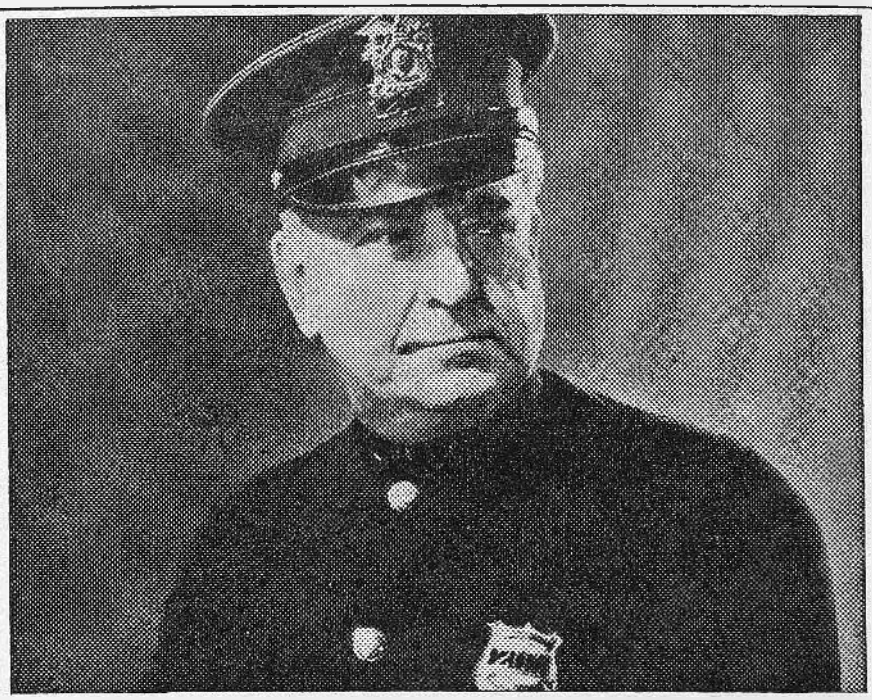
JOURNAL OF MILK TECHNOLOGY

MARCH-APRIL
1942
VOLUME 5 NUMBER 2

Official Bimonthly Publication of:
INTERNATIONAL
ASSOCIATION
of
MILK SANITARIANS
(Association Organized 1911)

Designated Official Organ of:
ASSOCIATIONS OF
MILK INSPECTORS and SANITARIANS
and
DAIRY TECHNOLOGY SOCIETIES
Listed on Page 121



A "POLICEMAN" for every bottle of milk!

You, as a public health officer or milk sanitarian, are constantly on duty to protect the purity of your community's milk—*in the dairy*. The Welded Wire Hood Seal takes over where you leave off — guards the milk *all the way home!*

It's like a "policeman" on every bottle! For the long hood that covers the *entire* pouring lip provides *complete protection* against those "sneak thieves": dust, dirt and contamination.

It's strong enough to resist those other dangerous "hoodlums": heavy icing and rough handling! And the Welded Wire Seal is *absolutely tamper-proof* . . . can't be removed without detection.

Hood-capping is the last word in "home defense" of your community's milk. Why not write for full details today?

Standard Cap and Seal Corporation
1200 Fullerton Ave.,
Chicago, Ill.

JOURNAL OF MILK TECHNOLOGY

Official Publication of the

International Association of Milk Sanitarians
(Association Organized 1911)
and Other Dairy Products Organizations

Office of Publication 374 Broadway, Albany, N. Y.
Application for entry from the post office at Orange, New Jersey to the post office at Albany, N. Y., pending

(For complete Journal information, see page 120)

Volume 5 March–April, 1942 Number 2

CONTENTS

Resists Abusive Impacts

Reduces Slipping Hazards

AT LAST ...THE PERFECT ANSWER TO THE PROBLEM OF Durable Non-Slip Dairy Floors

Low in cost . . . easy to install . . . attractive . . . and economy to dairies. EMERY AGGREGATE brings new safety AGGREGATE provides a hard, dense floor surface that can stand constant abusive impacts. A thousand cans a day are dropped on the floor shown above. Yet it shows no deterioration after more than a year of this smashing wear.
EMERY AGGREGATE floors provide a safe, non-slip working surface under all dairy operating conditions. EMERY AGGREGATE floors never wear smooth—moisture does not reduce gripping surface. They resist lactic acid solutions much longer than any other material comparable in cost, durability and safety.

EMERY AGGREGATE

HARD . . . DENSE . . . ACID-RESISTING

Scientifically graded EMERY AGGREGATE can be used effectively for Loading Platforms, Receiving Rooms, Truck Runways, Pasteurizing, Processing, Churn and Bottling Rooms. Attractive appearance recommends its use in Offices, Lobbies and Retail Store Rooms. Write for Bulletin.

THE CREAMERY PACKAGE MFG. COMPANY

1243 West Washington Boulevard, Chicago, Illinois

Branches: Atlanta — Boston — Buffalo — Chicago — Dallas — Denver — Kansas City — Los Angeles — Minneapolis — New York — Omaha — Philadelphia — Portland, Oregon — Salt Lake City — San Francisco — Seattle — Toledo — Waterloo, Iowa.

Creamery Package Mfg. Co. of Canada, Ltd.
267 King St., West, Toronto, Ont., Canada

The Creamery Package Mfg. Company, Ltd.,
Avery House, Clerkenwell Green, London, E. C. 1, England

JOURNAL
of
MILK TECHNOLOGY

Volume 5 March–April, 1942 Number 2

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.

Coöperating for Defense

EVERYONE is keyed up to the necessity for intelligently and adequately developing all ways and means for defense. There is unity of good intent to assist in every way possible, but lack of unanimity of opinion as to the best course or procedure to attain the goal. This is illustrated within our own organization. In order that the International Association of Milk Sanitarians could be prepared to collaborate with Federal agencies, if and when the occasion arises, it was recommended editorially in the November–December, 1940, issue of the JOURNAL OF MILK TECHNOLOGY that the association president appoint a "Committee on Defense." The suggestion was editorially opposed in the next issue of the JOURNAL.

Recent experience indicates the advantage of having such a committee consisting of persons selected solely on their technical qualifications and who could speak authoritatively on the many phases of milk technology and render intelligent opinion. The WPB is seeking advice as illustrated by a recent meeting invitation extended by the Chief of the Dairy Section to the United States Public Health Service and a small group of state and municipal health officials. It is of interest that all are members of the International Association of Milk Sanitarians (merely a coincidence). The existence of an association-appointed committee with members from Federal, state and municipal agencies could facilitate the calling of conferences when desired by the WPB. Under such a plan, official opinions and decisions issued for public information could be disseminated through the JOURNAL OF MILK TECHNOLOGY for the guidance of the association members and those in the organizations which have designated the JOURNAL as their official organ. This would assist in eliminating criticisms or misunderstandings and make it known that official orders are not arbitrary actions but are decisions resulting from judgment made after careful deliberation.

The reply to the original editorial suggestions asserted "that our business as an association is stated somewhat narrowly in our Constitution: 'to develop uniform and efficient inspection . . . and to place inspection . . . in the hands of men who have a thorough knowledge of dairy work'." This states our business concisely, not "somewhat narrowly." Efficient inspection is not restricted to the procedure of inspecting to determine the sanitary conditions prevailing in the industry. That is only part of the job. From experience over the years it is now accepted that "efficient inspection" pertains to all factors having any influence whatsoever on the quality, wholesomeness, and safety of milk, or in other words it refers to milk technology.

The defense program must of necessity interfere in some respects with modern equipment and practices. Metals, materials, and supplies used for the handling or processing of milk, or maintenance of equipment and sanitation, are among those which are now or may be restricted for war purposes. Efficient inspection is immediately involved in determining what substitutes can be safely used without adverse effect on the product or health of the consumers. It is far better to coöperate in solving problems in advance than waiting until equipment or materials are utilized in the industry and then have them rejected or officially condemned as unsuitable. By prevention we can save precious materials, time and effort.

It is realized that "innumerable committees on defense have been appointed" and "the military authorities would prefer that civilian agencies concerned with protection and promotion of the health of the civilian population 'mind their own business' until called upon for assistance." It is not necessary for our association to add to the number of committees now existing but simply to designate as our representatives those individuals already appointed by another organization. It so happens that the New York Area Food and Drug Officials have appointed such a committee, the personnel of which are all members of the International Association of Milk Sanitarians. This same situation may prevail in other areas or associations. This would also help to coördinate the efforts of numerous committees and unify opinions in the best direction. We can "mind our own" business, but we can also be prepared. We should not confuse the situation; we should correct it.

An inter-industry dairy committee and the Dairy Industries Supply Association have been coöperating with the WPB. There is no good reason why our Association cannot arrange through a suitable committee to collaborate with those groups and thereby avoid confusion such as would exist if conflict developed through lack of coöperation. It has already happened. The excellent results of the work of the Committees on Sanitary Practice appointed by the several associations demonstrate the soundness of the proposal. Our Association membership includes men in the Public Health Service and Department of Agriculture and could serve on our Association committee. This would afford opportunity for them to obtain our opinion and support in such matters as they may be called upon for advice by the WPB. Let's do it!

W.B.P.

Mastitis and the Plate Count of Milk

II.* The Influence of *Streptococcus agalactiae* Mastitis upon the Standard Plate Count of Milk

MAX E. MORGAN, E. O. ANDERSON, *and* W. N. PLASTRIDGE

Departments of Dairy Industry and Animal Diseases
University of Connecticut, Storrs, Connecticut

THE study of bovine mastitis carried on at the Storrs Agricultural Experiment Station during the last decade has been instrumental in making dairy farmers conscious of the importance of this disease, especially as applied to the economical production of milk. It is now known that the spread of mastitis caused by *Streptococcus agalactiae* may be prevented or greatly reduced by a program of animal segregation based upon laboratory tests and the employment of proper sanitary methods(1). Eventually the disease may be eradicated completely from dairy herds if producers follow a rigid plan of segregation and elimination of infected animals, replacing them with negative first calf heifers (2).

In some herds, eradication of *Str. agalactiae* infection by rapid elimination of infected animals may prove expensive to the producers. Consequently, gradual replacement along with segregation is usually the program followed. This has brought up the question as to whether the segregated infected animals may be the source of high bacteria counts in herd milk.

There has been a dearth of definite information in the literature concerning the extent to which bulk milk is contaminated with *Str. agalactiae*. Largely this is due to the lack of satisfactory practical methods of differentiating this organism from other milk streptococci. Frost *et al.* (3) examined the milk from five different Certified Milk farms monthly over a period of one and a half years. Samples from groups of 10 cows were plated in blood agar. Hemolytic streptococci of the "true beta type" were found in 28.6 percent of the samples. The number of such streptococci was usually very small, less than 1,000 per ml. in 65 percent, and less than 10,000 per ml. in 94 percent of the samples examined. They classified 394 cultures of hemolytic streptococci by means of seven biochemical tests, and placed them in six different species. One hundred and eighty-six cultures were identified as *Streptococcus mastitidis* * and 64 as *Streptococcus asalignus* (probably a non-salicin fermenting form of *Str. mastitidis*).

Sherman and Nivan (4) examined 68 samples of raw milk for broad zone hemolytic streptococci. Eighteen percent of the samples were found to contain these types, the majority being identified as *Str. mastitidis* and "animal pyogenes". These workers claimed that if they had considered the narrow zone hemolytic streptococci in this study, nearly all samples would have been found to contain *Str. mastitidis*.

In a recent report by Gunnison *et al.* (5), 134 of 444 samples of raw market milk were found to contain hemolytic streptococci. The blood agar counts of streptococcus colonies from the milk were low, with few exceptions. Most of the samples yielded fewer than 300 hemolytic streptococci per ml.; very few showed more than

* The first paper of this series was published in this JOURNAL, 4, 245–252 (1941).

* Probably organism now known as *Str. agalactiae*.

1,000 per ml.; and none contained over 3,000 per ml. Of the 134 positive samples, 125 contained Lancefield's group B streptococci (*Str. agalactiae*).

The crystal violet aesculin ox blood agar developed by Edwards (6) now affords a satisfactory method of estimating the number of *Str. agalactiae* organisms present in bulk milk. This medium has been found to be selective in the identification of *Str. agalactiae* (7, 8). In a previous experiment (9) the authors found that there was no significant difference in the growth-supporting ability of Edwards' medium and plain ox blood agar when the two are inoculated in parallel with pure cultures of *Str. agalactiae*. When the new American Public Health Association standard milk plating medium and Edwards' medium were inoculated with identical quantities of the same *Str. agalactiae* cultures, the Edwards' medium supported 37.6 percent more colonies than did the new standard medium.

The purpose of the investigation reported herein was to determine to what extent the total bacterial count of herd milk, as determined by the standard plate method, is affected by the incidence of *Str. agalactiae* infection in the herd.

METHODS EMPLOYED

A composite sample of milk from one entire milking was obtained at the farm from each of 93 herds.* These herds had been tested one or more times for mastitis by the laboratory procedure, as outlined by Plastridge *et al.* (7). All of the herds were known to have harbored animals affected with *Str. agalactiae* mastitis previous to the time of this study.

The herd samples were obtained by removing aliquot portions of milk from each can produced at the time of milking. Each herd sample was placed in a tightly sealed sterile pint milk bottle, immediately iced, and transported to the laboratory. Upon reaching the laboratory, usually late in the afternoon, it was placed in a refrigerator and held in ice water until the following morning.

Each sample was then plated in triplicate, using dilutions of 1:100, 1:1,000, and 1:10,000 in the new and the old standard media, and 1:10, 1:100, and 1:1,000 in Edwards' medium.

After 48 hours incubation at 35–37° C. the beta-hemolytic streptococcus colonies growing in the Edwards' plates were counted. Where different types of beta-hemolytic colonies appeared in the plates, seperate counts of each type were made. If some samples were found to contain beta-hemolytic streptococci which proved to be other than *Str. agalactiae*, the counts of these types could be subtracted from the total beta-hemolytic streptococcus count.

After the colonies were counted, from one to four isolations were made of the beta-hemolytic colonies which appeared in the Edwards' plates. Care was taken to make certain that at least one isolation was made from each different type of beta-hemolytic colony. These isolations were planted in beef infusion ox blood broth. The resulting cultures were incubated and checked for purity by streaking them on blood agar. When purified, the cultures were identified by the biochemical and serological tests previously described (9). Only the counts of beta-hemolytic colonies which proved to be *Str. agalactiae* were used in recording the *Str. agalactiae* numbers.

The total numbers of colonies were arrived at by counting the new and old standard media plates that contained between 30 and 300 colonies. The method of counting was the same as that employed in a previous report (9).

RESULTS

The total plate counts and the beta-hemolytic *Str. agalactiae* counts obtained by plating samples of milk from 93 herds affected with *Str. agalactiae*

* Samples taken by inspectors of the Connecticut State Dairy and Food Commission.

TABLE 1

CONTRIBUTION OF STR. AGALACTIAE TO THE TOTAL PLATE COUNT OF MILK FROM INFECTED HERDS

Herd No.	Total Count on Old St'd Medium per ml.	Total Count on New St'd Medium per ml.	*Str. agalactiae* Count on Edwards' Medium per ml.	Contribution of *Str. agalactiae* to the Total percent
1	25,000	33,000	1,600	4.85
2	174,000	185,700	None	0.00
3	12,300	15,730	23	0.15
4	75,300	89,000	2,400	2.70
5	37,700	148,500	2,300	1.55
6	9,230	12,070	227	1.88
7	9,430	10,200	90	0.88
8	111,300	122,700	370	0.30
9	33,300	19,800	307	1.55
10	15,230	18,570	1,470	7.91
11	10,170	10,400	290	2.79
12	51,000	58,300	2,800	4.80
13	15,200	16,600	None	0.00
14	22,130	21,970	5,600	25.50
15	26,630	29,220	2,270	7.77
16	20,930	21,100	1,430	6.78
17	293,000	292,700	1,053	0.36
18	12,730	15,900	1,030	6.48
19	6,830	7,870	203	2.58
20	74,000	92,000	777	0.84
21	6,100	14,600	2,130	14.59
22	1,400	1,270	None	0.00
23	1,830	2,930	47	1.60
24	2,100	2,030	16	0.79
25	30,700	104,000	2,330	2.24
26	6,830	7,770	318	4.06
27	33,600	46,700	300	0.64
28	11,300	13,270	4,270	32.17
29	154,300	163,700	1,100	0.67
30	34,000	36,000	None	0.00
31	466,700	516,700	2,770	0.54
32	7,370	7,430	7	0.09
33	148,700	175,000	None	0.00
34	977,000	923,000	17,700	1.92
35	12,800	16,200	1,370	8.46
36	223,000	238,300	187	0.08
37	26,430	44,300	11,300	25.51
38	159,700	56,700	1,570	2.77
39	3,330	3,570	1,430	40.06
40	7,970	13,130	3,530	26.88
41	5,430	6,100	2,930	48.03
42	173,000	189,000	12,900	6.83
43	7,850	10,730	90	0.84
44	13,300	13,970	1,300	9.30
45	16,000	19,700	260	1.32
46	1,007,000	1,063,000	None	0.00
47	79,700	313,300	7,850	2.51
48	6,370	7,930	313	3.95
49	610,000	640,000	None	0.00
50	14,370	21,200	1,830	8.63
51	543,000	530,000	217,000	40.94
52	32,000	41,000	2,330	5.68
53	26,300	54,300	3,900	7.18
54	35,000	58,700	6,300	10.73
55	30,000	47,300	17,700	37.42
56	69,300	91,000	330	0.36
57	49,700	110,700	3,230	2.92
58	65,000	62,000	None	0.00
59	49,300	53,000	None	0.00

TABLE 1—(Continued)

Herd No.	Total Count on Old St'd Medium per ml.	Total Count on New St'd Medium per ml.	*Str. agalactiae* Count on Edwards' Medium per ml.	Contribution of *Str. agalactiae* to the Total percent
60	83,500	106,000	2,630	2.48
61	19,300	41,000	None	0.00
62	40,700	100,700	597	0.59
63	26,700	21,030	2,070	9.84
64	144,700	222,300	4,300	1.93
65	153,000	163,000	100	0.61
66	28,030	23,930	5,330	22.27
67	117,300	123,000	53	0.04
68	35,000	57,300	300	0.53
69	6,670	10,000	1,430	1.43
70	84,300	140,300	4,100	2.92
71	139,000	127,300	None	0.00
72	103,700	135,000	10,400	7.70
73	15,800	39,700	475	1.20
74	43,500	110,700	1,000	0.90
75	6,730	7,830	1,870	23.88
76	5,230	6,300	None	0.00
77	71,700	66,300	4,370	6.59
78	9,270	11,930	5,570	46.69
79	4,547,000	4,333,000	23,700	0.55
80	8,830	18,270	163	0.89
81	51,700	43,700	1,400	3.20
82	23,700	29,000	970	3.34
83	101,000	120,700	None	0.00
84	27,000	45,000	77	0.17
85	2,900	3,500	580	16.57
86	56,300	109,700	4,070	3.71
87	1,200	1,700	None	0.00
88	793,000	920,000	23,700	2.58
89	16,230	21,170	None	0.00
90	343,000	560,000	400	0.07
91	5,400	6,530	17	0.26
92	17,530	19,200	1,600	8.33
93	18,000	17,470	1,270	7.27
Ave.	143,334	158,102	4,897	3.10

mastitis are tabulated in Table 1. All counts reported are averages of triplicate platings.

The total counts in the new standard medium ranged from 1,270 to 4,330,000 per ml., with a mean of 158,102 per ml. Of the 93 samples examined, 78 gave *Str. agalactiae* counts in Edwards' medium, while in 15 of the samples none of these organisms were present in the three plates which received one ml. each of the 1 : 10 dilution. The numbers of *Str. agalactiae* colonies obtained from infected samples ranged from seven to 217,000 per ml. The mean *Str. agalactiae* count for the 93 samples was 4,897 per ml.

The figures in the column at the extreme right in Table 1 indicate the percentage of the total count in the new standard medium which may be attributed to *Str. agalactiae,* as measured by the Edwards' platings. These calculations were made without correcting for the difference in the growth-supporting ability of Edwards' medium over the new standard medium, as found in the pure culture plating experiment reported earlier (9). On this basis the contributing effect of *Str. agalactiae* ranged from zero to 48.03 percent, with a mean of 3.10 percent. Since it was found previously that Edwards' medium supported 37.6 percent more *Str. agalactiae* colonies than the new standard medium (9), the actual contribution of this streptococcus to the total count is probably somewhat less

than the above figures indicate. For example, by reducing the mean *Str. agalactiae* count of 4,897 by 37.6 percent, only 3,056 of the mean total count of 158,102 may be attributed to *Str. agalactiae*. The mean contribution would then be 1.93 percent.

It should be noted that in the majority of cases the highest percentage contribution of *Str. agalactiae* occurred in samples where the total counts were comparatively low. In all but four of the 14 samples where the contribution was greater than 10 percent, the total count was less than 25,000 per ml. For example, in samples 39, 40, and 41 the contribution of *Str. agalactiae* was 40.06, 26.88, and 48.03 percent, and the total count was only 3,570, 13,130, and 6,100 per ml., respectively. This seems to indicate that *Str. agalactiae* mastitis affects, for the most part, the standard plate counts of milk samples of high quality, as judged by the standard plate count.

TABLE 2

THE AVERAGE TOTAL COUNTS OF SAMPLES GROUPED ON THE BASIS OF THEIR *Str. agalactiae* COUNT

Str. agalactiae Count per ml.	Samples number	Average Total Count per ml.
0–9	16	159,890± 89,018*
10–99	8	27,019± 26,543
100–999	20	82,386± 37,216
1,000–9,999	41	77,068± 19,875
10,000–99,999	7	94,166±11,328,063
Over 100,000	1	530,000

* Standard error.

After grouping the 93 samples on the basis of their *Str. agalactiae* counts, as shown in Table 2, it was found that the standard errors of most of the mean total plate counts of these groups were so great that it is doubtful whether there was a significant trend in the total plate counts resulting from an increase in the *Str. agalactiae* count. It may be pointed out, however, that the average total counts of groups containing increasingly greater numbers of *Str. agalactiae* were less than 159,890 per ml., the average of the 16 samples containing fewer than 10 *Str. agalactiae* per ml. The 20 samples containing from 100 to 999 *Str. agalactiae* per ml. had an average total count of 82,386 per ml., and the 41 samples containing from 1,000 to 9,999 per ml. had an average total count of 77,068 per ml.

