, Purley,' the Old Doc says, 'if an operation'l cure that boy of his smell, that's another argument for it.' Yes, pasteurization making milk keep—it's an argument for, not against."

The Influence of Pasteurization on the Ascorbic Acid (Vitamin C) Content of Certified Milk. A. D. Holmes, F. Tripp, E. A. Woelffer, and G. H. Satterfield. *J. Amer. Dietetic Ass.* 1939, v. 15, 363-8. *Bulletin of Hygiene,* Vol. 14, No. 10, October 1939, p. 767. Abstracted by Douglas C. Harrison. *Pub. Health Engin. Abs.* xx. Mi, 33.

"The ascorbic acid content of raw and pasteurized pooled milk was studied for 18 months. Pasteurization was done in stainless steel vats for 30 mins. at 143°F. There was great variation in vitamin C content of the raw milk itself, the values ranging from 14.1 mgm. per litre in September to 21.89 in January, with an average of 17.26. The pasteurized milk contained from 7.8 to 18.98 mgm. with an average of 14.03. The loss of ascorbic acid during pasteurization was greater in the warm seasons than in the cool weather. In August, there was a loss of 53.25 percent and in March 4.53 percent. The average loss over the whole period due to pasteurization was 18.71 percent. This study shows that a generous consumption of milk, either raw, or pasteurized under ideal conditions, can contribute significant amounts of vitamin C to the daily diet."

Copied by R.A.C.