Quarter Infection as Related to Str. agalactiae Count.—The first 33 samples examined in this study came from herds that had been laboratory-tested for mastitis within three months from the time that the samples were obtained. From the laboratory reports on these herds it was possible to estimate the percentage of quarters that were known to be shedders of *Str. agalactiae*. These percentages and the *Str. agalactiae* counts of the herd milks at the time of sampling are given in Table 3.

The weighted mean percent of quarters infected was 20.9, and the mean *Str. agalactiae* count of the 33 samples was 1,137 per ml. The relationship between the percent of quarters infected and the *Str. agalactiae* count is shown in Figure I.

While there is some variability in the values shown, the regression of *Str. agalactiae* counts on the percent of quarters infected indicated a very significant relationship. For every one percent increase in quarters infected there was an increase of 58.85±8.05 in the *Str. agalactiae* count.

Comparison of Total Plate Counts of Milk from Infected Herds on the New and Old A.P.H.A. Standard Media.—Since it was found in a previous experiment (9) that there was no significant difference in the numbers of *Str. agalactiae* colonies supported by the new and old standard media, very little of the difference between the total counts of milk from infected herds on the new and the old standard media in Table 1 should be due to the presence of *Str. agalactiae*.

In comparing the arithmetic means of the total counts on the old and new

TABLE 3

RELATIONSHIP BETWEEN THE PERCENT OF INFECTED QUARTERS IN 33 HERDS, AND THE NUMBERS OF *Str. agalactiae* IN THE HERD MILK

Herd No.	Animals number	Quarters number	Quarters Infected percent	*Str. agalactiae* Count ml.
3	34	136	1.5	23
24	44	172	2.9	16
33	37	148	4.7	None
13	39	156	5.8	None
2	8	32	6.2	None
22	46	184	6.5	None
20	26	103	7.8	777
26	62	245	8.6	318
8	52	207	9.1	370
7	20	80	9.9	90
23	38	152	9.9	47
21	29	114	11.4	2,130
1	26	104	12.5	1,600
6	46	184	12.5	227
19	33	132	12.9	203
29	30	108	13.0	1,000
10	44	172	13.5	1,470
27	26	102	15.7	300
5	22	88	15.9	2,300
17	25	100	18.0	1,053
32	40	160	18.2	7
9	24	96	18.7	307
31	21	84	19.1	2,770
11	50	200	19.5	290
30	28	112	20.6	None
18	51	203	22.7	1,030
4	26	101	30.7	2,400
28	42	164	31.1	4,270
25	25	100	33.0	2,330
16	106	424	41.8	1,430
15	68	270	43.3	2,270
12	32	128	55.4	2,800
14	29	114	96.5	5,600
Total	1,229	4,875		
Mean			20.9*	1,137

* Weighted.

standard media in Table 1, we find that the new standard medium supported only 10.3 percent more colonies than the old medium.

Since the variation between samples was so great, this method of comparing the mean counts on the two media was considered inadequate. By changing

TABLE 4

ANALYSIS OF VARIANCE OF TOTAL COUNTS ON NEW AND OLD STANDARD MEDIA

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	Variance Ratio (F)
Between Samples	92	85.264927		
New vs. Old St'd Media	1	.994033	.994033	173.18*
Error	92	.528125	.005740	
Total	185	86.787085		
Correction		3861.161097		
Mean Effect of New vs. Old St'd As Log of Ratio		$=0.10817 \pm 0.03464$		
Mean Ratio of New vs. Old St'd		$=1.282 \overset{\times}{\div} 1.1083$		

* Surpasses the 1 percent point, 6.92, for 1 and 92 degrees of freedom.

REGRESSION OF *Str. agalactiae* COUNT ON PERCENTAGE OF QUARTERS INFECTED

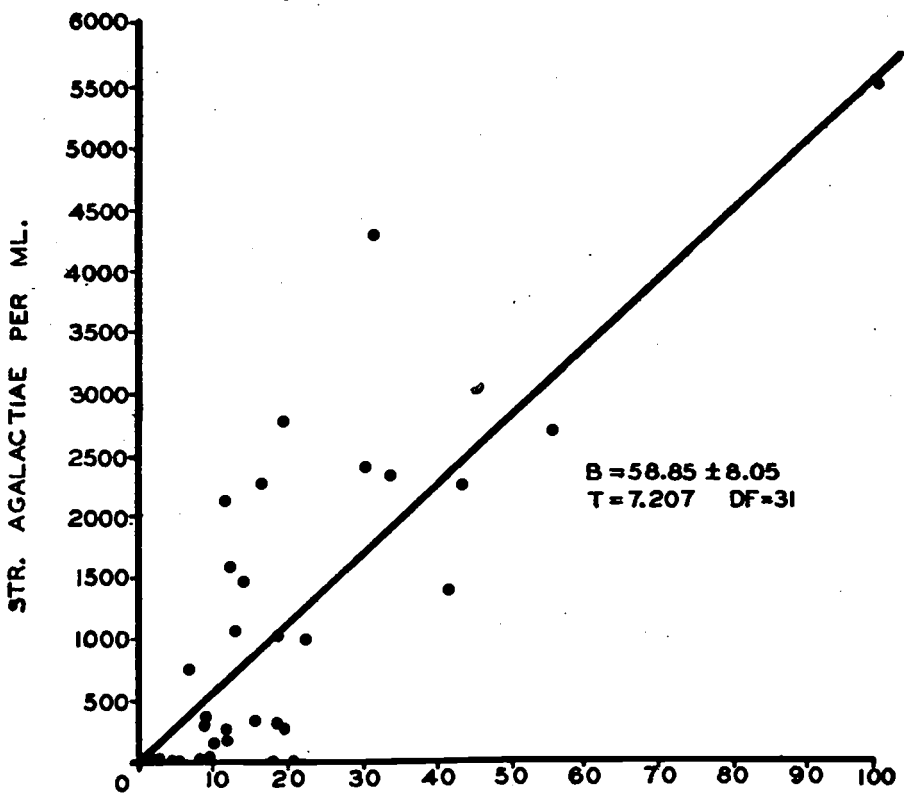


FIGURE I

Percentage of Quarters Infected

all the counts to their logarithms the variation between samples was reduced. This operation reduced the experimental error, so that a more accurate comparison of the media could be made. The analysis of variance of these logarithmic values (Table 4) indicates that there is a very significant difference between the number of colonies supported by the new and the old media. The ratio calculated from the logarithmic means indicated that the new standard medium supported more colonies than the old standard medium in the ratio of $1.282 \overset{\times}{\div} 1.108$. Therefore, the new standard medium supported 28.2 percent more colonies than did the old medium.

DISCUSSION

From the results obtained it appears that the conditions under which milk is produced and handled apparently have a much greater influence upon the plate count than does the incidence of *Str. agalactiae* infection in animals. If the *Str. agalactiae* counts of each of the 78 infected samples were subtracted from the standard plate counts, the grade classification of the milk according to the Dairy Laws of the State of Connecticut (10) would be improved in only four cases. Samples 37, 52, and 55 would change from grade B to grade A, and sample 51 would change from below the legal standard to grade B.

Our results show no correlation between the total plate count and the *Str. agalactiae* count. This may be explained by the work of Sherman (11) who pointed out that *Str. agalactiae* does not multiply below 10° C. Sherman (11) considers this fact important in the differentiation of this organism from the "lactic acid" streptococci and the "enterococci". Pullinger (12) has shown that beta-hemolytic streptococci in milk from herds infected with mastitis do not multiply when the milk is held at 15–20° C. for 24 hours.

It appears that *Str. agalactiae* mastitis will seldom cause the producers of grade B milk to be penalized for excessive plate counts. Grade A producers are more likely to be affected, but here again the cause of high counts is more likely to be the result of improper sanitation, poor cooling, and other causes, than to excessive numbers of *Str. agalactiae* cells. However, any producer who has to meet a plate count such as required for grade A or Certified Milk in Connecticut, should not run the risk of high counts which may result from maintaining a herd with a high incidence of *Str. agalactiae* infection. For example, if some of the producers who contributed samples for the present study desired to produce milk of a higher quality than grade A, they would experience some difficulty in meeting the standard plate count requirement, even though they produced their milk under the most exacting sanitary conditions.

Results obtained show that milk from herds with increasingly higher percentages of infected quarters gave higher *Str. agalactiae* counts. It is of interest to note that herd sample 14 from a segregated infected unit where 96.5 percent of the milking quarters were known to be infected, had a *Str. agalactiae* count of only 5,600 per ml., while the *Str. agalactiae* count of some of the samples from the last 60 herds examined were considerably higher than this, even though the percentage of quarter infection was much lower. The explanation of this situation may lie in the fact that samples numbering from 1 to 33 were from herds that had been laboratory-tested regularly and had followed a segregation and disposal program for from one to three years. In these herds the incidence of new infection had been kept low. The majority of samples numbering from 60 to 93 were from herds that had been tested once or twice, but had not been properly segregated. Most of the animals in the herd that produced sample 14 had been infected for a number of years. In the unsegregated herds, there were undoubtedly some recently infected animals. This condition may account for the high *Str. agalactiae* count in some of the herds because, as was shown by Little (13), the number of streptococci shed in milk from recently infected quarters may reach a very high level. Another possible explanation of the high counts in certain herds is that the number of *Str. agalactiae* cells eliminated in the milk of an infected animal varies over a fairly wide range, and the proportion of infected animals which give high counts may be greater at one time than at another.

Pullinger (12) observed marked variations in the beta-hemolytic streptococcus counts of successive herd samples, but high counts were obtained with relatively few. This phase was not covered in the present study. The problem of variation in the number of *Str. agalactiae* cells shed by infected quarters and the effect of the variation upon the count of herd milk invite further study.

It should be pointed out that Edwards' medium, as used in this investigation, may not have given a true index of the actual number of *Str. agalactiae* cells present in the herd milk, since only the hemolytic forms of this organism were counted. Stableforth (14) has shown that non-hemolytic forms of this organism may be present in milk from infected quarters. While some strains of *Str. agalactiae* appear to be non-hemolytic, when grown on the surface of Edwards'

medium or the plain blood agar, nearly all strains studied by us yielded subsurface colonies which possessed a distinct but often very narrow zone of hemolysis. It is not known to what extent non-hemolytic *Str. agalactiae* organisms were present in the samples examined in this investigation. However, several attempts to isolate *Str. agalactiae* from non-hemolytic colonies developing on some of the Edwards' plates were unsuccessful. Attention must necessarily be confined to the hemolytic types until a more satisfactory method of recognizing the strictly non-hemolytic forms of *Str. agalactiae* is developed.

By averaging the counts of the 93 herd samples arithmetically, we note that the new standard medium supported 10.3 percent more colonies than the old standard medium. Because of the extreme variation in the counts, the logarithmic average was the logical one to employ. Bowers and Hucker (15), in comparing their tryptone glucose skim milk medium with the old standard medium, found that raw milk samples gave 36 percent higher counts on their medium than on the old medium. This ratio was calculated from arithmetic means.

The results presented in this paper do not indicate that the presence of *Str. agalactiae* affected to any appreciable extent the ratio between the mean counts on the new and old standard medium.

SUMMARY AND CONCLUSIONS

Str. agalactiae mastitis may be responsible for a large proportion of the standard plate count of low count milk. On the other hand, *Str. agalactiae* mastitis usually contributes only a very small percentage of the total number of bacteria present in high count milk.

Samples of milk obtained from 93 herds, all of which were known to have harbored animals affected with *Str. agalactiae* mastitis at some time during the two-year period previous to the time of this study, were plated in the new and old A.P.H.A. standard media and in Edwards' medium.

The total counts obtained with the new medium ranged from 1,270 to 4,330,000 per ml., with an arithmetic mean of 158,102. The total counts obtained on the old standard medium from the same milk ranged from 1,200 to 4,547,000 per ml., with an arithmetic mean of 143,334.

Seventy-eight of the 93 samples gave beta-hemolytic *Str. agalactiae* counts in Edwards' medium, which ranged from seven to 217,000 per ml., with an arithmetic mean of 4,897 per ml., while in 15 of the samples none of these organisms were present in three 0.1 ml. portions.

Without correcting for the difference in the growth-supporting ability of Edwards' medium over the new standard medium, the mean percentage contribution of *Str. agalactiae* to the total count for all 93 samples was only 3.10 percent. Correction of this mean for the difference in the growth-supporting ability of the two media reduced the contributing effect of *Str. agalactiae* to 1.93 percent.

A very significant relationship was found to exist between the percentage of quarters infected and the number of *Str. agalactiae* present for 33 of the herds studied in which the percentage of quarters infected was known. For each one percent increase in the incidence of infected quarters, there was an increase of 58.85 ± 8.05 increase in the *Str. agalactiae* count. The infected animals in these herds had been segregated to prevent the spread of infection.

The highest *Str. agalactiae* counts observed occurred among 60 samples from herds that had not been segregated to prevent the spread of new infection.

There was no correlation between the total counts and the number of *Str. agalactiae* present in the 93 samples examined.

The logarithmic mean of the total counts in the new standard medium was 28.2 percent higher than the mean

of the counts in the old standard medium. Very little of this difference could be attributed to the presence of *Str. agalactiae* in the samples.

The writers wish to express their appreciation to Dr. C. I. Bliss, Consulting Biometrician, Storrs Agricultural Experiment Station, for his helpful suggestions regarding the statistical analysis of this problem, and also to Mr. F. F. Ferrigno, who made available the mastitis history on the 93 herds studied.

REFERENCES

1. Plastridge, W. N., Anderson, E. O., White, G. C., and Rettger, L. F. Infectious Bovine Mastitis. 3. Methods of Control. Storrs Agr. Exp. Sta. Bul. 197 (1934).
2. Plastridge, W. N., Anderson, E. O., Weirether, F. J., and Johnson, R. E. Infectious Bovine Mastitis. Report on a Control Program Based on Segregation of Infected Animals. *J. Dairy Sci.*, **29**, 641–650 (1936).
3. Frost, W. D., Gumm, M., and Thomas, R. E. Types of Hemolytic Streptococci in Certified Milk. *J. Infect. Dis.*, **40**, 699–705 (1927).
4. Sherman, J. M., and Niven, C. F. Hemolytic Streptococci of Milk. *Ibid.*, **62**, 190–201 (1938).
5. Gunnison, J. B., Luxen, M. P., Marshall, M. S., and Engle, B. Q. Hemolytic Streptococci in Raw Market Milk. *J. Dairy Sci.*, **23**, 447–455 (1940).
6. Edwards, S. J. Studies on Bovine Mastitis. IX. A Selective Medium for the Diagnosis of Streptococcus Mastitis. *J. Comp. Path. and Ther.*, **46**, 211–217 (1933).
7. Plastridge, W. N., Anderson, E. O., and Seremet, J. S. Infectious Bovine Mastitis. 6. A Laboratory Procedure for the Detection of Bovine Mastitis. Storrs Agr. Exp. Sta. Bul. 224 (1938).
8. Slanetz, L. W., and Naghski, J. Studies on Streptococci of Bovine Mastitis. *J. Infect. Dis.*, **66**, 80–85 (1940).
9. Morgan, M. E., Anderson, E. O., and Plastridge, W. N. Mastitis and the Plate Count of Milk. I. A Quantitative Study of the Growth of *Streptococcus agalactiae* in Various Plating Media. *J. Milk Technol.*, **4**, 245 (1941).
10. Dairy Laws of the State of Connecticut and Rules and Regulations of the Milk Regulation Board. Bulletin No. 12, Eighth Edition, 1940, Office of Dairy and Food Commission, Hartford, Connecticut.
11. Sherman, J. M. The Streptococci. *Bact. Review*, **1**, No. 1 (1937).
12. Pullinger, E. J. Mastitis Streptococci in Bulk Milk. *J. Dairy Res.*, **6**, 369–382 (1935).
13. Little, R. L. Bovine Mastitis. I. The Significance of the Dose Factor in the Production of Experimental Mastitis. *Cornell Vet.*, **27**, 297–308 (1937).
14. Stableforth, A. W. Studies on Bovine Mastitis. VII. The Serological Characters of Mastitis Streptococci. *J. Comp. Path. and Ther.*, **45**, 185–211 (1932).
15. Bowers, C. S. and Hucker, G. J. The Composition of Media for the Bacteriological Analysis of Milk. New York State Agr. Exp. Sta. Tech. Bul. 228 (1935).

The Role of Disinfectants in the Control of Mastitis*

C. S. BRYAN, C. W. DARBY, W. L. MALLMANN, *and* A. C. CORBETT

Section of Bacteriology, Michigan Agricultural Experiment Station

ALTHOUGH *Streptococcus agalactiae* is probably the chief cause of mastitis, other organisms such as the staphylococcus and colon bacillus must also be included as etiological agents. In addition, there is a possibility that a filterable virus may also play a part. Because the etiological agents represent several groups of microorganisms, any disinfectant to be effective, must act on all vegetative cells, must have rapid germicidal action, and must be relatively nontoxic. In addition, the ideal disinfectant should be nonirritating to the milker's hands and the cow's udder, odorless, continue to act in the presence of small amounts of milk, relatively stable, and relatively cheap. Unfortunately, the ideal disinfectant has not appeared, and until it does the use of the best ones available is necessary.

In the ever-widening search for the ideal disinfectant, McCulloch (1) reports the efficiency of soaps in destroying mastitis streptococci. He shows that many of the widely advertised bath and laundry soaps in laboratory tests killed mastitis streptococci, type B of Lancefield's classification, in dilutions simulating lathering concentrations in one minute at 40° C. He also found Drene (whose active agent is a sulphonated alcohol) equally effective.

Mallmann and Darby (2) found that sodium lauryl sulfate is an ideal selective bacteriostatic agent, allowing the unhampered growth of Gram-negative bacteria and the effective inhibition of Gram-positive bacteria in suitable concentration. A selective medium, lactose lauryl-sulfate tryptose broth, was recommended as a primary enrichment medium for the isolation of coliform organisms from water supplies.

Inasmuch as sodium lauryl sulfate has only limited germicidal activity for Gram-positive bacteria and numerous papers have stated that common soaps have only germicidal action on a few groups of bacteria, it was deemed necessary to repeat the studies of McCulloch to determine their accuracy. When compounds, which have been known as detergents and not as disinfectants, are reported as disinfectants and are recommended to veterinarians and dairymen for the disinfection of udders for the elimination of mastitis streptococci, such recommendations should be based on extensive laboratory and field tests.

In a recheck of McCulloch's studies on soaps, 11 strains of streptococci, isolated from mastitis-infected udders were used. The history of these cultures follows:

1.	2–2	*S. hemolyticus*	Obtained from Michigan Department of Health
2.	2–6a	*S. agalactiae*	Obtained from Dr. Lancefield, Sept., 1939
3.	2–6b	*S. agalactiae*	Obtained from Dr. Lancefield, Sept., 1939
4.	3–1	*S. agalactiae*	Obtained from Dr. Rosell, July, 1934
5.	3–2	*S. agalactiae*	Obtained from Dr. Rosell, July, 1934
6.	3–3	*S. agalactiae*	Obtained from Dr. Minnett, July, 1934
7.	3–5	*S. agalactiae*	Isolated by Dr. C. S. Bryan, 1938
8.	3–6	*S. agalactiae*	Obtained from Dr. Rosell, July, 1934
9.	3–7	*S. agalactiae*	Obtained from University of Wisconsin, No. B 98–35, July, 1934
10.	3–10	*S. agalactiae*	Isolated by Dr. C. S. Bryan, from infected goat, 1939
11.	A	*S. agalactiae*	Isolated by Dr. C. S. Bryan, from infected cow, Sept., 1941

* Journal Article No. 560 n.s., Michigan Agricultural Experiment Station.

Laboratory strains of *Escherichia coli* and *Staphylococcus aureus* were included because these organisms also cause mastitis, and any disinfectant recommended for mastitis control should be effective against these organisms.

In the first series of tests, two compounds were arbitrarily selected, namely, Lux Flakes and Drene. Only one concentration, 1 to 100, was tested. This concentration was selected to assure the use of a killing dilution because McCulloch showed that these compounds killed at a dilution of 1 to 250 for Drene and 1 to 300 for Lux Flakes. This dilution was, at least, 2.5 times stronger than the killing dilution reported by him.

The cultures were transferred at 24-hour intervals for one week to insure stability. Twenty-four hour broth cultures, grown in F. D. A. broth (3) at 37° C., were used in all experimental work.

Five-tenths ml. seedings of the well-mixed 24-hour broth cultures were made into a pot containing 1 percent by weight of Lux Flakes dissolved in 5 ml. of a sterile 5 percent milk suspension in a water bath maintained at 40° C. Similar seedings were made into sterile milk suspensions containing 1 percent by volume of Drene. The soaps and Drene were added aseptically to the sterile milk suspension. To check all possibility of contamination, all subcultures were examined microscopically. After exposures of one minute, subcultures were made to dextrose-tryptose broth and brom-cresol purple milk. A 4 mm. platinum loop was used for making the transplants. Immediately after the primary subculture was made, a loopful was transferred from it to a second tube (Shippen modification) to eliminate any bacteriostatic action by the soap or Drene. All primary and secondary subcultures were incubated at 37° C., and observations were made after 48 hours and 7 days incubation. The results are recorded in Table 1.

Streptococcus strains Nos. 3–1, 2–6a, 2–6b, and A were apparently killed by a one-minute exposure of a 1 percent concentration of both Lux Flakes and Drene. The other streptococcus strains, *Staph. aureus* and *Esch. coli*, grew in all subcultures. The subcultures made from the primary subcultures, which are recorded in Table 1, gave exactly the same results as the primary tube, thus show-

TABLE 1

THE BACTERICIDAL EFFECT OF LUX FLAKES AND DRENE ON MASTITIS STREPTOCOCCI, *Staph. aureus* AND *Esch. coli* IN A 5 PERCENT MILK SUSPENSION IN 1 MINUTE AT 40° C.

Cultures	Growth in Subculture **			
	Lux Flakes—1–100		Drene—1–100	
	Tryptose Broth	B.C.P. Milk	Tryptose Broth	B.C.P. Milk
Strept. 3–1	—	—	—	—
3–3	+	+	+	+
3–5	+	+	+	+
3–6	+	+	+	+
3–7	+	+	+	+
3–10	+	+	+	+
3–2	+	+	+	+
2–6a	—	—	—	—
2–6b	—	—	—	—
2–2	+	+	+	+
A*	+	—	—	—
Staph. aureus	+	+	+	+
Esch. coli	+	+	+	+

* Freshly isolated strain of *Strept. agalactiae*.
** 48-hour incubation at 37° C.

ing that failure of growth in the four strains previously mentioned is not due to bacteriostatic action.

To confirm these data, a second series of tests was conducted in exactly the same manner as stated except that quantitative platings were made from the primary tryptose broth subculture tubes, using appropriate dilutions in dextrose tryptose agar. All cultures were incubated at 37° C. for 48 hours.

By comparing the counts obtained from a series of control counts made in 5 percent sterile milk suspension, with the counts obtained from the soap and Drene suspensions, the bacterial reductions due to the soap and Drene can be calculated. These data are presented in Table 2. These data also show that streptococcus strains 3–1, 2–6a, 2–6b, and A were killed by a 1 minute exposure. The other streptococcus strains, *Staph. aureus* and *Esch. coli*, were reduced in numbers but the reduction was not significant.

From the organisms tested in the series cited, three streptococcus strains, 3–3, a resistant strain, 2–2, a slightly susceptible strain, and 2–6a, a very susceptible strain, were selected. These strains together with *Staph. aureus* and *Esch. coli* were selected as representative organisms for testing other soaps reported by McCulloch.

The technic used in their study was the same as before except that instead of transferring a 4 mm. loopful from the soap-culture mixture to 10 ml. dextrose-tryptose broth, 1 ml. was pipetted to saline blanks and appropriate dilutions plated as before. In testing culture 2–6a, a 2 ml. quantity was used because the density of the broth culture was extremely light. Controls were made using a 5 percent sterile milk suspension. The data are presented in Table 3.

The following soaps were tested: Life Buoy, Neko, Ivory Soap and Flakes, Super-Suds, Fels-Naptha Soap Chips, Oxydol, Rinso, Lux Flakes, and Drene. All of the soaps killed streptococcus strain 2–6a, but streptococcus strains 3–3, 2–2, and *Staph. aureus* and *Esch. coli* were resistant to these soaps. Although reductions in numbers occurred, the reductions were insignificant.

The susceptibility of streptococcus strain 2–6a to soap solutions is not limited to soap as shown in Table 4. These data show that this strain is equally susceptible to phenol.

The data presented in this paper show that soap solutions do have a

TABLE 2

REDUCTIONS IN BACTERIAL COUNTS PRODUCED BY 1 PERCENT CONCENTRATIONS OF LUX FLAKES AND DRENE IN 5 PERCENT MILK SUSPENSIONS IN 1 MINUTE AT 40° C. ON MASTITIS STREPTOCOCCI, *Staph. aureus* AND *Esch. coli*

Cultures	Initial No. Bacteria	No. Bacteria Surviving Exposure	
		Lux Flakes	Drene
Strept. 3–1	3,000	0	0
" 3–3	16,000	12,000	9,000
" 3–5	18,000	6,000	200
" 3–6	22,000	9,000	1,000
" 3–7	25,000	11,000	4,000
" 3–10	55,000	26,000	500
" 3–2	17,000	10,000	2,000
" 2–6a	15,000	0	0
" 2–6b	7,000	0	0
" 2–2	13,000	3,000	200
" A *	1,400	0	0
Staph. aureus	69,000	34,000	27,000
Esch. coli	85,000	42,000	50,000

* Freshly isolated strain of *Strept. agalactiae*.

TABLE 3

REDUCTIONS IN BACTERIAL COUNTS PRODUCED BY 1 PERCENT CONCENTRATIONS OF VARIOUS SOAPS IN 5 PERCENT MILK SUSPENSIONS IN 1 MINUTE AT 40° C. ON MASTITIS STREPTOCOCCI, *Staph. aureus* AND *Esch. coli*

	Series A						Series B					
		No. of Bacteria Surviving Exposure						No. of Bacteria Surviving Exposure				
Cultures	Initial No. Bacteria	Lifebuoy	Neko	Ivory Soap	Supersuds	Fels-Naptha Soap Chips	Initial No. Bacteria	Oxydol	Ivory Flakes	Rinso	Lux Flakes	Drene
Strept. 3–3	10,000,000	9,100,000	1,400,000	11,600,000	12,700,000	8,900,000	12,800,000	9,000,000	10,500,000	7,000,000	11,200,000	6,100,000
Strept. 2–2	17,500,000	5,800,000	3,200,000	12,900,000	5,300,000	2,300,000	14,300,000	5,300,000	4,300,000	7,200,000	5,800,000	145,000
Strept. 2–6a	25,700,000	0	0	0	0	0	11,800,000	0	0	0	0	0
Staph. aureus	61,000,000	36,300,000	740,000	60,000,000	27,200,000	17,200,000	65,000,000	14,300,000	27,800,000	14,100,000	31,500,000	23,100,000
Esch. coli	55,000,000	46,000,000	52,000,000	58,000,000	54,000,000	54,000,000	49,000,000	38,000,000	48,000,000	33,000,000	46,000,000	55,000,000

TABLE 4

RATE OF KILL OF MASTITIS STREPTOCOCCI BY 1 PERCENT SOAP CONCENTRATIONS IN 5 PERCENT MILK SUSPENSIONS COMPARED WITH 1 PERCENT PHENOL IN 5 PERCENT MILK CONCENTRATION

Compound	Exposure in seconds	No. of Bacteria Surviving Exposure		
		Strept. 3–3	Strept. 2–6a	Strept. 2–2
Neko	0	19,000	19,000	10,000
	60	10,000	0	1,000
Ivory	0	19,000	19,000	10,000
	60	11,000	0	2,500
Drene	0	19,000	19,000	10,000
	60	6,000	0	0
Phenol	0	19,000	19,000	10,000
	60	9,000	0	9,000

bactericidal effect on some strains of mastitis streptococci but the data also show that other strains are highly resistant. Furthermore, such organisms as *Esch. coli* and *Staph. aureus,* which occasionally cause mastitis, are not destroyed.

Soaps and sulphonated alcohols are good detergents and aid in the removal of undesirable bacteria but they are not only very questionable general germicides but even questionable selective bactericides. It would be folly to place any dependence on the germicidal efficiency of such compounds in the control of mastitis.

The data do not substantiate McCulloch's conclusion that "Soap solutions in the concentrations usually obtained in lathering the hands with soap in warm water are effective disinfectants against mastitis streptococci, and may satisfactorily replace other disinfectants for the hands of the milkers and the teats of the cows".

McCulloch shows that 100 p.p.m. available chlorine in 5 percent milk solution were necessary to kill streptococci in 1 to 2 minutes exposure. Forty and 60 p.p.m. available chlorine in 5 percent milk was ineffective. These data would appear to invalidate the usefulness of hypochlorites for udder disinfection.

The writers have used hypochlorites routinely for a number of years for this purpose but no control studies on the germicidal efficiency of these solutions were made. Hence the following studies were made to ascertain the efficiency of hypochlorites in the laboratory and in the field.

The hypochlorite solutions were tested on various streptococci isolated from milk collected from mastitis-infected cows. The strains represented alpha, beta, and gamma streptococci.

Five hundred ml. of water were sterilized in liter flasks. Concentrations of 0.25, 0.5, 1.0, and 1.5 p.p.m. available chlorine were added to a series of flasks for each strain of streptococci. The chlorine concentrations were checked by the starch-iodine titration. The flasks were held at room temperature. To each flask was added 1 ml. of a 24-hour broth culture of streptococci. At intervals of 15, 30, 45, 60, 90, 120, and 150 seconds, 1 ml. portions were removed and added to tubes of nutrient broth. The tubes were incubated 36 hours when they were examined for growth.

Data are presented in Table 5 on the susceptibility to hypochlorites of

TABLE 5

THE SUSCEPTIBILITY OF SIX STRAINS OF ALPHA STREPTOCOCCI, ISOLATED FROM MILK, TO SODIUM HYPOCHLORITE

Amounts of Chlorine in p.p.m.	Number of Strains Showing Viability Exposure in seconds						
	15	30	45	60	90	120	150
1.5	3	0	0	0	0	0	0
1.0	6	3	0	0	0	0	0
0.5	6	6	4	2	0	0	0
0.25	6	6	6	6	6	6	6

six strains of alpha streptococci isolated from milk. Chlorine residuals of 0.25, 0.5, 1.0, and 1.5 p.p.m. were tested. Viability tests were made after exposures of 15, 30, 45, 60, 90, 120, and 150 seconds. The data are compilations of results from the six strains tested. The table presents the number of strains showing growth at the various chlorine concentrations and exposure periods. When 1.5 p.p.m. available chlorine was used, only three strains were viable after 15 seconds' exposure. Three strains survived 30 seconds exposure at 1 p.p.m. available chlorine. All strains were viable after 150-second exposures at 0.25 p.p.m. available chlorine.

The susceptibility of five strains of beta streptococci isolated from milk to hypochlorites is presented in Table 6. These strains were slightly more susceptible to chlorine than were the alpha strains. All of them were killed in 15-seconds' exposure at 1.5 p.p.m. available chlorine and three survived 15 seconds' exposure at 1.0 p.p.m. available chlorine.

TABLE 6

THE SUSCEPTIBILITY OF FIVE STRAINS OF BETA STREPTOCOCCI, ISOLATED FROM MILK, TO SODIUM HYPOCHLORITE

Amounts of Chlorine in p.p.m.	Number of Strains Showing Viability — Exposure in seconds						
	15	30	45	60	90	120	150
1.5	0	0	0	0	0	0	0
1.0	3	0	0	0	0	0	0
0.5	5	5	3	0	0	0	0
0.25	5	5	5	5	5	5	5

Data on the susceptibility of 26 strains of gamma streptococci isolated from milk to hypochlorites are presented in Table 7. These strains show a susceptibility picture of the same pattern presented by the alpha and beta strains. It appears that all of these streptococci strains are readily killed by chlorine concentrations of 1.5 p.p.m. available chlorine after 30 seconds exposure at a temperature of 22° C.

It is apparent from these data that alpha, beta, and gamma strains of streptococci isolated from mastitis-infected cows are highly susceptible to hypochlorites in concentrations of approximately 1 p.p.m. in 30 seconds' exposures at room temperature. These tests included the streptococci tested on soaps with the exception of streptococci "A". Furthermore it is also demonstrated in these studies that there is no marked variation in resistance in the various strains as was observed in the resistance of streptococci to soaps.

TABLE 7

THE SUSCEPTIBILITY OF 26 STRAINS OF GAMMA STREPTOCOCCI, ISOLATED FROM MILK, TO SODIUM HYPOCHLORITE

Amounts of Chlorine in p.p.m.	Number of Strains Showing Viability — Exposure in seconds						
	15	30	45	60	90	120	150
1.5	1	0	0	0	0	0	0
1.0	24	2	0	0	0	0	0
0.5	26	26	20	2	0	0	0
0.25	26	26	26	26	26	25	23

Mallmann (4) has reported that coli and streptococci in swimming pools are readily destroyed by chlorine residuals of less than 1 p.p.m. He has also demonstrated in unpublished data that *Staph. aureus* is equally susceptible to 1 p.p.m. available chlorine.

To demonstrate the practical value of hypochlorites in the control of mastitis, a series of practical field tests was made. Table 8 presents the results of a comparative study on washing the udders with clear water and washing with a chlorine solution containing 200 p.p.m. available chlorine. Eighteen cows were selected for the series in which cows 7, 11, 14, 15, 16, and 17 were infected. Samples of milk were collected, starting with cow 1, Series B. Before the milk sample was collected the udder was washed with clear water. The same water was used to wash each udder. It will be observed that all milk samples and samples of wash water

TABLE 8

THE COMPARATIVE VALUE OF HYPOCHLORITE SOLUTION AND CLEAR WATER USED TO WASH THE UDDERS DEMONSTRATED BY THE RESULTS OF THE MICROSCOPIC TEST FOR MASTITIS STREPTOCOCCI AND THE PRESENCE OF LIVING STREPTOCOCCI IN WASH SOLUTIONS

Cow No. and Sequence of Cows Tested	Series A: Udders Washing With Chlorine (200 p.p.m.)		Series B: Udders Washed With Clear Water	
	Microscopic Test of Milk *	Viable Strepts. in Wash Solution	Microscopic Test of Milk *	Viable Strept. in Wash Solution
1	—	—	—	—
2	—	—	—	—
3	—	—	—	—
4	—	—	—	—
5	—	—	—	—
6	—	—	—	—
7	+	—	+	+
8	—	—	—	+
9	—	—	—	+
10	—	—	—	+
11	+	—	+	+
12	—	—	+	+
13	—	—	+	+
14	+	—	+	+
15	+	—	+	+
16	+	—	+	+
17	+	—	+	+
18	—	—	+	+

* + indicates streptococci.

were free of streptococci until cow 7 was examined. The milk sample and wash water sample both yielded streptococci. Milk samples collected for cows 8, 9, and 10 were negative for streptococci, but the contamination of the wash water continued positive as a result of contamination of cow 7. Milk sample for cow 11, which was infected, showed positive, and wash water samples collected after washing the udder of this animal were positive. An increase in the number of streptococci in the wash water occurred at this point owing to the presence of streptococci in this infected animal. When cows 12 and 13, which were negative animals, were washed with the contaminated wash water, streptococci were deposited on the udder and the milk samples were contaminated. These milk samples yielded streptococci. Milk samples from cow 18, also a negative animal, yielded streptococci as a result of contaminated wash water. Not only were false positives obtained from the milk samples in cows 12, 13, and 18 but these cows were exposed to infection. Cows Nos. 8, 9, 10 were exposed to streptococci from cow 7 and cows Nos. 12 and 13 to infection from cows 7 and 11, and cow No. 18 was exposed to streptococci from infected cows 7, 11, 14, 15, 16, and 17.

In a second series of tests (Series A) a 200 p.p.m. available chlorine hypochlorite solution was used for washing the udders. It will be observed from the data in Table 8 that the wash water remained free of living streptococci throughout the sampling period, and it will also be observed that streptococci were isolated only from the infected cows. No mechanical carry-over of streptococci from the infected animals occurred. Furthermore no possible infection through the wash waters occurred because each udder was washed with a streptococci-

free wash water. In addition, of course, the wash water used acted as a disinfectant to free the udder from external contamination prior to the collection of the milk sample.

McCulloch showed that chlorine in concentrations of 40, 60, 80, and 100 p.p.m. available chlorine in the presence of 5 percent milk was an unsatisfactory disinfectant. He showed that 40 and 60 p.p.m. available chlorine had no germicidal value. These studies were checked as presented in Table 9. To flasks containing 500 ml. of sterile water, sodium hypochlorite was added to give residuals of 40, 60, 80, 100, and 200 p.p.m. available chlorine. Sterile skimmilk was added to give a concentration of 5 percent in each flask. Titrations were then made to determine the titratable chlorine residuals. The 40, 60, 80, 100, and 200 p.p.m. available chlorine flasks gave residuals of 0, 3.5, 8.9, 26.6, and 51.4 p.p.m. respectively. One ml. portions of a 24-hour broth culture were added to the flasks and the number of surviving bacteria surviving 1, 2, 5, and 10 minutes' exposure was determined. A resistant strain (3–3) and a susceptible strain 2–6a were tested.

Although the susceptible strain 2–6a was readily killed in the flask containing a titratable residual of 51.4 p.p.m. available chlorine, the resistant strain 3–3 survived for 5 minutes. These data confirm McCulloch's finding; however, this is not unexpected because oxidizing agents are rapidly dissipated in the presence of large quantities of organic matter. It must also be remembered that the titratable residuals obtained in the presence of milk are not the actual germicidal residuals as demonstrated by Mallmann (3). The germicidal residuals would be much lower.

The fact that oxidizing agents such as hypochlorites are dissipated in the presence of organic matter does not necessarily invalidate their usefulness. The data do show, however, that fresh solutions must be used. As soon as a chlorine solution shows turbidity it should be discarded. An opalescent solution such as that represented by a 5 percent milk solution should never be used. This is clearly demonstrated in Table 9.

It is recommended that the udders be washed with a fresh solution of hypochlorite containing 200 p.p.m. available chlorine. The solution should be renewed as soon as turbidity appears or better yet, fresh solution be used for each series.

TABLE 9

THE EFFECT OF 5 PERCENT MILK IN THE RINSE WATER ON THE GERMICIDAL ACTIVITY OF SODIUM HYPOCHLORITE ON SELECTED STREPTOCOCCI STRAINS

Organism Tested	Chlorine Residual		Number of Bacteria Expressed in Millions				
	Initial Chlorine p.p.m.	After Adding Milk	Initial Seeding	No. of Surviving Bacteria After Exposure			
				1 min.	2 min.	5 min.	10 min.
Strept. No. 3–3	200	51.4	92	57.2	40.7	0.68	0
	100	26.6	..	63.5	60.3	53.4	41.3
	80	8.9	..	82.4	63.4	48.9	28.7
	60	3.5	..	92.7	37.2	80.6	69.8
	40	0	..	89.4	94.0	88.9	83.8
	40	No milk	..	0	0	0	0
Strept. No. 2–6a	200	51.4	38	0	0	0	0
	100	26.6	..	12.9	0.5	0	0
	80	8.9	..	18.0	6.3	0	0
	60	3.5	..	82.6	6.3	36.8	31.7
	40	0	..	43.2	42.3	41.3	42.5
	40	No milk	..	0	0	0	0

SUMMARY

1. Soap solutions were found to be unsatisfactory germicidal agents inasmuch as many strains of streptococci, *Staph. aureus,* and *Esch. coli* were unaffected.

2. Sulphonated alcohols exhibited germicidal properties comparable to soaps.

3. Soaps and sulphonated alcohols are unsatisfactory agents for destroying the organism on the udder causing mastitis.

4. Hypochlorite solutions containing 1 p.p.m. available chlorine killed alpha, beta, and gamma streptococci in less than one minute.

5. A fresh hypochlorite solution containing 200 p.p.m. available chlorine is recommended for the disinfection of cows' udders.

6. Hypochlorite solutions, turbid from the introduction of organic matter, are unreliable disinfectants.

LITERATURE CITED

1. McCulloch, E. C. The Efficiency of Soaps and Other Disinfectants in Destroying Mastitis Streptococci. *Am. J. Vet. Res.,* 1, 18 (1940).
2. Mallmann, W. L. and Darby, C. W. Uses of a Lauryl Sulfate Tryptose Broth for the Detection of Coliform Organisms. *Am. J. Pub. Health,* 31, 127 (1941).
3. Ruehl, G. L. A. and Brewer, C. M. United States Food and Drug Administration Methods of Testing Antiseptics and Disinfectants. U. S. Dept. Agri. Circ. 198 (1931).
4. Mallmann, W. L. and Gelpi, A. G. Chlorine Resistance of Colon Bacilli and Streptococci in a Swimming Pool. Mich. Eng. Exp. Sta. Bul. 27 (1930).

Development of Oxidized Flavor and the Speed of Oxidation of Ascorbic Acid in Milk*

G. H. HARTMAN *and* O. F. GARRETT

New Jersey Agricultural Experiment Station, New Brunswick, N. J.

MANY papers have been published directing attention to the effect of metallic contamination on the development of oxidized flavor in milk. A review of the literature on the development of oxidized flavor was published in 1940 by Brown and Thurston (1). Though copper contamination is not the only cause of oxidized flavor it is an important one.

Despite the attention given to this problem, many dairies still have hidden sources of metallic contamination, especially copper, of which the management is not aware. The exposure of only a small surface of metallic copper is sufficient to contaminate the milk with enough soluble copper to cause the development of strong oxidized flavor. The observations reported below suggest a means of detecting the source of copper contamination.

During a routine check, it had been observed for some time that a strong oxidized flavor was developing in the pasteurized milk from the College creamery. Accordingly, seven different samples of the pasteurized College milk were taken for analysis and observation. These samples are described as follows:

No. 1—Jersey milk taken from the bottle filler, pasteurized December 18.

No. 2—Jersey milk taken from the bottle filler, pasteurized December 20.

No. 3—Mixed herd milk taken from the bottle filler, pasteurized December 19.

No. 4—Mixed herd milk taken from the pasteurizing vat, pasteurized December 20.

No. 5—Mixed herd milk, first part of milk which passed over the cooler, pasteurized December 20.

No. 6—Mixed herd milk taken after 50 gallons had passed over cooler, pasteurized December 20.

No. 7—Mixed herd milk taken from last of milk over the cooler, pasteurized December 20.

The flavor of these milks was judged immediately and at the end of 24, 48 and 72 hours. The concentration of ascorbic acid was determined by the dye-titration method (2) at the same intervals. The results are shown in Tables 1 and 2.

TABLE 1

INTENSITY OF OXIDIZED FLAVOR IN MILK SAMPLES

Sample No.	Time of determination in hours after pasteurization			
	0	24	48	72
1	0	±*	++	+++
2	0	0	0	±
3	0	0	0	±
4	0	0	0	0
5	0	0	0	±
6	0	0	0	0
7	0	0	0	0

* + Indicates the intensity of oxidized flavor.

± Presence of oxidized flavor questionable.

* Journal series paper of the New Jersey Agricultural Experiment Station, Rutgers University, Department of Dairy Husbandry.

TABLE 2

CONCENTRATION OF ASCORBIC ACID IN MILK SAMPLES
(Milligrams per liter of milk)

Sample No.	Time of determination in hours after pasteurization			
	0	24	48	72
1	18.50	11.17	5.98	1.71
2	18.60	14.02	11.43	7.51
3	18.30	14.18	10.61	8.63
4	18.20	16.52	15.04	13.72
5	17.74	13.72	11.12	7.61
6	17.03	15.14	12.29	11.12
7	18.50	15.65	12.29	11.43

It is interesting to note that sample 1 developed an intense oxidized flavor and that the speed of the oxidation of ascorbic acid in this sample was greater than in the other six samples. Sample 1 was pumped from the pasteurizing vat over the cooler by a worn bronze pump. Subsequently the bronze pump was replaced by a new stainless steel pump, and samples 2–7 were handled by this new pump. It is interesting, also, to note that the rate of oxidation of ascorbic acid in samples 2, 3, and 5 was greater than that of samples 4, 6, and 7, and that this phenomenon is coincident with the development of a slight oxidized flavor in these samples at the end of 72 hours.

Undoubtedly a considerable amount of copper was being dissolved from the surfaces of the bronze pump by the hot milk. Replacement of the old pump with a stainless steel one apparently did not completely remove the source of copper contamination, as evidenced by the rate of oxidation of ascorbic acid of samples 2, 3, and 5, but the most serious source of trouble was eliminated.

It seems advisable for dairies to check their pasteurized milk occasionally for copper contamination. Titration of a sample of milk for ascorbic acid on 3 or 4 successive days may reveal an abnormal rate of oxidation, and lead to the detection of a hidden source of copper contamination. This determination is not much more difficult than an acidity determination and can be conducted easily by a dairy laboratory technician.

REFERENCES

1. Brown, W. C., and L. M. Thurston. A Review of Oxidation in Milk Products as Related to Flavor. *J. Dairy Sci.*, 23, 269 (1940).
2. Garrett, O. F. Determination of Ascorbic Acid (Vitamin C) in Milk. *J. Milk Technol.*, 1, No. 3, 37 (1938).

Public Health Compliance by Manufacturers of Paper for Packaging Perishable Foods*

J. R. SANBORN

New York State Experiment Station, Geneva, New York

IN spite of the fact that nearly all of the mills manufacturing paper and paperboard for the packaging of such perishable foods as milk, cream, and frozen desserts, are continuing to meet public health requirements, there is still some discussion as to the relationship of mill conditions and practices to compliance with public health regulations and standards. The data presented below should help to clarify the situation.

BACTERIOLOGICAL CONDITION OF PAPERBOARD USED FOR MILK CONTAINERS

During the early stages of the present study (1937–1938), approximately 22 mills were engaged more or less actively in the manufacture of paperboard for milk containers. In a few instances the runs made were largely experimental. Some mills discontinued making this board for economic reasons. While many of the plants demonstrated their ability to produce paperboard that meets bacteriological standards, several encountered some difficulty in doing so. Such instances were due to the inadequacy of microbiological control, to temporary difficulties in locating certain focal points of growth within the mill system, or to limitations of the equipment utilized.

Table 1 presents a summary of the bacteriological results on milk container board from representative mills, secured during the past 5 years.

More than 7,500 analyses have been made of paperboard produced by the 22 mills. Most of the mills were able to meet with fair consistency a standard of less than 500 colonies per gram. Several of the largest producers, working toward the manufacture of a board that is essentially free of microörganisms, were in a position to meet a

TABLE 1

BACTERIOLOGICAL ANALYSES OF PAPERBOARD USED FOR MILK CONTAINERS

Colonies per Gram of Disintegrated Paperboard

Media: Old and New Standard Agars. Incubation: 37° C. for 48 hours

No. Mills	Year	Total No. Tests	Percentages Yielding Counts Between 0 and 10	Between 11 and 100	Between 101 and 250	Between 251 and 500	Over 500	Maximum Count Obtained*
14	1937–1938	1,064	15.7	47.3	19.1	9.2	8.7	10,300
7	1939	2,341	40.2	53.9	4.8	0.8	0.3	1,100
9	1940	2,182	46.7	41.2	5.5	1.3	5.3	1,100
6	1941	1,581	76.0	23.3	0.7	0	0	140
3	1942†	276	69.6	27.9	2.5	0	0	130

* Usually this figure is much higher than the next highest count.
† January to March, 1942.

* Approved by the Director of the New York State Agricultural Experiment Station for publication as Journal Paper No. 499, March 20, 1942.

standard of less than 250 colonies. Since 1939, the majority of the 7 or 8 mills that have continued to make milk container board have experienced little trouble in meeting public health standards. Table 2 shows the results obtained during the past 15 months from 4 of these mills.

TABLE 2

BACTERIOLOGICAL ANALYSES OF MILK CONTAINER BOARD BY DISINTEGRATION METHOD*
Medium: New Standard Agar. Incubation: 37° C. for 48 hours

			Percentages of Counts per Gram of Paperboard					
			Between					*Maximum*
Mills	*Year*	*Total No. Tests*	*0 and 10*	*11 and 100*	*101 and 250*	*251 and 500*	*Over 500*	*Count Obtained*
S	1941	678	89.2	10.8	0	0	0	70
C	1941	197	58.4	39.6	2.0	0	0	130
T	1941	110	28.2	66.3	5.5	0	0	140
Q	1941	529	80.9	18.9	0.2	0	0	130
Combined Count S, C, Q, Jan. to March, 1942		276	69.6	27.9	2.5	0	0	130

* *Standard Methods for the Examination of Dairy Products*, 8th edition, 1941, p. 138.

In order for a mill to achieve strict control comparable with the results shown in Table 2, it is necessary to prevent microbiological growths in the mill system through the use of treatments that are carefully, thoroughly, and systematically applied.

IMPORTANCE OF MICROBIOLOGICAL CONTROL

During the past two decades numerous workers have given considerable attention to the microbiological problems involved in the manufacture and uses of various pulp, paper, and paperboard products. In carrying out these studies, investigators have had advantages in the experiences and research background provided by cellulose microbiology, water works practices, investigations of the slimy fermentations, and by other industries that have encountered similar problems such as the sugar, dairy, food, textile, rubber, leather, and fermentation industries.

An investigation of microbiological and sanitation problems of miscellaneous types of mills and their products was started by the author in 1930. Conditions at plants experiencing troubles due to the excessive development of microörganisms have been studied. It has been demonstrated that the growth and activities of these organisms in mill systems result in economic losses and often in products of inferior quality, due to offensive odors, slime spots, and microbiological growths in paper and paperboard.

Mills that fail to take proper precautions often fail, as well, to manufacture products that are suitable for the packaging of foods. Under conditions of inadequate sanitary and microbiological control, nearly all of the miscellaneous groups of microörganisms that are found in mill systems, raw materials, and water supplies may also be isolated from paper and paperboard products. Effective control of microörganisms by mills is important, therefore, for economic as well as for sanitary reasons.

MICROBIOLOGICAL CONTROL AT MILLS

Studies of the experiences of many mills, including those manufacturing paper and paperboard for food packages, have produced several pertinent facts. The following conclusions may be drawn:

1. The growth of microörganisms in pulp, paper, and paperboard mills can be effectively controlled.

2. Failure of attempts to do so indicates that a mill has not succeeded in locating the focal points of growth, that efficient remedies have not been utilized, or that the treatments used were improperly applied.

3. Microbiological surveys reveal the origin of the objectionable microorganisms, the places in the mill systems where active growth takes place, the extent and methods of growth distribution, the most effective treatments, and precautions that should be employed.

4. The decision as to how far a mill is prepared to go to remedy conditions and avoid future trouble rests with the plant itself. In the case of mills that manufacture miscellaneous grades such as newsprint, wrapping, or boxboard, it is usually sufficient, as well as economically necessary, to establish a type of microbiological control that enables a plant to prevent losses and to meet customer specifications.

In other instances where more efficient control is feasible, desirable, or essential, mills should adhere strictly to programs of prevention which, while similar to the precautions taken for economic reasons, are applied more carefully, thoroughly, and systematically.

5. Microbiological problems are often widely variable among individual mills and groups of mills. Nevertheless, despite variations in local conditions, water supplies, raw materials, processing methods, and microbiological flora, mill problems can be solved quite as effectively as have many similar difficulties in the food, dairy, sugar, textile, and fermentation industries.

6. It is idle to stress as insurmountable such obstacles as the persistence in some mill systems and their products of microörganisms that are resistant to heat and to some chemical reagents. Many plants that have had to contend with abundant development of aggressive, persistent types and varieties of bacteria and fungi, have succeeded, through critical investigation and painstaking effort, in eradicating the sources of such growths and in preventing their further development. Procedures and treatments are available to mills that insist upon getting results.

MICROBIOLOGICAL CONTENT OF PAPER AND PAPERBOARD

In 1931, certain members of the paper and paperboard industry were sufficiently concerned as to the fate of carefully processed foods, packaged in or held in direct contact with paper containing microbiological growths, to request the author to investigate the problem. A method was devised in 1932 for the disintegration of paper and paperboard and the determination of bacterial counts per gram of stock.* Numerous samples of different food container boards were tested. The microörganisms isolated included various types of fungi, coliform bacteria, and putrefactive organisms.

Food authorities and sanitarians showed increasing interest in the microbiological content of wrappers and containers for foods when it was found that certain types of bacteria, yeasts, yeast-like fungi, and molds, occurring on or in packaging materials, were sometimes responsible for or associated with spoilage, deterioration, and objectionable contamination of perishable foods, such as butter, meats, fish, bread, and eggs.(1) When the industry attempted to package such perishable and easily contaminated foods as milk, cream, and ice cream in paper containers, public health officials, quite naturally, demanded reliable information as to the bacteriological and sanitary condition of these containers and of the paperboard from which they are made. In response to a general request for information and data, both mills and converting plants have coöperated in programs of research. This work has as its object the attainment and

* Unpublished Report, issued August 18, 1932.

TABLE 3

BACTERIOLOGICAL ANALYSES OF PAPER AND PAPERBOARD PRODUCTS BY DISINTEGRATION METHODS

Media: Old and New Standard Agars. Incubation: 37° C. for 48 hours

Classes of Products Paper or Paperboard for	No. of Plants	Total No. Tests	Percentages of Counts per Gram of Paper or Paperboard Between								
			0 and 100	101 and 500	501 and 1,000	1,001 and 5,000	5,001 and 10,000	10,001 and 50,000	50,001 and 100,000	100,001 and 200,000	200,001 and 500,000	500,001 and 1,000,000
Milk bottle caps, hoods and closures	12	1,856	93.30	5.61	0.65	0.38	0	0.06	0	0	0	0
Milk containers	24	7,153	88.00	9.00	1.44	1.42	0.13	0.01	0	0	0	0
Liquid tight containers	10	501	86.20	13.80	0	0	0	0	0	0	0	0
Food wrappers	6	242	65.30	31.80	1.70	0.40	0	0.40	0.40	0	0	0
Other types of food containers;												
trays, pails, cups, etc.	13	201	59.20	16.90	17.40	6.50	0	0	0	0	0	0
Bulk fiber cans	6	1,115	54.00	32.10	6.60	5.70	0	1.60	0	0	0	0
Tubing	8	166	44.00	28.30	17.50	10.20	0	0	0	0	0	0
Miscellaneous uses	14	321	10.30	13.40	6.20	12.80	3.10	18.40	10.90	9.00	14.30	1.60

maintenance of high standards of bacteriological quality and sanitation.

In the course of the investigation of methods suitable for determining the bacteriological content of paperboard, seven or eight disintegration devices including pulpers, churns, shredders, ball mill types, food and beverage mixers were employed. Two specially modified mixers(2) have given particularly satisfactory results. A critical review and investigation of disintegration procedures and other methods for the examination of paper, paperboard, and products made therefrom, including milk-bottle caps, hoods, closures, cups, fiber cans, and containers have been carried out by a Committee on Standard Methods for the Examination of Dairy Products of the American Public Health Association. Microbiological methods resulting from these studies are included in *Standard Methods for the Examination of Dairy Products,* Eighth Edition (1941). Interpretations of bacteriological counts and standards for these products are also given.

Table 3 presents some of the analytical results that have been obtained at this laboratory on various classes of paper and paperboard products. A summary of the bacteriological results secured on paper containers used for perishable foods, is reported elsewhere.(3)

When it was found that the bacteriological condition of the original paper or paperboard determines, in general, the bacteriological condition of the fabricated product, nearly all of the mills involved actively coöperated with public health officials by investigating and establishing programs of microbiological control with consistency and critical thoroughness. Mills studied their flow diagrams and operations in order to determine and control all sources of microbiological contamination and points of growth build-up. Many mills installed bacteriological laboratories and employed trained workers for the purpose of obtaining

information as to the number and types of microörganisms present, their significance, and methods of eradication. They found, as other industries have, that certain microbiological problems are so complex that definite correlations between control procedures and the microbiological results secured are not always apparent. However, the solutions to some of the more important problems are sufficiently complete to enable mills to produce good results. Research on a comprehensive and critical scale is still in progress.

Ground wood mills have discovered that the fermentation type of flora, characteristic of these mills, consists of many species that are rather readily killed by heat and chemicals so that, even when pulp suspensions have a relatively high bacterial content, it is frequently possible to reduce appreciably the number of bacteria in the paperboard produced. Ground wood pulp, being rich in nutrients available to microörganisms, requires proper treatment and care during manufacture, handling, and storage. Many mills are today making paper and paperboard of suitable quality with a high ground wood content, used for food wrappers, containers, milk-bottle caps, and closures.

Other types of mills have to contend with groups of microörganisms that are usually essentially different from those found in ground wood mills. This is the case with mills that utilize mainly bleached and unbleached chemical pulps. These plants may start out with a clean, sanitary pulp, containing few microörganisms, but unless suitable remedies and preventive measures are properly applied, the stock will not remain in this condition.

High counts are often due to the persistence of spore-bearing bacteria and other heat-resistant types and to the neglect of adequate preventive measures.

While it is true that, as microbiological control procedures increase in effectiveness, the flora of paper and paperboard tends to become restricted to a relatively few heat- and dryness-resistant types of bacteria, the problem is not as simple as this statement suggests. For example, the presence in stock of gelatinous masses of microbiological growth or "slime" is sometimes a direct cause of high counts in paperboard. It has been demonstrated that miscellaneous groups of microorganisms, embedded in such masses, are afforded a certain amount of protection from the lethal effects of heat and chemical reagents. As previously stated, procedures and treatments for controlling the various types of microbiological growths are available to and utilized successfully by mills that insist upon getting results.

EFFECT OF CALENDER WATER ON PAPERBOARD COUNTS

The influence of calender water on the bacteriological content of a sheet is a good example of a source of growth that is controllable. Paper is often calendered at the end of the paper machine after it is formed and dried. In this process, the paper or paperboard passes between cast-iron rolls to increase surface smoothness and gloss. During the operation the sheet is usually moistened with water (sometimes starch solutions or emulsions) from troughs or calender water boxes. Many mills take precautions to keep this water clean and free from bacteriological growth. If the condition of water and water boxes is not properly controlled, calender water develops high counts which raise the bacterial content of the paper or board, nullifying the beneficial effect of the bactericidal treatments that the original pulp suspensions may have received. Bacteria that are objectionable from a sanitation standpoint may be transferred to the sheet in this way.

The data in Table 4 show the effect of bacteriological growths in calender water or solutions upon bacterial counts in finished paperboard.

TABLE 4

INFLUENCE OF HIGH BACTERIAL COUNTS IN CALENDERING SOLUTIONS UPON PAPERBOARD COUNTS

	Average Bacterial Counts Normally Obtained		Average Bacterial Counts per Gram of Paperboard When Water or Solutions Containing Microbiological Growths are Used for Calendering	
Mills	Pulp Suspensions at Machines Colonies per Ml.	Finished Paperboard When Water or Solutions Used are Under Bacteriological Control Colonies per Gram	Calender Water or Solutions Colonies per Ml.	Finished Paperboard Colonies per Gram
B	43	74	Source (a) 27,200 Source (b) 88,000	1,150
E	580	164	5,730	660
T	Source (a) 3 Source (b) 77	31	3,325	637

COMPLIANCE WITH PUBLIC HEALTH REQUIREMENTS

A number of laboratories have undertaken investigations of the various problems involved in the microbiology and sanitation of paper and paperboard products. Departments of Health have participated and taken an active interest in these developments. The results of this work have provided public health officials with pertinent information and data which have enabled them to promulgate certain regulations and standards. On the whole, the record of the past five years appears to indicate satisfactory compliance with these requirements. According to our observations and experience it also shows benefits both to manufacturer and consumer. The industry should be reminded that public health officials desire to have certain information and data as to products, processes, and practices, insofar as they may, in the judgment of these officials, affect the health and well-being of the consuming public. Departments of Health have every right to demand such information. Thus far, the majority of interested public health authorities have seemed well satisfied with the progress that the mills are making.

Based on the record, it appears clear that mills which make a sincere effort to comply with bacteriological standards have found no difficulty in meeting them.

BIBLIOGRAPHY

1. Clayton, W. Modern Advances in Preventing Food Spoilage. *The Chemical Age*, London, Aug. (1941). Reprinted in *Modern Packaging*, 15, 64 (1942).
   Mallmann, W. L. and Michael, C. E. The Development of Mold on Cold Storage Eggs and Methods of Control. Michigan Sta. Tech. Bull. 174 (1940).
   Hood, E. G. and White A. H. The Cause and Prevention of Mould in Canadian Pasteurized Butter. Dept. of Agriculture, Canada Publications 570 (1939).
   Macy, H. and Pulkrabek, G. M. Parchment Paper as a Source of Mold Infection in Butter. Minnesota Sta. Bull. 242 (1928).
2. Sanborn, J. R. Microbiological Content of Paperboard Used in the Packaging of Foods. *Amer. J. Public Health*, 30, 247–255 (1940).
   Ball, C. O. Aspects of Public Health Legal Control of Paper Milk Containers. *J. Milk Technol.*, 5, 6–17 (1942).
   Standard Methods for the Examination of Dairy Products, A.P.H.A., 8th Ed., 127–141 (1941).
3. Sanborn, J. R. Microbiology of Paper Containers. *Modern Packaging*, 14, 46–47 (1941).

Concise Methods for the Detection of Streptococci of Lancefield's Group B or C in Milk Samples

EDWARD J. FOLEY

Laboratories of Bacteriology, University of Notre Dame
Notre Dame, Indiana

IT is generally conceded that *Streptococcus agalactiae* (Lancefield's Group B) is the most important cause of bovine mastitis (1) and it has been conclusively proved that the spread of *S. agalactiae* infection can be stopped when all the infected cows are identified and segregated (2, 3, 4). *S. dysagalactiae* (Lancefield's Group C) (5, 6) is another important cause of mastitis. It is important that bacteriological methods be applied in diagnosis, since it has been shown that methods which detect the causative agents are most decisive and efficient (7, 8).

It is well known by those who have attempted mastitis control on a large scale under practical conditions that diagnosis by extensive laboratory examinations is at the present time possible only through the cooperation of well equipped and well staffed laboratories. A more practical approach is necessary. A method or combination of methods, the use of which will enable the examiner to divide up a herd efficiently and concisely with the least labor and expense. It is the purpose of this paper to describe such a method. It involves the use of both the Hotis test and Edwards' broth which have been modified to increase their effectiveness under the conditions adopted.

A number of relatively simple methods have been described in the interest of making the laboratory diagnosis of mastitis a practical procedure. Important among these are the microscopic examination of films from incubated milk samples for streptococci, the observation of incubated milk samples which have been mixed with brom cresol purple for changes which characterize the growth of *S. agalactiae* (Hotis test) (9), and inoculation of Edwards' broth (10) in which *S. agalactiae* grows in a characteristic manner.

The Hotis test is perhaps the most widely used. It is simple to conduct and positive reactions show a high correlation with the presence of *S. agalactiae* (9, 11). Milk is drawn into sterile tubes containing 0.5 percent aqueous brom cresol purple and the tubes are incubated for 24 to 48 hours. The presence of *S. agalactiae* is revealed by the formation of yellow balls of growth along the sides of the tube or by a copious yellow deposit with or without an acid change in the column of milk as a whole. When this test is used, a difficulty is encountered inasmuch as a variety of extraneous bacteria or udder micrococci may overgrow streptococci which are present.

Recently the microscopic and the Hotis tests have been improved by the addition of selective inhibitory agents which tend to prevent the overgrowth of streptococci by miscellaneous bacteria which may be contained in the sample (12, 13, 14). Bryan and his coworkers (13) were the first to show the advantages of modified Hotis tests. They used sodium azide and brilliant green as selective inhibitory agents. Edwards (10) recommended the use of sodium azide to keep down the growth of *Esch. coli* in samples shipped in to the laboratory for examination. He found many indefinite reactions when Hotis tests modified by the addition of sodium azide were

used. On the other hand, Little (14) recommended this procedure.

Colon bacilli and micrococci of various groups are the principal types of bacteria which interfere with the diagnosis of streptococcic mastitis from incubated milk samples. Of the two, the micrococci are perhaps the more troublesome in samples taken with proper attention to cleanliness. Considerable experience with the Hotis test impressed the author with the necessity of inhibiting the growth of micrococci in incubated samples, and experiments were carried out to test various substances. Crystal violet was chosen because of its effectiveness against these types. Its action is shown in the following observation. Samples from six udders infected with *S. aureus* were drawn into (a) tubes containing brom cresol purple alone, (b) tubes containing sodium azide and brom cresol purple, and (c) tubes containing crystal violet, sodium azide, and brom cresol purple. Within 24 hours the tubes in series (a) and (b) developed colonies surrounded by liquefaction indicative of staphylococcus growth, while tubes of series (c) remained unchanged.

The modified Hotis test that was adopted is carried out as follows: 20 ml. (composite) samples of milk are drawn into sterile tubes containing 1 ml. of a solution made up of sodium azide, 1 gram; brom cresol purple, 5 grams; crystal violet, 0.1 gram; distilled water, 1 liter. The final concentrations are: crystal violet 1/200,000 and sodium azide 1/20,000. This modification has proven superior to the original Hotis test or to that in which sodium azide alone is employed. Used in conjunction with the other test to be described, it has been possible to demonstrate *S. agalactiae* in each instance in a series of fifty examinations done repeatedly on samples from known positive quarters.

It has not been compared side by side with the modification reported by Bryan *et al.*(13) but theoretically the two methods should be about equally efficient. They reported a decrease in the number of equivocal reactions when inhibitors were used, and similar results are obtained with the present modification.

Appearances characteristic of the growth of *S. agalactiae* may develop more slowly in the modified Hotis test than in tubes made according to the original method. This is more than compensated for by the avoidance of many of the confusing changes which occur in the ordinary Hotis test. Acid changes in the cream line are of added significance in the modified test. Such changes occurring at 16 hours incubation with or without yellow flakes of growth in the column of milk usually indicates streptococcus growth.

A modification of Edwards' broth (10) has been used in conjunction with the crystal violet-sodium azide modification of the Hotis test. It has the following composition:

Lactose	5 grams
Crystal violet 1% solution	*1 ml.*
Sodium azide	0.1 gram
Tryptose Phosphate Broth (Difco)	1000 ml.
Final pH	6.8–7.0

Sufficient brom thymol blue is added to impart a slight but distinct color to the broth. The medium is tubed in 8–10 ml. amounts in test tubes and autoclaved. This medium, or Edwards' broth, in the author's hands has been made to reveal concise information as to the identity of certain streptococci developing in it: The identity of *S. agalactiae* (Group B) or *S. dysagalactiae* (Group C) can be determined serologically using extracts made from the growth in Edwards' broth (14). The importance of the method as used in connection with the modified Hotis test described above warrants a detailed description of the technique.

Edwards' dextrose broth is useful for the recognition of streptococci in milk samples. According to Edwards, growths of *S. agalactiae* appear as copious sediments in these broth tubes.

It occurred to the author that from such sediments "C" substance preparations could be extracted according to the method of Lancefield, and tested with suitable group specific precipitating serum. Using commercially available serum (Lederle), preliminary observations of milk samples from a raw supply which consistently contains Group B streptococci and from one known to be free from Group B streptococci established the correctness of this surmise.*

It will be remembered that all species of the *S. agalactiae* group fall into Lancefield's serological Group B, and that *S. dysagalactiae,* another, though less frequent, cause of streptococcic mastitis belongs to Group C, while potentially pathogenic streptococci of human origin belong to Group A. By the method described, it has been possible to determine decisively the presence of *S. agalactiae* and *S. dysagalactiae* in milk samples without resorting to preliminary plating and pure culture study. Those who have been engaged in mastitis diagnosis by cultural methods will readily appreciate the convenience of omitting this heretofore essential step.

Inoculations are made from crystal violet-sodium azide Hotis tests which have been incubated over night.

Edwards' practice is to inoculate broth with a loopful of cream from tubes which had stood over night at room temperature. The author has modified the formula of Edwards' broth since it is advantageous to increase the concentration of crystal violet from 1/1,000,000 to 1/100,000 when the inoculum is from incubated milk samples. This concentration of crystal violet has little retarding effect on streptococci (15) and growth is rapid when cream from samples incubated 16–24 hours is seeded into the broth.

Preparations of the "C" substance solution may be carried out by Brown's method (16) or as follows. If a copious growth is present as sediment, this may be transferred to a centrifuge tube by means of a capillary pipette. (If the growth is diffuse, centrifugation must be carried out to obtain the sediment.) The growth suspended in the small amount of broth carried over with it is spun down, and the broth removed. Then 0.5 ml. of N/20 HCl/saline is added and the tubes placed in a boiling water bath for 15 minutes. The tubes are then thoroughly cooled in running water, a drop of pH 7.0 buffer is added, and the solution neutralized with N/20 NaOH after which it is centrifuged. The supernatant liquid represents the antigen used in the precipitin test.

The test is carried out microscopically according to Brown's method (16) or by Lancefield's tube technique (17), or in tubes of small caliber by layering the antigen *over* the various grouping sera. It has been shown by Lancefield that ring tests are reliable if strong extracts and strong specific antiserum are used.

Antigen solutions may react with two or more sera when the broth inoculum is from a composite sample, or when mixed infections occur in separate quarters.

Precautions should be taken to avoid the occurrence of non-specific reactions with broth components such as described by Bliss (18).

The procedure using the crystal violet-sodium azide Hotis test with serological verification follows. It should be said that labor on the part of the examiner and expense to the owner can be saved if, at the outset, information as to history of low production or udder abnormalities, and palpation for the presence of suggestive or extensive fibrosis is made before samples are taken. In this way animals with diseased udders may be detected and henceforth disregarded. Such cows are generally unprofitable

* The author wishes to acknowledge with thanks the use of the facilities of the Coventry Farm laboratory, Princeton, New Jersey, where preliminary observations on modified Hotis tests and serological identification of streptococci in Edwards' broth were carried out.

and regularly secrete milk abnormal in composition so they can be relegated to the early disposal group without further examination.

Departures from normal pH of the samples are noted and recorded before incubation is begun. The tubes are inspected after 16 and 24 hours incubation. Those showing yellow balls of growth along the sides of the tube, at the bottom or at the cream line are regarded as positive for the presence of *S. agalactiae*. Further incubation of tubes showing slight acid changes at 16 hours often brings forth characteristic positive changes by 24 hours. The question whether all samples are to be inoculated into modified Edwards' broth is one for the individual worker to decide. In routine work the author inoculates broth with cream from only those tubes which are suspicious. It is superfluous (except in special instances) to carry out the serological test routine on growths from tubes showing the typical positive Hotis appearance. Furthermore, there is usually no need to inoculate broth from tubes with normal pH which show no suggestive growth changes after 48 hours incubation.† The work is thus limited to samples which show suspicious changes after 24 or 48 hours incubation.

The surface of modified Edwards' broth is inoculated with a loopful of cream, and incubation is carried out at 37° C. The milk tubes are refrigerated for further examination, if necessary. Growth of *S. agalactiae* is manifest within 24 hours as soft or granular floccules, discrete in the clear broth. (This appearance is for all practical purposes diagnostic of *S. agalactiae* and further investigation is usually not required.) *S. dysagalactiae* developes a cloudy growth with more or less sedimentation. With both types the pH falls to 5.0 or below. The volume of work connected with serological identification can be reduced by making films for microscopic examination from broths showing an acid reaction and diffuse turbidity. Only tubes with copious flocculent growth or those shown to contain streptococci by microscopic examination are tested serologically. Those in which growth is not extensive are reincubated and tested the next day if streptococci are demonstrated in the films.

It will be seen that the method described has been concerned with the examination of composite samples. Examination of separate quarter samples may be carried out in the same way except that 0.5 ml. of the inhibitor-indicator solution is mixed with 9.5 ml. of milk from individual quarters. This procedure is much to be preferred. It is more delicate, and with the information thus obtained the herd may be further classified according to the number of quarters in which the cows are infected.

In short, the method is as follows: Cows which according to clinical observations can be considered unfit for the production of good milk are not submitted to laboratory examination. Those which are found to give typical Hotis tests are considered to be infected. Those suspicious by the Hotis test which are found to give flocculent or granular sediments in modified Edwards' broth are also considered to be infected. Whenever possible, serological verification should be made on such tubes since this entails little extra effort. Broth tubes showing diffuse turbidity are examined microscopically, and if streptococci are present they are carried through the serological test routine.

It is, of course, apparent that the modified Hotis test could be used alone or the serological technique could be carried out on samples handled according to Edwards' technique, or with incubated samples handled in other ways. Best results, however, are ob-

† Group C streptococci may produce slight or insignificant changes in the incubated milk samples. (19, 3) In order to detect these it is advisable to examine smears of all samples which have insignificant or unaltered appearance and inoculate broth tubes from those containing streptococci.

tained when they are used together as described above.

It is desirable to accompany the methods outlined with a physical examination of the udder since this method is outstanding for determining the status of a cow as regards ability to produce milk of good quality.

To date, Group A streptococci have not been encountered in incubated milk samples nor in modified Edwards' broth inoculated therefrom. Should they occur, however, tests with Group A antiserum according to the method outlined should detect their presence.

DISCUSSION

The good features of the methods described are evident, since they are extensions and applications of other successful and well established techniques. Also, the advantages from the standpoint of labor and economy are obvious. The value of the tests is further emphasized by the recent findings of Minett (8) to the effect that the study of incubated milk samples is the most suitable method of demonstrating *S. agalactiae.*

The use of crystal violet to inhibit micrococci, and of sodium azide to inhibit *E. coli* greatly improves the Hotis test. The number of tubes suitable for prolonged incubation or further examination is increased.

Typical positive Hotis reactions develop in many positive samples. The significance of an acid cream line is enhanced as this change within 16 hours incubation usually indicated streptococcus growth.

The occurrence of growth of extraneous bacteria in broth transfers from incubated milk samples is reduced by the presence of 1/100,000 crystal violet in the modified Edwards' medium.

By conducting several tests in practically one operation, distinct advantages are obtained, and as there is a certain amount of overlapping in the efficiency of the diagnostic tests they tend to merge and confirm each other in the majority of instances.

One need not rely alone on the reaction seen in the incubated milk sample since the nature of the streptococci can be quickly determined by serological methods. The results of one test complements the other.

SUMMARY

A laboratory method is described for the diagnosis of bovine mastitis caused by streptococci of Lancefield's Group B or C by the use of Hotis tests and Edwards' broth which have been modified by the addition of selective inhibitory agents.

BIBLIOGRAPHY

1. Munce Peterson, E. Survey of the Literature on Bovine Mastitis to the End of 1935. Imperial Bureau of Animal Health. Weybridge, Surrey, England. 1938.
2. Minett, F. C., Stableforth, E. W., and Edwards, S. J. *J. Comp. Path. and Therap.*, **46**, 131 (1933).
3. Little, R. B. *J. Amer. Vet. Med. Assoc.*, **97**, 212 (1940).
4. Anonymous. *Guernsey Breeder's J.*, August, 1939.
5. Little, R. B. *Proc. Soc. Exp. Biol. and Med.*, **41**, 254 (1939).
6. Plummer, H. *J. Immunol.*, **42**, 91 (1941).
7. Edwards, S. J. *J. Comp. Path. and Therap.*, **47**, 49 (1934).
8. Minett, F. C. *Ibid.*, **52**, 266 (1939).
9. Hotis, R. P., and Miller, W. T. U. S. Dept. Agr. Circ. No. 400. 1936.
10. Edwards, S. J. *J. Comp. Path. and Therap.*, **51**, 250 (1938).
11. Murphy, J. M. *Cornell Vet.*, **29**, 279 (1939).
12. Bryan, C. S., and Nelson, E. A. *Amer. J. Pub. Health*, **27**, 914 (1937).
13. ———, Devereaux, W. C., Herschey, W. C., and Corbett, A. C. *N. Amer. Vet.*, **20**, 41 (1939).
14. Little, R. B. Bull. Int. Assoc. of Milk Dealers, 565. 1941.
15. Edwards, S. J. *J. Comp. Path. and Therap.*, **46**, 211 (1933).
16. Brown, J. H. *J. Amer. Med. Assoc.*, **111**, 310 (1938).
17. Lancefield, R. C. *Proc. Soc. Exp. Biol. and Med.*, **38**, 473 (1938).
18. Bliss, E. A. *J. Immunol.*, **34**, 337 (1938).
19. Foltz, V. D. *J. Bact.*, **40**, 331 (1940).

Milk Sanitarian's Rôle in Milk Legislation*

H. C. ERIKSEN
Santa Barbara, California

ONE of the interesting chapters in the history of public health is that with reference to milk and dairy sanitation, and one to which we have all contributed in part. It is interesting because of the magnificent progress and accomplishments within the milk industry during the past half a century, and the part that modern science has played in these achievements. But, it is interesting primarily because of the part that safe milk has played as a factor in public health.

NEED FOR ORGANIZATION

When this Association was organized, 30 years ago, slightly more than 50 cities in this country had established official milk control, and places where effective work was done were few and scattered. Milk and dairy inspection was mostly on a local basis, and without any coördinating agency. Each inspector had to solve his own problems in the light of his own knowledge, and in accordance with local restrictions. His functions were primarily those of a police officer.

In California the problem in milk and dairy sanitation was somewhat similar to those that existed in other parts of the country, but something better was in the offing.

In 1916 public demand for some sort of progressive state-wide milk control legislation resulted in the enactment of the Pure Milk Law. This, in spite of its limitations, was a commendable start towards the procurement of a pure milk supply in California.

Having supported the adoption of the State Market Milk Program, inspectors saw the need of an organization for dissemination of information and accurate scientific knowledge in the field of milk sanitation; and likewise to provide an opportunity for inspectors to exchange views on inspection problems and policies to the end that milk inspection be placed on a uniform basis. Such an organization, to be known as the California Association of Milk and Dairy Inspectors, was organized in 1917, and was destined to become a constructive force in public interest, and the spearhead in a crusade for a progressive development and expansion of the Market Milk Program in California.

Through the years the Association has counted among its members the progressive and constructive individuals engaged in milk control work throughout the State. In addition, the Association's roster has always included as honorary and associate members the names of many noted educators, State officials, health officers, producers, distributors, and members of allied agencies.

Guided by information and experience, these people have, at Association meetings, contributed their best thoughts. Out of these ideas and ideals, tested by a thorough discussion, there has emerged at every assembly the perspective of a new objective in the field of progressive milk sanitation, towards which the Association set its goal.

Milk control officials in California may well be proud of their contribution to the advancement of the present milk sanitation program. Individually they have pioneered improvements and standards within their own communities. Collectively they have sponsored

* Presented at meeting of the International Association of Milk Sanitarians, Tulsa, Oklahoma, October 27, 1941.

the incorporation of these same improvements and standards in a statewide program. It is by this procedure that the California Association of Milk and Dairy Inspectors has sought to advance the State program to a point where its protective requirements in production, processing, distribution, and standards shall be sufficiently high and abreast of time to meet demands of all progressive communities within the State, and thus secure uniformity with simplification of enforcement procedures.

Today, as in the past, consumers look to their health officers and milk control officials not only for assurance that there be no let down of trusted standards, but to sponsor such additional improvements and safeguards as are consistent with public interest in milk supplies.

Therefore, and in order that the public, the dairy industry, and those interested in milk legislation may have the unbiased opinion of the men whose daily work and observations throughout the State qualifies them preëminently to make constructive recommendations on needed revisions and progress in dairy legislation, the California Association of Milk Inspectors has for years taken an active interest in advancing the cause of sound, constructive, and uniform dairy legislation.

Some years ago the Association's stand on certain legislation became somewhat confused due to the fact that officers and committee members appearing before the Legislature were not in complete agreement. This situation resulted in loss of prestige for the Association.

During the last few years, however, a more definite and clear-cut policy has been pursued in matters of legislation, and much lost ground has been regained.

LEGISLATIVE PROGRAM

Two years ago our Legislative Committee was instructed to prepare a legislative program to be presented for discussion at our 1940 convention. The result of the meeting was the adoption of 9 separate resolutions, which in turn were referred to the Legislative Committee with instructions that said Committee translate the intent and purpose of said resolutions into 9 separate bills, and secure their introduction in the 1941 Legislature. All resolutions were adopted unanimously.

Of the 9 bills introduced, 4 were passed and signed by the Governor; 5 died in committee. Bills passed were as follows:

1. Establishing qualification and civil service examination requirements for future inspectors.
2. Requiring indicating, as well as recording thermometers on each pasteurization vat.
3. Requiring an 80 score for all milk processing plants.
4. Requiring skim milk sold for human consumption, including that used in the manufacture of buttermilk or for mixed milk drinks, to be derived from market milk.

Bills that failed to pass are as follows:

1. Requiring Grade A cream for manufacturing of ice cream.
2. Requiring protective closures for milk bottles.
3. Requiring minimum pasteurization temperature to be increased from 140 to 143 degrees Fahrenheit.
4. Change in labeling requirements of milk bottles.
5. Requiring persons operating a pasteurizer to obtain a license to do so.

Following introduction of our bills by which the Association is placed on record, little more is done to secure their passage except for the chairman to appear at a legislative committee hearing on any of the said bills.

Probably one of the most helpful and constructive measures sponsored by the California Association, and now for some time a part of the State law, is that which governs minimum construction standards and arrangements for future dairies.

Prior to adoption of this measure, State regulations merely required that

dairy buildings used for production of market milk should meet approval of the local milk inspection department. A few health departments had specific building requirements included in their milk ordinance, but these varied greatly in different localities. Some milk inspectors offered practical suggestions in the erection of new dairy structures. A few took the time and trouble to prepare pencil sketches, but in most cases the dairymen went ahead with construction without either plans or specifications only to find that upon completion or occupation of the dairy he was informed by some inspector that the arrangements were all wrong. Many minor, but all important, details had been overlooked; dimensions were out of balance, efficient operation retarded, sanitary maintenance difficult, and depreciation was rapid, because of faulty construction. Yet, in many cases, more money had been spent than would have been required for a first class job had proper plans and specifications been available to the owner for submission to the builder. Furthermore, the dairyman was often refused a permit for the sale of his products within the jurisdiction of another department on the ground that his buildings did not meet said department requirements.

On suggestion of our Association, the Division of Agricultural Engineering of the University of California made a survey of dairy structures throughout the State for the purpose of preparing up-to-date plans and specifications for future sanitary dairy structures. Following a number of meetings with interested parties in various sections of the State, the engineers completed a series of plans and specifications flexible enough to be adoptable to our many different localities in California.

Following unanimous approval of said plans and specifications by our Association, the law was enacted which now makes it mandatory that building requirements, plans, and specifications, adopted by the Director shall be minimum and approved standards for all market milk dairies operating in the same geographical area of the State. The results have been most gratifying, and one serious obstacle to uniform procedure practically eliminated.

Now, the personal attitude and policy we employ in the interpretation and enforcement of our laws is equally if not more important in the results we obtain than is the law itself. There is no substitute for a good, sound policy, based on understanding, courtesy, frankness, common sense, and the faculty of making friends without swerving from duty. But, laws we must have, not only for efficient and effective supervision of dairies and milk supplies, but also from the standpoint of fostering respect for regulatory measures on the part of the industry, and confidence in their protective features on the part of the consuming public.

For 50 years we have pioneered and explored the field of milk sanitation. The course ahead will follow a higher plane from whence there will be a broader perspective. As we advance, the call for more uniformity of standards and regulatory measures will become louder. As a result, states and communities throughout the Nation will find it necessary to revise and streamline their milk laws to meet modern conditions and follow the trend of time. In this task the milk sanitarian, through his association—international, state and district—has a major responsibility and opportunity for service. We can never hope for, nor should we expect, one hundred per cent uniformity. We can, and should, however, strive for a much higher degree of uniformity than that which exists at the present time, not only within states, but also between states.

Thermophilic and Thermoduric Organisms in Milk

LEON P. EISMAN, ENSIGN H-V(S) USNR

Director of Laboratories, St. Louis County Health Department
Clayton, Missouri

As we are all aware there are many ways in which bacteria may be classified but as the title of this paper indicates, we are only interested here in their classification by temperature—which consists of three groups: (1) the psychrophilic bacteria which grow at an optimum temperature of 15–20° C. and have a range from 0° C. to 30° C.; (2) the mesophilic bacteria which have an optimum of 37° C. and a range from 15° C. to 43° C.; and (3) the thermophilic bacteria which have an optimum of 55° C. and range from 25° C. to 70 or even as high as 80° C.

To establish clearly in our minds what we are to discuss, it is important to have a definition of the organisms under consideration. As just explained, the thermophilic organisms are those which grow best at very high temperatures; while the thermoduric organisms are those organisms, while not strictly thermophilic because of their inability to grow at high temperatures, nevertheless survive prolonged exposures to heat as experienced during pasteurization.

Now since both the thermophilic and thermoduric organisms are so classified or named because of their ability to resist heat, it would be advantageous to review briefly the habitat as well as the physiology of bacteria. The psychrophilic bacteria are mainly found in water; the mesophiles embrace the pathogenic bacteria of warmblooded animals; and the thermophiles are mainly soil bacteria and are almost exclusively of the spore-bearing variety. You may raise here, and justly so, the question of pathogenicity of the spore-formers. The family Bacillaceae is divided into two groups: the aerobic spore-bearing Bacilli and the anaerobic spore-bearing Clostridia. This latter group include tetani, welchii, etc., which are truly pathogenic but their distribution is limited to soil and away from the air; while the former division is widely distributed being found in the air, soil, water, milk, wool, feces, etc., but this large group of various species is practically devoid of any pathogenicity.

All bacteria have varying resistance to changes brought about by their exposure to sun-light, chemical agents, electrical currents, cold and heat. It is these latter two elements, and especially the last, which plays the most important role in the life and death cycle of bacteria. Temperatures below 0° C. are only slightly injurious to microörganisms, and different species are affected with varying rapidity. Experiments have demonstrated many bacteria can survive freezing for various lengths of time. For example when typhoid organisms are frozen, approximately 50–70 percent of them are destroyed immediately but 10 percent are still living at the end of a week, 1 percent still survive at the end of four weeks and it is not until after a period of six months that they are all destroyed. Accordingly more resistant bacteria live longer, and spores, such as those produced by the thermophiles, may survive ice for years. Other workers have subjected bacteria to temperatures as low as –175° C. by immersing them in liquid air, and were able to grow these organisms again

Presented at Annual Milk Control Short Course, University of Missouri, April 10, 1941.

after placing them in a favorable medium. By this experiment approximately 10 percent of a culture of typhoid organisms were alive after 30 minutes exposure and spores were scarcely affected at all.

On the other hand excessive temperatures have an entirely different effect. If the maximum temperature is exceeded the organisms die and that point at which the bacterium dies is termed its thermal death point. It is this principle which acts as the basis of the theory of pasteurization. Since the thermal death point of the psychrophiles is 37° C., the mesophiles 45–55° C., and the thermophiles is 75° C., we can understand how pasteurization properly conducted will render milk safe and effect a reduction in bacteria as high as 97–99 percent of the original. Therefore, it would be safe to assume that the bacteria surviving pasteurization are either thermophilic or thermoduric bacteria, and are especially bothersome and of great economic significance in the dairy industry. During the long run of pasteurization (142° F. for 30 min.) the thermophiles may grow at a tremendous rate because they are held near their optimum temperatures, and the by-products of their metabolism may injure the quality of the milk while these same organisms when incubated at 37° C. fail to grow rapidly but grow in pin-point colonies.

Then why not employ flash pasteurization (160° F. for 15 sec.) for the simple reason that exposure of bacteria for short times at a high temperature is equivalent to longer periods at lower temperatures? The ferments and other labile food constituents are not altered as much as at the high temperature. Therefore, it is best to choose the lowest temperature which will kill non-spore-bearing pathogens in a practical length of time, because insofar as is known the thermophilic organisms cannot produce disease nor do their products cause frequent illnesses.

Now bearing in mind the fact that the equilibrium and number of the different types of bacterial flora of milk depend upon the initial contamination, the age of the milk, and especially the temperature at which it is kept, the location of high counts in a mixed milk supply presents many problems. Almost invariably it leads us back to the farm which is the natural place for these organisms to gain their entrance into the milk. Here feed, bedding, and soil exist as a continual reservoir of the thermophilic bacteria. If great care is not taken, they can easily find their way into the milk. Therefore, it is not strange that the problem of thermophiles is greater in the winter than in the summer for the farmer often relies upon the cold of the winter air to cool his milk rather than cooling it in the approved manner. Then too, during the winter the cows are usually housed, and their coats become dirtier than in the summer.

When inspecting a farm for thermoduric organisms, it is most necessary to take careful note of any piece of equipment and especially rubber tubes of milking machines which may have dried milk solids adhering to them. This condition is always a good indication that one source of contamination has been located. Proper sterilization of equipment is the second commandment of clean milk production. When organisms have multiplied on improperly sterilized utensils they may also become a means of contaminating the milk. However, many producers are lured into a feeling of false security of merely using chemical rinsing agents. The time of exposure and strength of solution should be stressed.

Experiments carried out at the University of Illinois has shown that thermoduric organisms can withstand 75 p.p.m. of chlorine for 2 minutes but are destroyed in this length of time by 100 p.p.m. and likewise by only 35 p.p.m. for 5 minutes.

Thus on the one hand the presence of thermoduric organisms is almost certain to be caused by some gross

contamination on the farm while on the other hand thermophilic organisms may originate in raw milk but do not become a problem until some careless condition in the milk plant allows them to increase. The refilling of pasteurizing vats without first having cleaned them out is extremely undesirable, because the foam produced by the pasteurizing of the milk may contain thermophiles which will remain behind to seed the next batch of milk. Likewise the presence of milkstone or any dead ends in the pasteurizing equipment or lines will offer an excellent opportunity for the reproduction of thermophiles. Another source of seeding milk with thermophilic organisms is cans not cleaned and sterilized properly and then allowed to stand in the sun with the lids on tightly.

By this time we have established the fact that thermophilic and thermoduric organisms may easily gain access to milk. This makes it more and more difficult to determine bacterial content. The replacing of nutrient agar by the new TGEM agar as adopted by the Committee on Standards for the Examination of Dairy Products of the American Public Health Association has greatly helped the laboratory worker to secure a more accurate bacterial content of milk since it enhances the growth of many organisms which could not grow on the old agar and makes other colonies more easily countable. (*E.g.,* two cultures of *S. scarletina* developed colonies on the new medium which were easily distinguishable by aid of the Quebec counter while no visible colonies were observed on the old medium using 30x magnification. Seven cultures of animal pyogenes streptococci grew on the new medium forming colonies which were easily countable using Quebec counter while no growth was observed in old medium. With 53 *S. **mastiditis*** cultures all developed easily countable colonies on new medium while using old 5 developed colonies recognizable with the Quebec counter, 20 gave colonies requiring 10x magnification, 10 needed 30x magnification and 18 did not develop at all.—F. E. Nelson of the Kansas Agriculture Experiment Station.)

Since milk receives its grading on its bacterial content this is ascertained by the number of bacteria in 1 c.c. of milk estimated from colonies developing in standard milk agar plates at 37° C. for 48 hours. This time interval is most undesirable, for by the time the plates are counted the milk has already gone to market and there is no calling it back if thermoduric organisms happen to be present. Then, too, Standard Methods states, "When there is reason to suspect the presence of bacteria that do not develop at 37° C. prepare additional plates. Incubate at 45° C. for 24 hours if the presence of high temperature (thermophilic) bacteria is suspected." This seems like a stupid statement for how are we to know whether thermophilic bacteria are present or not?

For this purpose we have what is called the direct microscopic count which consists of spreading 0.01 ml. of milk over an area 1 sq. cm. on a slide, removing the fat, and staining and examining. Here again Standard Methods states, "The routine preparation and immediate examination of microscopic preparations from samples of bottled raw and pasteurized milk accomplishes two purposes. If large numbers of stainable bacteria are found, remedial measures should be started at once without waiting 48 hours for the standard plate counts. This procedure also furnished the most convenient method of detecting thermophilic and other fastidious types of bacteria the presence of which may not be indicated by colonies on agar plates. While this latter method seems ideal, its disadvantages almost offset its advantages which can be listed as follows:

Advantages:

1. Results are quickly available,
2. Less work required,

3. Less apparatus required, therefore less expensive,
4. Remains as a permanent record,
5. Actual number of bacteria and type and proportion noticeable.

Disadvantages:

1. Very small quantity of milk used,
2. Some of dead bacteria as well as live ones counted after fixing,
3. Expert technician due to personal error:

A. Individual bact.	164,000
clump count	65,000
B. Individual bact.	29,000
clump	8,000
C. Individual bact.	133,000
clump	38,000

Therefore, it only stands to reason that the two methods of counting should always be used to supplement each other.

Recently, Professor W. L. Mallmann of Michigan State College has devised a test for detecting thermoduric bacteria in milk. The test is based on the fact that when the bacteria are killed they autolyze very rapidly and disappear. By placing milk at pasteurizing temperature for a period of two hours he was able to demonstrate by both bacterial count and microscopic count that all the dead bacteria had disintegrated and disappeared from the microscopic preparation. If examinations were made within an hour he occasionally found some bacteria surviving. If the milk was examined directly after pasteurization many of the dead bacteria were found in the microscopic preparation. However, if he incubated the milk at pasteurizing temperature for two hours the only remaining bacteria in the microscopic field were the viable thermoduric organisms. He reached the conclusion that if excess of 40,000 bacteria were found it was indicative that the dairy equipment on the farm had been improperly cleaned while less than 40,000 indicated the equipment was in fair condition.

There remains but one more point to be considered and that is by far the most important. What is the significance of thermophilic and thermoduric organisms in milk? From the public health standpoint they have none unless where legal requirements limit the maximum number of bacteria in pasteurized milk they would cause the milk greatly to exceed this designated number. However, commercially the presence of excessive numbers of thermophiles may affect the palatability of the milk by causing abnormal flavors and thus decrease the demand for the product. In severe cases it may even cause the milk to sour. In years gone by the most prevalent microbial flavor defect of milk was sourness, but flavors and odors are not produced until millions per c.c. of thermophiles are present. Thermophilic counts of less than 10,000 c.c. in pasteurized milk are certainly not significant because of the fact that a large percentage die during storage at low temperatures for six hours or more.

Thermodures likewise are of little public health significance in pasteurized milk but like the thermophiles their presence is demonstrative of contaminated milk and had this milk been marketed in the raw state it means that at any time it is capable of becoming a vector of disease and the possible source of an epidemic.

A Neglected Phase of Frozen Desserts Sanitation*

F. W. FABIAN

Research Professor of Bacteriology,
Michigan State College, East Lansing, Michigan

THERE are three main sources of microörganisms in frozen desserts, viz., the ingredients, the equipment, and the workers. Under ordinary conditions, the ingredients, especially the milk products, contribute the greatest number of bacteria to the mix. We can divide the ingredients into two groups. Those that are added to the mix prior to pasteurization such as the dairy products, stabilizers, sugar, and eggs, and a second group including fruits, nuts, coloring and flavoring materials, candy, and bread or cake products which are added to the mix subsequent to pasteurization. Considerable attention has been directed to the first group of constituents since they contribute the largest number of bacteria to the mix. Many cities and states have bacterial standards for the dairy products entering the mix and in addition require the mix to be pasteurized. On the whole this phase of frozen desserts sanitation has received more consideration than some of the others.

Work done within the past decade has shown that some of the second group of ingredients—those added to the mix subsequently to pasteurization—may be potential health hazards and should be given more sanitary consideration. As early as 1935, attention was called (5) to the fact that all ingredients entering the mix after pasteurization should be given a germicidal treatment equivalent to pasteurization.

MICROÖRGANISMS FOUND IN UNPASTEURIZED PRODUCTS

A number of investigators (4, 9, 12, 13) have shown coloring material to contain large numbers of bacteria. Counts as high as 198,000,000 were obtained by one investigator (13) while another (4) found that 35 percent of the samples contained members of the coliform group. Brown (1) has shown that two pathogenic organisms, *Staphylococcus aureus* and *Eberthella typhosa,* were capable of surviving for a period of two weeks in three different shades of coloring material.

Flavoring extracts are not as a rule as prolific a source of bacteria as are the coloring materials. Alcohol is used as the solvent in most of them and while it is not a good germicide, yet it does keep down the microflora of the extracts. Prucha (12) found bacterial counts ranging from 30 to 60,000 in thirteen samples examined. There are some exceptions, however. Chocolate (6) may contain large numbers of bacteria and frequently does especially after it has been melted and made into a syrup.

Fruits may add large numbers of microörganisms, especially yeasts and molds, to frozen desserts. Only fresh fruit should be used for freezing, canning or added to the mix since fruit that has been picked several days contains more organisms and may have started to decay. In this case the mold count is high since molds is one of the principal agents of fruit decay.

Prucha (12) in his examination of fruits found maraschino cherries to contain from 0 to 110 molds, from 0 to

---

* Paper given at Dairy Technology Conference, Ohio State University, Columbus, Ohio. Feb. 12, 1942.

1,780,000 bacteria and one sample to contain *E. coli*. Frozen pack strawberries contained no *E. coli*, from 0 to 19,000 molds and from 10 to 67,000 bacteria. Downs (3) examined eleven samples of frozen strawberries, and found three with high yeast and mold counts ranging from 1,350 to 28,000 while the count on the rest ranges from 25 to 205 per gram. Fresh strawberries obtained on the open market contained as many as 839,000 bacteria per gram (14). These examinations are sufficient to indicate that fruits may be a source of contamination. Proper care and prompt handling will greatly reduce the microörganisms in the finished product.

Nut meats may contain many microorganisms especially if the nuts are cracked by hand. Prucha (12) says in this connection,

"Picture a large room, piles of cracked pecans or fruits on the benches, 200 people sorting these materials. These people probably had no medical examination. They are selected as they come. A few may have colds, one may be a typhoid carrier, another a syphilitic carrier, and there may be carriers of other diseases. As a bacteriologist, I would like to have the nut meats that I buy produced and handled under better sanitary control. If that is not possible and practical, then the nut meats should be given a treatment to kill the stray typhoid bacillus that may be hiding in the crevices of the nut meats."

Twenty samples of nut meats collected at different ice cream plants throughout Illinois by Prucha (12) and by Tracy and Brown (14) showed counts as high as a half million bacteria per gram with 50 percent of them giving a positive test for *Escherichia coli*. Weinzirl (15, 16) in his studies on candy investigated the possibility of nuts as a source of contamination in candy and found that 2 percent of the 200 samples collected from wholesalers and 0.5 percent of 400 specimens collected from retailers contained *E. coli*.

More recently Ostrolenk and Hunter (10) in studying the extent of contamination as evidenced by the presence of the coliform group examined 548 samples representing 11 varieties of nut meats from retail markets in Washington, D. C. (200 samples), from domestic shelling plants located in the large producing areas of the United States (234 samples), and 114 samples of nut meats imported from nine different countries. They found that nut meats in the unbroken shell did not contain any members of the coliform group. The samples of nut meats purchased on the retail market contained the coliform group in from 4 to 45 percent of the samples, those from the domestic shelling plants in from 6 to 68 percent of the samples, and the imported nuts in from 14 to 62 percent of the samples. Nut meats contaminated with *E. coli* and stored at room temperature contained viable *E. coli* for approximately 68 days.

Prucha (12) after visiting about 200 ice cream plants and collecting about 600 samples of fruits, flavors, nuts and colors concludes:

1. There is no definite evidence that these materials had infected ice cream with disease bacteria and that such ice cream caused epidemics.
2. The plants where these materials are handled and prepared are not properly controlled by health officers.
3. The storing of these ingredients in the ice cream plants should be inspected and controlled by the health officers and by the ice cream plant superintendents.
4. Potential possibilities for contamination of these ingredients exist. We should not wait until somebody contracts disease by eating ice cream in order to get proof and in order to start in to correct the situation.
5. Much can be done by the ice cream plants themselves, such as:
   (a) Keep the ingredients under proper sanitary conditions.
   (b) Treat the ingredients in some manner to keep them safe.
   (c) Purchase only good products from houses where some effort for sanitation is being made.
   (d) Use good ingredients in the mix, properly pasteurized mix, and efficient safeguards against the contamination of the ice cream so that ice cream can be made the safest food on the market is the goal for 1937.

In view of these facts, the practice of adding unpasteurized products to the pasteurized mix is shown to be an

unsound sanitary procedure and poor economy. All ingredients added to the mix subsequent to pasteurization should receive a treatment equivalent to pasteurization.

TREATMENT EQUIVALENT TO PASTEURIZATION

Tracy and Brown (14) have shown that it is possible to treat the products added after pasteurization in such a manner as to render them safe to add to the pasteurized mix. They found in the case of colors that they could be heated successfully for as many as five times without injury to the quality of the color providing the temperature was held to 145° to 160° F. for 30 minutes. Likewise flavoring materials could be heated for 30 minutes at 145° F. In some cases there was no change in the intensity of the flavor while in others the flavor had faded slightly.

Nut meats were treated in 69 different ways of which 12 were considered more successful than the others. The treatment which gave a very crisp bacteria-free nut meat with no rancid flavor consisted of heating them for 15 seconds in a boiling (216° F.) 50 percent sucrose solution. Heating 15 seconds in a boiling 20 percent salt solution gave the best flavored and crisp nuts but the taste of salt in the ice cream immediately surrounding the nuts was objectionable. The treatment which was finally considered to give the best results consisted of dipping the nut meats for 15 seconds in a boiling solution containing 50 percent sucrose and 1 percent salt. Nut meats so treated would keep best by storing in an open container at room temperature.

Ostrolenk and Welch (11) made a survey of pecan shellers in the Georgia and Texas pecan-producing areas and found that certain insanitary practices existed in the industry. They found that certain inexpensive changes and modifications in handling would eliminate the most flagrant sources of pollution. They suggested a modification of the tempering tank to allow settling of debris, elimination of burlap bags during tempering, and the addition of 1,000 parts per million of chlorine at each tempering. They also recommended the replacing of wooden-top tables with metal-covered tables to eliminate the rancid-oil-soaked wooden top which accumulates pollution and filth which is later transferred to the pecan meats by the operators. Also the wooden-handled picking knives which become encrusted with oily filth should be replaced with a one-piece metal picker to be treated daily with chlorine. All-metal containers should be used and the practice of nesting containers should be abandoned. They demonstrated that with these suggested changes and proper supervision of operations and plant personnel, pecan meats could be produced which would be reasonably free of contamination.

Fruits may be prepared for use in frozen desserts in two different ways. They may be preserved by canning or by freezing. The latter method has been used very extensively during the past decade due to the development of the frozen food industry. Frozen fruits are superior in flavor and if properly packed are practically sterile. Fruits to be frozen should be fresh and of the best quality. They should then be thoroughly washed and packed in sugar in the ratio of 3 to 1 or 2 to 1 of fruit to sugar after which they should be pre-cooled to 0° F. and subsequently held at 15 to 20° F. Frozen fruits are usually packed in 50 gallon barrels, 5 gallon containers, 30 pound tins, and 1 pound containers.

The greatest trouble in using frozen fruits in the frozen desserts industry has come in connection with the thawing of the fruit preparatory to using it. When the fruit is frozen in barrels, it requires several days to thaw out the barrel so that the fruit can be used. After it has been thawed, it should be refrozen, unless all the contents have been used. Under conditions prevailing in the average plant this use would take several days. Consequently what

frequently happens is that after the fruit is once thawed, it is not refrozen but is allowed to remain at room temperature until fermentation takes place or is placed in a cool room at temperatures from 32° to 50° F. It has been shown by several investigators (3, 8) that microörganisms grow slowly in fruits held at 32° F. and rapidly at 50° F. High yeast counts in frozen fruits may be indicative of improper handling after packing while high mold counts indicate inferior fruit at packing time. Bacterial analysis either by plating or direct microscopic examination of the fruits should be made to determine the quality of the fruits being used in frozen desserts. Doubtless some day we shall have yeast and mold standards for frozen fruits the same as we now have for tomato products.

THE COST OF EPIDEMICS

Next to milk, frozen desserts is the next most important cause of epidemics. During the five year period from 1934 to 1938, there were 10 outbreaks of disease involving 252 cases traced to ice cream, or an average of two epidemics per year according to Fuchs (7). They included two of typhoid fever, one of septic sore throat, four of gastroenteritis, and three of food poisoning.

We have not yet reached the point in dairy sanitation where if an epidemic of disease is traced to a certain dairy plant that plant can be held liable for all damages caused by their product. However, let us see just what such an epidemic might cost. In 1928 the city of Olean, N. Y., had a typhoid epidemic (2) caused by a contaminated water supply involving 248 cases with 25 deaths. The State Legislature authorized the City of Olean to issue 25 year bonds to the amount of $425,000 to pay the cost of the care of the cases and to settle claims. In addition, the direct loss to Olean business was conservatively estimated to have been $200,000. If a city can be held liable for damages for epidemics caused through carelessness or by accident, then it is not a very great step to holding dairies responsible for disease epidemics caused by their products when it can be shown without a doubt that such is the case.

SANITATION PAYS GOOD DIVIDENDS

In conclusion, experience shows that sanitation pays good dividends. Many of those connected with the dairy industry such as producers, manufacturers, and milk control officials, do not appreciate the fact that practically every operation is or should be done with two things in mind: first, sanitation, and second, economy. For example milk pails, cans, utensils, and equipment should be washed clean and sterilized. If this is done, they will not be a source of bacteria and they will last much longer. Furthermore, the product will not spoil as quickly and will have a much better flavor.

In the case of other dairy equipment such as coolers, pasteurizers, and evaporators, if they are not properly cleaned, milk stone will collect on them. Milk stone is not only a source of bacteria but it also reduces the conducting or heat-transferring properties of the metal so that more refrigeration or heat, as the case may be, is required to cool or heat the milk or ice cream mix.

REFERENCES

1. Brown, W. H. This Matter of Mix. *Ice Cream Field,* 31, (3), 9–14; (4), 27–29 (1937).
2. Dean, A. S. The Olean City Epidemic of Typhoid Fever in 1928. *Am. J. Pub. Health,* 21, 390–402 (1931).
3. Downs, P. A. Control of Yeast and Mold Content in Making Strawberry Ice Cream. *Ice Cream Trade J.,* 26, 61–63, Oct. (1930).
4. Fabian, F. W. Bacteria Added to Ice Cream in Flavors and Colors. *Ice Cream Field,* 16, No. 6, 16 (1930).
5. Fabian, F. W. The New Era in Ice Cream Sanitation. *Ice Cream Trade J.,* 31, 17–18 (1935).
6. Fabian, F. W. Sanitary Factors at the Fountain Other Than Ice Cream. Proc. 37th An'l Conv. Int'l Ass'n. Ice Cream Mfrs., 2, 1–10 (1937).
7. Fuchs, A. W. The Frozen Desserts Code Recommended by the Public Health

Service. *J. Milk Technol.*, 4, 26–31 (1941).
8. Mudge, C. S., and Tucker, L. O. The Cold Pack Method of Preserving Strawberries. *Ice Cream Field*, 25, 40–41, 54, 56, July (1931).
9. Newman, R. W., and Reynolds, A. F. Bacterial Flora of Some Ice Cream Ingredients. Cal. Agr. Exp. Station Monthly Bul. 19, 677–680 (1930).
10. Ostrolenk, M., and Hunter, A. C. Bacteria of the Colon-Aerogenes Group on Nut Meats. *Food Research*, 4, 453–460 (1939).
11. Ostrolenk, M., and Welch, H. Incidence and Significance of the Colon-Aerogenes Group on Pecan Nut Meats. *Ibid.*, 6, 117–125 (1941).
12. Prucha, M. J. The Relation of Fruits, Flavors, Nuts, and Colors to the Sanitary Production of Ice Cream. (a) Importance of Problem from Public Health Point of View. Proc. of 36th Annual Conv. Int'l Ass'n Ice Cream Mfrs., 2, 40–46 (1936).
13. Smallfield, H. A. Bacterial Contamination of Ice Cream from Color Solutions. *Ice Cream Review*, 16, 42–43 April (1933).
14. Tracy, P. H. and Brown, W. H. A Study of the Methods Used to Improve the Sanitary Quality of Nut Meats, Flavoring and Coloring Used in Ice Cream. Proc. of 36th Annual Conv. Int'l Ass'n of Ice Cream Mfrs., 2, 52–67 (1936).
15. Weinzirl, J. Occurrence of the Colon Group on Commercial Candies. *Am. J. Pub. Health*, 17, 708–711 (1927).
16. ——— Nuts as a Possible Source of *Escherichia Coli* found in Candy. *Am. J. Hyg.*, 10, 265–268 (1929).

Methylene Blue (Reductase) Test to be Studied for Standard Methods Revision

THE American Public Health Association has appointed a committee to study the effects of specific requirements of technique in the use of the methylene blue reductase test as a quality control procedure. These data are necessary as a basis for revision of this technique for incorporation in the ninth edition of *Standard Methods for the Examination of Dairy Products*. The committee will need the data from tests and also information from the literature. Volunteers are solicited to help in this study. They are requested to communicate with the chairman, Mr. C. A. Abele, Board of Health, 54 West Hubbard Street, Chicago, Illinois.

As the initial steps in a general study of the effects of specific requirements in Standard Methods procedure, the following have been selected as a point of departure:

1. *The capacity of the sample dipper.* The test is conducted upon 10 ml. of milk. In practice this is drawn from bulk with a long-handled dipper of stainless steel or tinned copper. Commercially distributed dippers vary in capacity from slightly over 8 ml. to more than 11 ml. Furthermore, the quantity of milk delivered by an accurate dipper varies—always under 10 ml., of course—with the angle at which the handle is held when it is withdrawn from the bulk sampled, and with the care with which it is poured into the tube.

What degree of tolerance in dipper capacity, or in quantity of milk tested—plus and minus—may be permitted without appreciable effect upon the reduction time?

2. *The period of storage in ice water.* It is prescribed that samples shall be stored—between the time of taking and addition of the dye—in ice water, *but not longer than two hours*, the claim being made that lengthy storage clumps the organisms, thus tending to retard the rate of reduction during incubation. This test is conducted at stations at which hundreds of supplies are received through long periods of the day—six to eight hours or more—and the samples are taken and the tests conducted by the same indi-

vidual. Consequently, it is not practical to break the sample-taking procedure at the end of each two-hour interval, in order to set up the tests.

Does long storage at low temperature retard the rate of reduction to a significant degree? If so, what is the maximum limit of storage at the various ranges of storage temperature from 32° to 50° F.?

3. *Closure of the tubes with individual stoppers.* This requirement introduces into the procedure a handicap and a nuisance. Rubber stoppers—the most satisfactory type of individual closures—will become increasingly expensive and unobtainable. Cleaning and bactericidal treatment—such as is prescribed—is time-consuming and hard on the stoppers, and is practically nullified by the subsequent manual contact involved in insertion in the tubes. Stoppers are frequently dropped, and are also often blown from the tubes by the air expanded during incubation.

Are the results altered by the omission of individual tube closures? If other means of protecting the contents of the tubes from contamination, and of preventing spilling during mixing, are available, should not their use—in lieu of stoppers—be permitted?

4. *Number of inversions of the tubes.* The declared object of inversion of the tubes, prescribed at a definite point in the procedure, is to disperse the fat content so that creaming starts simultaneously in all the tubes.

Can this result be as well obtained by rapid shaking so that inversion and the use of individual stoppers can be dispensed with? If inversion at the beginning of the incubation period must be included, is further thorough mixing of the tube contents at the hourly reading intervals an aid to sharper results? Will mixing at regular intervals, and at the last reading, result in a more definite end-point, so that the determination or decision as to whether the decolorization amounts to 80 percent may be avoided?

5. *Water bath temperature variations.* Not all baths in which sample tubes are incubated are provided with thermostats for controlling the temperature. Some baths are heated by admitting steam; others are heated over an open flame or hot plate; some by a submerged light globe or thermal unit; and still others consist of a thermos jar in which it is attempted to hold the temperature at 37°C. as long as possible without reheating or adding hot water. This latter method results in cyclic temperature variations, relatively uniform for each jar and number of test tubes incubated, and temperature fluctuations of greater or less degree are characteristic of all the baths above described.

How far above or below 37°C., and for what period, may the temperature range without measurably affecting the result?

6. *Total solid content of the milk.* Most of the studies of the methylene blue reduction test have been conducted with low-fat-low-solids milk. The test is being applied to milks of all types, including high-fat-high-solids milks.

Are the reduction time-bacterial content relationships now accepted applicable to all milks, irrespective of their total solid content? (This question is now being studied.)

7. *Sequence of the qualities of the milk in the weigh-can from which the samples are drawn.* It is very time-consuming to draw samples from a representative number of the cans of each producer, so as to make a composite from which to take a 10 ml. sample. Unless a composite is made of such can samples, the morning milk of one patron and the night milk of another may be tested on the same day and compared, resulting in misleading deductions. The taking of all samples from the weigh-can may introduce legal hair-splitting, because, after dumping, the milk is the property of the receiver—it can rarely or never be returned to the producer.

Is the reduction time of a sample of known good milk, taken from the weigh-can, measurably affected by the fact that the milk just previously passing through the weigh-can was of poor quality—that is, reduced in a short time?

Data on these questions—and possibly on others—should be available to this sub-committee for study before it can advocate or oppose the modification of the methylene-blue test procedure in the Eighth Edition of Standard Methods.

SANITATION AND BACTERIOLOGY OF PUBLIC EATING UTENSILS

Murray P. Horwood and P. J. Pesare. *Public Health Reports, (Abstract)* 57, 33–44 (1942).

The paper is a report on a thorough sanitary survey of 55 public eating and drinking establishments in Providence, Rhode Island, coupled with a bacteriological examination of the dishes and eating utensils used in these places. There were 18 restaurants, 8 soda fountain establishments, 10 cafés, and 19 barrooms. The places were widely distributed and are considered representative of the entire community.

Ignorance of accepted sanitary requirements and procedures was generally manifest both by managers and employees. It would seem that the public health engineering profession is not utilizing education adequately as a tool to improve sanitary conditions and practices.

Health cards for food handlers have deteriorated into a mere formality and have no practical public health significance. Among the sanitary defects that occurred frequently were lack of environmental cleanliness, inadequate and ineffective screening of doors and windows, the presence of flies, unclean, poorly lighted and inadequately ventilated toilets often in poor repair, the lack of posted instructions concerning hand hygiene, especially after using the toilet, and unsatisfactory storage of food.

There was no correlation between high temperature of rinse water and low bacterial counts of eating utensils, since a temperature of 170° F. or more is only one of the many factors which influence the bacterial counts. Other important factors include the length of time the utensils are exposed to the hot water, the composition and amount of detergent, the thoroughness and preliminary washing and removal of the soil, the method of drying the washed utensils, the method of handling and storing wash utensils and their protection against dust, dirt, insects, rodents, human contamination.

In general, the temperatures of the wash waters and rinse waters were too low to insure effective disinfection, and the period of exposure to the germicidal action of hot water or of chemical disinfectants was too short.

The total count is regarded as a satisfactory index of the sanitary efficiency of the methods employed in washing, disinfecting, handling, and storing eating and drinking utensils. There was no correlation between high total counts and the presence of specific pathogenic bacteria.

Concerning specific types of bacteria, this study showed that *E. coli* may be carried on eating and drinking utensils; that *A. aerogenes* may be isolated frequently; that few, if any, organisms associated with Vincent's angina survive the normal dishwashing procedures when the infection is not epidemic; that hemolytic streptococci and staphylococci can be readily recovered; that the diphtheria bacillus was not isolated; that although acid fast bacteria can be isolated, none could be identified as *Mycobacterium tuberculosis;* and that *B. subtilis* and *Staphylococcus albus* were found to be the most frequent bacterial contaminants.

Ninety percent of the bartenders do not employ heat treatment for disinfecting beverage glasses. Most of them use a "magic" soap powder of unknown chemical composition which is allowed to act only for 6 to 12 seconds. The bacterial counts on beer glasses were particularly high. Chlorine compounds can be used effectively for disinfecting purposes if properly employed and carefully supervised.

M.P.H.

FREE LITERATURE

Milk House Construction, Arrangement and Maintenance

U. S. Dept. Agr. Farmers Bul. 1214. Farm Dairy Houses. 1932.
Cal. Agr. Expt. Sta. Circ. 286. Milk Houses for California Dairies, Davis. 1925.
Cornell Extension Bul. 200. Plan for a Simple Milk House, Ithaca. 1930.
Cornell Extension Bul. 330. Milk House Construction, Ithaca. 1939.
Ill. Agr. Expt. Sta. Circ. 371. A Plan for the Milk House, Urbana. 1931.
Kansas Extension Bul. 74. Milk Houses for Kansas, Manhattan. 1934.
Michigan Extension Bul. 206. The Farm Milk House, E. Lansing. 1940.
Wisconsin Agr. Extension Circ. 312. Milk Houses for Wisconsin, Madison. 1940.
Cherry-Burrell Corporation, Bul. G 375, 427 W. Randolph St., Chicago, Ill. Practical Plans for Modern Dairies. 1940.
Creamery Package Manufacturing Co., 1243 W. Wash. Blvd., Chicago, Ill. Milk House Plans.
U. S. D. A. Farmers Bul. 734. Flytraps and Their Operation. 1928.
U. S. D. A. Farmers Bul. 1097. The Stable Fly. 1927.
U. S. D. A. Farmers Bul. 1408. The House Fly and How to Suppress It. 1926.
U. S. D. A. Farmers Bul. 1452. Painting on the Farm. 1925.
U. S. D. A. Farmers Bul. 1638. Rat Proofing Buildings and Premises. 1930.
Portland Cement Association, 33 W. Grand Ave., Chicago, Ill., or Seaboard Bldg., Seattle, Wash. Dairy Farm Improvement of Concrete. How to Build Sanitary Milk House, Insulated Cooling Tanks. Plans for Concrete Farm Buildings. Milk House Plans No. C 2141 (1 room), No. C 2142 (2 rooms), No. C 2143 (3 rooms), No. C 2144 (4 rooms). Concrete Floor Finishes.
Louden Machinery Co., Fairfield, Iowa. Catalog C 10 on Ventilation.
De Laval Pacific Co., 61 Beale St., San Francisco, Calif. De Laval Magnetic Combine Milking Systems.
National Lime Association, Washington, D. C. Bul. 304-D, Whitewash and Cold Water Paints.
Babson Bros. Co., 2843 W. 19th St., Chicago, Ill. Dead Flies.
Fumeral Company, Racine, Wis. Fumeral Instant Diffuser.

General Sanitary Milk Production

U. S. D. A. Leaflet No. 3. Improved Sanitation in Milk Prod. 1927.
U. S. D. A. Leaflet No. 25. Preventing Feed Flavors and Odors in Milk. 1928.
U. S. D. A. Farmers Bul. 602. Production of Clean Milk. 1932.
Wash. Agr. Extension Bul. 192. Production of High Quality Milk and Cream, Pullman. 1934.
Oregon Agr. Extension Bul. 489. The Production of Milk and Cream of High Quality, Corvallis. 1936.
Idaho Agr. Extension Circ. 66. Essentials of Producing Good Milk and Cream, Moscow. 1940.
Nebraska Agr. Extension Circ. 625. How to Produce Better Milk and Cream, Lincoln. 1931.
So. Dakota Agr. Expt. Sta. Circ. 22. Production of Quality Milk and Cream on the Farm, Brookings. 1935.
W. Virginia State Dept. of Health. Clean Milking Methods Produce Clean Milk, Charleston.

International Harvester Co., 180 N. Michigan Ave., Chicago, Ill. Producing Clean Milk.
U. S. Public Health Bul. 220, U. S. Public Health Service. Milk Ordinance and Code. Price 35 cents. Washington, D. C. 1939.

STERILIZATION OF DAIRY FARM EQUIPMENT

U. S. D. A. Farmers Bul. 1315. Cleaning Milking Machines. 1939.
U. S. D. A. Farmers Bul. 1473. Washing and Sterilizing Farm Milk Utensils. 1926.
U. S. D. A. Farmers Bul. 1675. Care of Utensils on the Farm. 1931.
U. S. D. A. Tech. Bul. 756. The Corrosive Effect of Chlorine and Lye Solutions on Metals Used in Dairy Equipment. 1941.
Wash. Agr. Extension Bul. 234. Chemical Sterilization of Dairy Utensils, Pullman. 1937.
Wash. Agr. Extension Bul. 245. Disinfectants on the Farm, Pullman. 1938.
Idaho Agr. Expt. Sta. Bul. 183. Sterilizing Dairy Utensils on the Farm, Moscow. 1931.
Cal. Agr. Expt. Sta. Bul. 468. Sterilization of Dairy Utensils with Humidified Hot Air, Davis. 1929.
Cal. Agr. Extension Circ. 69. Sanitary Care, Operation, and Installation of Milking Machines, Davis. 1932.
Ind. Agr. Expt. Sta. Bul. 348. A Study of Methods for Cleaning Milking Machines, LaFayette. 1931.
Ind. Agr. Expt. Sta. Bul. 447. Experiments with Electric Water Heaters for Dairy Farms, LaFayette. 1939.
Ind. Agr. Expt. Sta. Bul. 449. Bacteriological Studies on the Cleaning of Milking Machines, LaFayette. 1940.
Kansas Agr. Expt. Sta. Circ. 160. The Preparation, Testing and Use of Chlorine Disinfectants, Manhattan. 1931.
Ill. Agr. Expt. Sta. Circ. 332. Chemical Sterilization of Dairy Utensils, Urbana. 1929.
Kansas Agr. Expt. Sta. Circ. 176. Cleaning and Sterilizing Dairy Farm Utensils, Manhattan. 1935.
Iowa Engineering Expt. Sta. Bul. 132. Germicidal Properties of Chlorine Compounds, Ames. 1937.
New York State Agr. Expt. Sta. Bul. 612. Sterilization of Dairy Farm Utensils with Dry Heat, Geneva. 1932.
Pa. Agr. Expt. Sta. Bul. 296. Electrically Heated Dairy Utensil Sterilizers, State College. 1933.
Vermont Agr. Expt. Sta. Bul. 369. The Use of Chlorine Products as Germicides on Dairy Farms, Burlington. 1934.
De Laval Pacific Co., 61 Beale St., San Francisco, Calif. Combined Water Heaters and Dairy Sterilizers. Methods of Cleaning and Sterilizing Milkers.
Pacific Power & Light Co. Electro Steam Boiler Dairy Sterilizer.
Babson Bros. Co., 2843 W. 19th St., Chicago, Ill. The Magic of Hot Water.
Cherry-Burrell Corporation, 427 W. Randolph St., Chicago, Ill.
Creamery Package Mfg. Co., 1243 W. Wash. Blvd., Chicago, Ill.
Despatch Oven Co., Minneapolis, Minn.
Esco Cabinet Co., West Chester, Pa.
Evers Mfg. Co., Spokane, Wash.
Oakes & Burger Co., Cattaraugus, N. Y.
Strauss Electric Appliance Co., Waukesha, Wis.
Victor Products Corporation, Hagerstown, Md.

STERILIZING MATERIALS

Diversey Corporation, 53 W. Jackson Blvd., Chicago, Ill.
J. B. Ford Sales Co., Wyandotte, Mich.
General Laboratories, Inc., Philadelphia, Pa.
J. I. Holcomb Mfg. Co., Indianapolis, Ind.
Mallinckrodt Chemical Works, St. Louis, Mo.
Mathieson Alkali Works, Inc., 60 E. 42nd St., New York, N. Y.
Oakite Products, Inc., 22 Thames St., New York, N. Y.
Preservaline Mfg. Co., Brooklyn, N. Y.
Solvay Sales Corp., 40 Rector St., New York, N. Y.
Turco Products, Inc., Los Angeles, Calif.
Wallace and Tiernan Co., Newark, N. J.

COOLING MILK ON THE FARM

U. S. D. A. Farmers Bul. 976. Cooling Milk and Cream on the Farm. 1932.
U. S. D. A. Farmers Bul. 1078. Harvesting and Storing Ice on the Farm. 1922.
U. S. D. A. Farmers Bul. 1818. Mechanical Milk Cooling on Farms. 1938.
U. S. D. A. Circ. 155. The Ice Well for the Dairy Farm. 1931.
U. S. D. A. Circ. 336. Cooling Milk on the Farm with Small Mechanical Outfits. 1934.
Wash. Extension Bul. 241. Home Freezing Unit, Pullman. 1938.
Wash. Extension Bul. 249. The Farm Freezing Plant and How to Use It, Pullman. 1939.
Wash. Extension Bul. 257. Building the Farm Freezing Plant, Pullman. 1940.
Ore. Agr. Expt. Sta. Bul. 268. Mechanical Refrigeration of Milk in a Tank Type Refrigerator, Corvallis. 1930.
Ore. Agr. Expt. Sta. Bul. 331. Comparative Efficiency of Farm Milk Coolers, Corvallis. 1934.
Ala. Agr. Expt. Sta. Bul. 241. Dairy Refrigeration on Rural Electric Lines, Auburn. 1934.
Cal. Agr. Expt. Sta. Bul. 495. Milk Cooling on California Dairy Farms, Davis. 1930.
Conn. Agr. Extension Bul. 205. How to Build an Insulated Milk Cooling Tank, Storrs. 1934.
Kansas Agr. Expt. Sta. Bul. 180. The Evaporation and Spray Systems of Cooling Cream, Manhattan. 1936.
Kansas Agr. Expt. Sta. Bul. 295. Milk Cooling on Kansas Farms. 1941.
Neb. Agr. Expt. Sta. Bul. 266. Cooling Milk on Nebraska Farms, Lincoln. 1932.
Neb. Agr. Expt. Sta. Circ. 65. Cooling, Storage and Transportation of Milk and Cream, Lincoln. 1940.
N. H. Agr. Expt. Sta. Bul. 233. Electric Dairy Cold Storage, Durham. 1928.
N. Y. Agr. Expt. Sta. Bul. 581. Electric Cooling of Milk on the Farm, Geneva. 1930.
Pa. Agr. Expt. Sta. Bul. 375. Electric Milk Refrigeration at the Farm, State College. 1939.
Vermont Agr. Expt. Sta. Bul. 300. The Production of High Quality Milk. I. Cooling—The Electric Brine Cooler With Cold-Air Storage Versus Ice and Water, Burlington. 1929.
Vermont Agr. Expt. Sta. Bul. 313. The Production of High Quality Milk. II. The Influence of Delayed Cooling Upon the Quality of Milk, Burlington. 1930.

Vermont Agr. Expt. Sta. Bul. 326. III—Electric Cooling Versus Ice Cooling, Burlington. 1931.
Vermont Agr. Expt. Sta. Bul. 377. Influence of Temperature on Bacterial Growth in Pure Culture and in Mixed Flora of Milk, Burlington. 1934.
Babson Bros. Co., 2843 W. 19th St., Chicago, Ill.
Baker Ice Machine Co., Omaha, Nebraska.
Borg-Warner Corp., Detroit, Michigan.
Cherry-Burrell Corp., 427 W. Randolph St., Chicago, Ill.
Brunswick-Kroeschell Co., New Brunswick, N. J.
Creamery Package Mfg. Co., 1243 W. Wash. Blvd., Chicago, Ill.
Esco Cabinet Co., West Chester, Pa.
Dryice Appliances, Inc., Mt. Vernon, Ill.
Frick Company, Waynesboro, Pa.
Frigidaire Corp., Dayton, Ohio.
General Electric Co., Cleveland, Ohio.
General Refrigeration Sales Co., Beloit, Wis.
Haven Mfg. Co., Milwaukee, Wis.
In-A-Can-Cooler Co., 118 Monticello St., Winamac, Ind.
International Harvester Co., 180 N. Michigan Ave., Chicago, Ill.
Jacobi-Ness Sales Co., Fergus Falls, Minn.
Jensen Machinery Co., Bloomfield, N. J.
Kelvinator Sales Corp., 14250 Plymouth Road, Detroit, Mich.
Losee Products Co., Hebron, Ill.
Milcare Corporation, Fergus Falls, Minn.
Milk Cooling Equipment Co., Leonard Bldg., Grand Rapids, Mich.
Oakes & Burger Co., Cattaraugus, N. Y.
Parker Ice Machine Co., San Barnardino, Calif.
Perfection Stove Co., Refrigerator Division, Cleveland, Ohio.
Servel Sales, Inc., Evansville, Ind.
Superior Metal Products Co., 311 Chestnut St., St. Paul, Minn.
Universal Cooler Corp., 18th and Howard Sts., Detroit, Mich.
Victor Products Corporation, Hagerstown, Md.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wilson Cabinet Corp., Smyrna, Del.
Wilson Mfg. Co., Knightstown, Ind.
York Ice Machinery Corp., York, Pa.
De Laval Pacific Co., 61 Beale St., San Francisco, Calif.
Dole Refrigerating Co., 5910 N. Pulaski Road, Chicago, Ill.

Floor Materials

American Fluresit Co., Cincinnati, Ohio.
Armstrong Cork Products Co., Lancaster, Pa.
Ceresit Waterproofing Co., Chicago, Ill.
Concrete Materials Corp., Chicago, Ill.
Drehmann Paving & Construction Co., Philadelphia, Pa.
Flexrock Company, Philadelphia, Pa.
Johns-Manville, 22 E. 40th St., New York, N. Y.
Master Builders Co., Cleveland, Ohio.
Mosarc Tile Co., Zanesville, Ohio.
Mundet Cork Corporation, Brooklyn, N. Y.
National Fireproofing Corp., Pittsburgh, Pa.
Pacific Lumber Company, San Francisco, Calif.
H. H. Robertson Co., Pittsburgh, Pa.

(Continued on page 126)

Legal Aspects

Garbage for Hog Feeding Must Be Cooked Before Shipment Outside State *

The United States Public Health Service has asked that the following amendment to the Interstate Quarantine Regulations, Section 14½, be brought to the attention of authorities of municipalities from which shipments of garbage for hog feeding purposes are sent in interstate traffic:

"No person, firm, or corporation shall offer for shipment in interstate traffic, or shall accept for shipment or transport in interstate traffic any garbage intended to be used for feeding swine unless all particles of such garbage have been heated to a minimum temperature of 212 degrees F., and held at that temperature at least thirty minutes in apparatus and by methods approved by the state or local health officer: *Provided*, That this requirement may be waived where such heat treatment of garbage intended for swine feeding is carried out at destination under state or local statutes, ordinances, or regulations."

Health officers of communities in New York State who know of violations of this law are asked to communicate with the Division of Sanitation, New York State Department of Health, Albany.

* *New York State Health News*, February 23, 1942.

Records of County Health Commissioner Concerning Typhoid Carrier Held Not Privileged *

(New York Court of Appeals; *Thomas* v. *Morris et al.*, 36 N.E.2d 141; decided July 29, 1941.) An action was brought by the plaintiff, as administrator, for damages for the death of a person from typhoid fever. It was alleged that the fatal bacillus was transmitted to the decedent by reason of the negligent conduct of the defendant who, it was charged, prepared and handled food served to the decedent, a guest at defendant's hotel, notwithstanding that the defendant was, to her own knowledge, a typhoid carrier. The plaintiff sought an order requiring a county health commissioner and the State department of health each to produce at the trial such records and papers as might indicate whether or not the defendant was a typhoid carrier and, if so, might show what, if any, knowledge the defendant had of such condition and what, if any, information was furnished her by the county or State health departments to the effect that she could transmit the disease to others. The State was willing to produce its records but the county health commissioner opposed the plaintiff's motion and, when the trial court granted an order for the issuance of a subpena duces tecum, appealed to the appellate division of the supreme court. The appellate division reversed the trial court's order, holding that the records were privileged under section 352 of the civil practice act and that the county health commissioner could not be required to bring them into court. The case was carried to the New York Court of Appeals which took the view that the order of the trial court was correct and that the records kept by the county health commissioner in the course of his official duties could be made available to the plaintiff.

"We decide," said the court, "that no privilege attaches to these records and that the public policy of the State as expressed in the public health law (Consol. Laws, ch. 45) and the State sanitary code, confers no such privilege." Privilege was stated not to exist unless conferred by some statute and that here the statutes pointed the other way and seemed to require that such records, insofar as they referred to known or suspected typhoid carriers, be made available in a case like the instant one. The sanitary code, which had the force of law, required local health officers to keep the State health department informed regarding the names, ages, and addresses of known or suspected typhoid carriers, to furnish to the department necessary specimens for laboratory examination, to inform the carrier and members of his household of the situation, and to exercise certain controls over the activities of the carriers, including a prohibition against any handling by a carrier of food which was to be consumed by persons other than members of his own household. Answering its own question of why should the record of compliance by the county health officer with these salutary requirements be kept confidential, the court said that, hidden in the files of the health office, it served no public purpose except a bare statistical one, but that, made available to those with a legitimate ground for inquiry, it was effective to check the spread of the disease. "It would be worse than useless to keep secret an order by a public officer that a certain typhoid carrier must not handle foods which are to be served to the public."

Section 352 of the civil practice act was held not to control in the instant case, the court saying that the information, if any, in the health commissioner's files concerning the defendant was not acquired by the commissioner "in attending a patient in a professional capacity" nor was the informa-

* *Pub. Health Repts.*, 57, 281 (1942).

tion "necessary to enable him to act in that capacity." Although the information may have come to the commissioner from a physician in private practice, the transmittal from the physician to the commissioner was in obedience to the express command of law. Also, the court was of the view that an intention that the communicable disease records should not be kept confidential was found in the history of such law. Since 1909, said the court, the law had provided that reports as to tuberculosis should not be divulged or made public. In 1939 an amendment named three other diseases, not including typhoid fever, as to which reports should be kept secret. "It seems to follow that similar reports as to other communicable diseases are not so privileged."

Use of Paper Containers in the Sale of Milk *

(United States Circuit Court of Appeals, Seventh Circuit; *Fieldcrest Dairies, Inc.* v. *City of Chicago, et al.,* 122 F.2d 132; decided August 4, 1941.) In January 1935, the city of Chicago adopted an ordinance regulating the production and distribution of milk in the city. One of the provisions of this ordinance read: "Any milk or milk products sold in quantities of less than one gallon shall be delivered in standard milk bottles; provided, however, that nothing herein contained shall be construed to prohibit hotels, soda fountains, restaurants, and similar establishments from dispensing milk or milk products from sanitary dispensers approved by the board of health." The plaintiff corporation sought a judicial declaration that the above-quoted requirement that milk be delivered in "standard milk bottles" did not prohibit the sale of milk in the plaintiff's paper containers or that, if it did, the provision of the ordinance was invalid. Also, an injunction was sought restraining the defendants from interfering with the sale of milk in such paper containers.

The court of appeals concluded that the use of the plaintiff's paper containers for the delivery of milk in the city was prohibited by the ordinance, taking the view that what the city council meant and intended by standard milk bottle was the glass bottle in universal use at the time of the adoption of the ordinance. The language of the ordinance had to be construed as it was intended to be understood when the ordinance was passed, and the court pointed out that the use of paper containers was scarcely known when the ordinance was enacted.

In connection with the attack made upon the validity of the ordinance, the court proceeded to consider the legislation enacted by the Illinois Legislature in July 1939, during the pendency of the instant suit. By this lengthy statute, as well as by the regulations promulgated pursuant thereto, the State undertook to regulate the pasteurization of milk and the sale and distribution thereof, and, according to the court, it was plain that the use of single service containers, such as those of the plaintiff, for the distribution of milk was permitted and approved upon compliance with the act. "Thus," said the court, "we are confronted with a situation wherein the State on the one hand has expressly recognized and made provision for the use of a single service container for the sale and distribution of milk upon compliance with the requirements of the act, and regulations lawfully promulgated in conformity therewith, and on the other hand, with the provision of the city ordinance which prohibits such use." The conclusion was reached that the portion of the ordinance prohibiting the plaintiff from distributing milk in single service containers was contrary to the public policy of the State and void. The court said, however, that it had no doubt that the city, by virtue of a saving clause contained in the statute, had the power to regulate paper containers and held that the plaintiff was entitled to an injunction restraining the defendants from prohibiting, but not from regulating, the use of such containers.

* *Pub. Health Repts.*, 57, 283 (1942).

Oleomargarine Law Construed *

(Tennessee Supreme Court; *Jacobs Packing Co. et al.* v. *Flanery,* 151 S.W.2d 1073; decided June 14, 1941.) Section 2 of a Tennessee statute relating to oleomargarine provided that, for the purpose of the act, certain enumerated products should be known and designated as oleomargarine and further provided that the section should apply to all ingredients essential to and used in the manufacture, mixing, or compounding of oleomargarine. It was also stated that nothing in the section should be construed to mean that shortening should come under the act unless shortening or other similar compound of fats and/or oils was sold with or there was given away with shortening, etc., any article which when mixed with such shortening, etc., made oleomargarine as defined in the act.

A company sold two packaged products labeled as vegetable shortening and vitamin fortifier. The former weighed 12 and the latter 4 ounces and when mixed by the purchaser a pound of yellow oleomargarine was produced. The Tennessee Supreme Court was of the opinion that the statutory language mentioned was intended to and did embrace these two products and that, in view of the construction placed on section 2, it was manifest that the complainants were liable for the license fee stated in section 5, which section required a license of every person

* *Pub. Health Repts.*, 57, 30 (1942).

desiring to manufacture or sell oleomargarine as defined in section 2.

Section 10 of the statute levied a tax of 10 cents per pound "on all oleomargarine sold in the State as defined in section 2 of this act which is yellow in color, irrespective of the types or kinds of fats or oil ingredients contained by such yellow oleomargarine, any other provision of this act to the contrary notwithstanding." The supreme court held that under this section the two products above mentioned were subject to the tax of 10 cents per pound and in this connection said: "* * * It will be recalled that section 2, as amended, specifically embraces any two ingredients which when mixed produce oleomargarine. This is exactly what occurs when the two Jelke products are mixed; so that these two products, under the provisions of section 2 are oleomargarine even before they are mixed. And, being oleomargarine, they are of a yellow color, because that color only can be produced by mixing them. It follows that these products are subject to the tax of 10 cents per pound because, by the amendment, they are made yellow oleomargarine. * * *"

The court further held that those engaged in selling the two Jelke compounds were subject to the regulations imposed by section 3 and 3-A of the statute and stated that the requirements as to advertising, vitamin content, inspection, etc., were reasonable regulations under the police power of the State.

Court Upholds Mold Test *

U. S. District Judge Carroll C. Hincks, New Haven, Conn., decided in favor of FDA on seizure of 1,332 cases of tomato paste, declaring the Howard test to be "effective in determining the presence of mold in the packaged product," and ordering condemnation. This was the first court test under the new law of the Howard method.

This method forms the basis for the Wildman microscopic method for the determination of mold mycelia in butter.

Phosphatase Test Upheld by Court

The Division of Health of Dayton recently brought a local dairyman to trial for underpasteurization. The specific charge was "selling and offering for sale, milk which was not pasteurized". The sample used for evidence was just one of a long series of underpasteurized samples.

The sample had been tested by the Leahy method for phosphatase, and was characterized as "grossly underpasteurized".

The defendant was found guilty and was fined twenty-five dollars and costs, and the fine was suspended.

* Bulletin American Butter Institute.

Responsibility for Tularemia Infection *

(Ohio Supreme Court; *Rubbo* v. *Hughes Provision Co.*, 34 N.E.2d 202; decided April 30, 1941). In an action against a provision company it appeared that the husband of the plaintiff purchased some rabbits from the defendant's market, which rabbits the plaintiff prepared and cooked. After eating the rabbit meat the plaintiff became ill with tularemia. The rabbits were sold at a counter which was rented by the defendant to a third person, but the advertisement regarding the sale of the rabbits was by the defendant and the purchase was made without knowledge of the arrangements between the defendant and its lessee and in the belief that the defendant was the seller of all merchandise in the market. The judgment of the trial court, affirmed by the court of appeals, was in favor of the plaintiff.

When the case reached the supreme court one of the questions submitted by the defendant for decision was whether the doctrine of agency by estoppel applied. Regarding this the supreme court said that it agreed with the court of appeals in its opinion that, when the provision company advertised the sale of rabbits in its place of business, prospective purchasers going to the company's place of business had a right to assume that the company was selling these rabbits through its employees, in the absence of knowledge to the contrary, and that the company, under these circumstances, was estopped from denying it was selling rabbits. That being so, the supreme court said that the same rules of law applied as if the seller of the rabbits was, in fact, defendant's agent.

Another question presented was whether the trial court had erred in charging that the violation of section 12760, General Code, constituted negligence per se. That section provided that whoever sold, offered for sale, or had in possession with intent to sell, diseased, corrupted, adulterated, or unwholesome provisions without making the condition thereof known to the buyer should be penalized. The supreme court took the view that the rule of law applied in a prior case also applied in the instant case. In such earlier case it was held (a) that the violation of the State pure food laws by the sale of unwholesome meat was negligence per se and could be the basis of recovery for damages by the user of such unwholesome meat who suffered injury proximately resulting therefrom, provided the user was not himself guilty of negligence in the care, preparation, cooking, or in any other manner which contributed directly to his injury, and (b) that lack of intent to violate the law or ignorance of the condition of the meat at the time it was sold was no defense.

The judgment for the plaintiff was affirmed.

* *Pub. Health Repts.*, **56**, 1337 (1941).

JOURNAL OF MILK TECHNOLOGY

Official Publication of the

International Association of Milk Sanitarians

(Association Organized 1911)

The JOURNAL OF MILK TECHNOLOGY is issued bimonthly beginning with the January number. Each volume comprises six numbers. It is published by the International Association of Milk Sanitarians, and is printed by The William Boyd Printing Co., Inc., Albany, N. Y., U. S. A.

Subscriptions: The subscription rate is $2.00 per volume. Single copy, 50 cents.

Advertising: All correspondence concerning advertising, reprints, subscriptions, and all other business matters should be addressed to the Managing Editor, W. B. PALMER, 29 NORTH DAY STREET, ORANGE, N. J.

Manuscripts: All correspondence regarding manuscripts, editorials, news items, announcements, and other reading material should be addressed to the Editor, J. H. SHRADER, 23 EAST ELM AVE., WOLLASTON, MASS.

Membership and Dues: Active membership in the Association is $3.00 per year, and Associate membership is $2.00 per year, including respectively all issues of the JOURNAL OF MILK TECHNOLOGY. All correspondence concerning membership in the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS, including applications for membership, remittances for dues, failure to receive copies of the JOURNAL OF MILK TECHNOLOGY, and other such matters should be addressed to the Secretary of the Association, C. SIDNEY LEETE, STATE DEPARTMENT OF HEALTH, ALBANY, N. Y.

ASSOCIATIONS WHICH HAVE DESIGNATED THE

JOURNAL OF MILK TECHNOLOGY

AS THEIR OFFICIAL ORGAN

CALIFORNIA ASSOCIATION OF DAIRY AND MILK INSPECTORS

President, H. E. Ball.....Lodi, Cal.
Vice-President, Fred Lucas.....Bakersfield, Cal.
Secretary-Treasurer, A. E. Reynolds, Bureau of Dairy Service, Department of Agriculture, Sacramento, Cal.

CENTRAL STATES MILK SANITARIANS

President, William Dotterer.....Barrington, Ill.
1st Vice-President, F. M. Keller.....Oak Park, Ill
2nd Vice-President, J. C. Krueger....Chicago, Ill.
3rd Vice-President, Oliver C. Hutter, Lake Geneva, Wis.
Secretary-Treasurer, Donald V. Fitzgerald, Box 154, Cedar Lake, Ind.

CHICAGO DAIRY TECHNOLOGY SOCIETY

President, Donald B. Hemb.....Chicago, Ill.
Vice-President, E. C. Scott.....Chicago, Ill.
Treasurer, J. E. Rockwell.....Chicago, Ill.
Secretary, P. H. Tracy, University of Illinois, Urbana, Ill.
Sergeant-at-Arms, George Edman.....Chicago, Ill.

CONNECTICUT ASSOCIATION OF DAIRY AND MILK INSPECTORS

President, B. E. Bowen.....Waterbury, Conn.
Vice-President, Harold Clark.....Colchester, Conn.
Secretary-Treasurer, H. C. Goslee, State Office Building, Hartford, Conn.

INDIANAPOLIS DAIRY TECHNOLOGY CLUB

President, Dewey Elmore.....Indianapolis, Ind.
Vice-President, C. H. Denny....Indianapolis, Ind.
Treasurer, H. E. Stone.....Indianapolis, Ind.
Secretary, B. E. Horrall.....Lafayette, Ind.
Assistant Secretary, W. K. Moseley, Moseley Laboratory, 315 N. DeQuincy St., Indianapolis, Ind.

KANSAS ASSOCIATION OF MILK SANITARIANS

President, Dan Van Gundy.....Wellington, Kan.
Vice-President, Wesley Coblentz.....Topeka, Kan.
Secretary-Treasurer, W. J. Caulfield, Kansas State College, Manhattan, Kansas

MASSACHUSETTS MILK INSPECTORS' ASSOCIATION

President, J. T. Manning.....Boston, Mass.
Vice-President, M. G. O'Connor..Springfield, Mass.
Secretary-Treasurer, Robert E. Bemis, Cambridge, Mass.

METROPOLITAN DAIRY TECHNOLOGY SOCIETY

President, O. F. Garrett....New Brunswick, N. J.
Vice-President, A. B. Quencer....New York, N. Y.
Secretary-Treasurer, F. C. Button, New Brunswick, N. J.
Sergeant-at-Arms, F. L. Seymour-Jones, New York, N. Y.

MICHIGAN ASSOCIATION OF DAIRY AND MILK INSPECTORS

President, F. E. Holiday.....Detroit, Mich.
1st Vice-President, A. C. Miller....Lansing, Mich.
2nd Vice-President, C. S. Bryan, East Lansing, Mich.
Secretary-Treasurer, Harold J. Barnum, Ann Arbor Health Department, Ann Arbor, Mich.

MISSOURI ASSOCIATION OF MILK SANITARIANS

President, C. P. Brandle....St. Louis County, Mo.
Vice-President, W. S. Feagan....Kansas City, Mo.
Secretary-Treasurer, Glenn M. Young, Jefferson City, Mo.

NEW YORK ASSOCIATION OF MILK SANITARIANS

President, G. W. Molyneux....White Plains, N. Y.
Vice-President, I. Mikkelsen....Pleasantville, N. Y.
Secretary-Treasurer, W. D. Tiedeman, State Office Building, Albany, N. Y.

PACIFIC NORTHWEST ASSOCIATION OF DAIRY AND MILK INSPECTORS

President, A. W. Metzger.....Salem, Ore.
Vice-President, E. W. Soper.....Arlington, Wash.
2nd Vice-President, R. D. Bovey.....Boise, Idaho
Secretary-Treasurer, Frank W. Kehrli, Portland, Ore.

PENNSYLVANIA ASSOCIATION OF DAIRY SANITARIANS

President, M. E. Dauer.....St. Marys, Pa.
1st Vice-President, R. G. Vogel.....Bradford, Pa.
2nd Vice-President, Maurice Farkes, McKeesport, Pa.
Secretary-Treasurer, G. C. Morris, P. O. Box 141, Troy, Pa.

PHILADELPHIA DAIRY TECHNOLOGY SOCIETY

President, Col. A. P. Hitchins....Philadelphia, Pa.
Vice-President, E. J. Roberts.....Philadelphia, Pa.
Secretary-Treasurer, W. S. Holmes, 158 North 20th Street, Philadelphia, Pa.

TEXAS ASSOCIATION OF MILK SANITARIANS

President, Taylor Hicks.....San Antonio, Texas
1st Vice-President, F. C. Armstrong, Fort Worth, Texas.
2nd Vice-President, R. N. Hancock, McAllen, Texas.
Secretary-Treasurer, G. G. Hunter, Lubbock, Texas.

WEST VIRGINIA ASSOCIATION OF MILK SANITARIANS

Chairman, G. L. Johnson.....Moundsville, W. Va.
Auditor, L. J. Manus.....Morgantown, W. Va.
Secretary-Treasurer, J. B. Baker, Department of Health, Charleston, W. Va.

Association News

California Association of Dairy and Milk Inspectors

The California Association of Dairy and Milk Inspectors held its 24th annual convention at Sacramento, California, October 13, 14, 15, 1941. The meeting was attended by over 80 milk inspectors representing state, county, and city milk inspection units. Many excellent papers were presented by recognized authorities in the field of research, milk control, production, and distribution of market milk and other related dairy products.

The Secretary-Treasurer has inaugurated a membership campaign which aims to attain the high figure established some years ago, when 142 active members belonged to the Association. Emphasis is being placed on the fact that membership includes a year's subscription to the JOURNAL OF MILK TECHNOLOGY, official organ of the International Association of Milk Sanitarians.

The members of the Association played their part in international good will during the convention at Tulsa, Oklahoma, when for the first time a paper was presented on "Milk Sanitation in Mexico." Genuine friendship was shown the delegates from Mexico, Dr. Samuel de la Pena and Ing. Tomas Chavez. In a letter to Max A. Heinzman, Ventura, California, Dr. Victor Fernandez Manero, Director of the Federal Health Department of the Republic of Mexico, extended thanks for the courtesy shown Dr. de la Pena and Ing. Chavez, and for the interest of the delegates in the paper which they prepared. It is certain that all Association members enjoyed having the Mexican delegates at the convention, and that all will be pleased to coöperate with Dr. Manero of the Federal Health Department and Dr. Gustavo Baz, Secretary of Public Welfare, under whose supervision the "Provision of Leche" is operated.

On February 5 and 6 all milk and dairy inspectors employed by cities and counties in southern California were in attendance at an Inspectors' Training Course which is required by the Agricultural Code and held under the direction of the California State Department of Agriculture.

Of particular interest to the group was a talk by W. J. Cecil, Director of Agriculture, in which he stated that the present war emergency could not be used as an excuse to relax the sanitary production requirements which surround milk and its products.

A. E. REYNOLDS,
Secretary-Treasurer.

Chicago Dairy Technology Society

Dr. Ralph Hussong discussed, before a large enthusiastic group of members, "Some Technical Problems of the Butter Industry," at the January 6, 1942, meeting of the Chicago Dairy Technology Society.

At the February 10, 1942, meeting, in the absence of Dr. Paul Krueger of the Chicago Health Department, other officials of the Department, assisted by several from the audience, gave a very interesting discussion on "The Problem of Sabotage in Dairy Plants."

Mr. J. E. Rockwell, after twenty-three years of service with Sidney Wanzer & Sons, Inc., the last twelve as Superintendent, took up his new duties as Superintendent with the Hawthorne-Mellody Farm Dairy, Inc., in December, 1941. H. C. Schroeder, chemist formerly associated with Meadowmoor Dairies, Inc., is also now with Hawthorne-Mellody, making the change at about the same time as did Mr. Rockwell.

John E. King, formerly Assistant Superintendent, was promoted to the position of Superintendent at Sidney Wanzer & Sons, Inc., upon the departure of Mr. Rockwell.

P. H. TRACY,
Secretary-Treasurer.

Massachusetts Milk Inspectors' Association

In a two-day convention at Worcester on January 7 and 8, 1942, the Massachusetts Milk Inspectors' Association met at the Hotel Bancroft. The first afternoon meeting consisted of the dramatization of scenes pertaining to dairy farm inspection, plant inspection, and visiting of a milk plant equipped with high-temperature, short-time pasteurization equipment. The second day, Professor F. J. Doan gave a paper on "Homogenized Milk and The Milk Inspector," and Mr. F. M. Scales presented a paper entitled, "More Sanitary Cans With an Acid Detergent."

Everybody is interested in priorities now, and in rearrangement of deliveries of milk to the consumers in which the dealers are gradually working out every other day delivery. What we are also interested in is how this arrangement will work out in the coming hot months.

ROBERT E. BEMIS,
Secretary-Treasurer.

Metropolitan Dairy Technology Society

Mr. L. Baron of H. Baron and Company, Linden, New Jersey, spoke on the processing of fruits and nuts for the manufacture of ice cream at the February 17 meeting of the Metropolitan Dairy Technology Society.

At the March meeting there was a discussion of the problems now facing the manufacture of ice cream.

F. C. BUTTON,
Secretary-Treasurer.

Michigan Association of Dairy and Milk Inspectors

On December 11, 1941, the Association sponsored a milking machine demonstration at Michigan State College. This was probably the first meeting of its kind to be held anywhere. Manufacturers of every make of machine were invited to contribute, and the following makes of machines were demonstrated: Chore Boy, Clean Easy, Conde, De Laval, Ford, Hinman, International Harvester, McCartney, Perfection, Pioneer, Rite Way, Surge, and Universal.

Each representative demonstrated the method recommended by his company for the taking apart, washing, sterilizing, storing, and reassembling his machine. Adequate facilities for the job were provided, and each representative was given ample time to answer questions. Sales talks were prohibited and the order of demonstrating was determined by drawing names from a hat. Nearly 200 milk sanitarians and field men attended the all day session.

The coöperation offered by the manufacturers represented was very fine and all deserve commendation for their efforts. Each contributed new ideas for consideration, and a follow-up on the information presented will be made in the near future.

The annual meeting of the association was held at Lansing on February 24 and 25, 1942.

HAROLD J. BARNUM,
Secretary-Treasurer.

Philadelphia Dairy Technology Society

The Society will hold all future dinner meetings at Houston Hall, 3417 Spruce Street, the second Tuesday evening of every month. A cordial invitation is extended to all interested, and reservations may be made with Mr. W. S. Holmes, Philadelphia Dairy Council, 158 North 20th Street, Philadelphia, Pennsylvania.

Mr. J. L. Hileman, Director of Laboratories, Dairymen's League, Syracuse, New York, was the guest speaker at the February meeting. His topic was "Butterfat Losses in Dairy Plants."

On Tuesday evening, March 10, Dr. R. Adams Dutcher of the Pennsylvania State College Faculty spoke on "Trends in Vitamin Research."

W. S. HOLMES,
Secretary-Treasurer.

New Members

INTERNATIONAL ASSOCIATION OF MILK SANITARIANS

ACTIVE

Blacklock, J. F., Dairy Farm Inspector, Health Department, 22 Main St., Hamilton, Ont.

Breedlove, H. E., Public Health Engineer and Director, Division of Sanitation, Board of Health, Mobile, Ala.

Kinnison, C. B., Assistant Bacteriologist, City Health Department, Room 108, City Hall, Omaha, Neb.

Sparks, Harry Dixon, Chief Food Inspector, Board of Health, City Hall, Ottawa, Can.

Weiser, Harry H., Assistant Professor of Bacteriology, Ohio State University, Columbus, Ohio.

ASSOCIATE

Baselt, Fred C., Research Representative, American Can Co., 230 Park Ave., New York, N. Y.

Everson, Harry L., Dairy Inspector, Department of Agriculture and Markets, 105 S. Smalley St., Shawano, Wis.

Fassnacht, R. G., Milk Inspector, City Hall, Salina, Kan.

Green, Tom R., Dairy Chemist, Consolidated Badger Co-op., 218 Center St., Shawano, Wis.

Greene, Howard T., Vice-President, Brook Hill Farm, Genesee Depot, Wis.

Hainline, Harold, Laboratory Superintendent, Quality Milk Association, Bettendorf, Iowa.

McKenzie, Joseph, Dairyman, Route 1, Diamond, Pa.

McQuillan, R., Chief Food and Dairy Inspector, City Health Department, Winnipeg, Manitoba, Canada.

Wesemann, Fred A., Laboratory Technician, Johnson Creamery Co., R. R. 6, Bloomington, Ind.

RESIGNED

Perryman, DeForest G., Rochester, New York.

Russ, Richard, Rochester, New York.

DECEASED

Hollingsworth, J. B., Ottawa, Canada.

CHANGES IN ADDRESS

*Barron, J. L., 42 Laurel Lane, Roslyn Heights, N. Y.

*Cline, Robert, 75–28 65th Drive, Middle Village, N. Y.

Colien, F. E., *City Health Department, Omaha, Neb.*, instead of Creighton University, Omaha.

*Gobel, A. G., 11 West End Ave., Oneonta, N. Y.

*Hameline, Arthur, *31 Pease Ave., Utica, N. Y.*, instead of Faas Ave., Utica.

*Hettinger, Stanford, 307 E. Grant Ave., Roselle Park, N. J.

*Kieda, Adam, *Queensboro Furm Products, Clinton, N. Y.*, instead of Canastota, N. Y.

*Nichols, Dr. R. E., *Albany, N. Y.*, instead of Chatham.

Richards, George F., *Golden Guernsey, Inc., 204 Abbot Building, East Lansing, Mich.*, instead of Bethesda, Md.

*Ryan, Joseph, 62 W. Main St., Cobleskill, N. Y.

*Salvato, Joseph, 6858 76th St., Middle Village, N. Y.

*Schachtmeister, Sydney, Certified Laboratories, 19 Hudson St., New York, N. Y.

*Snell, R. J., 8 So. Ten Broeck St., Scotia, N. Y.

Templeton, Hugh L., *5011 Chicago St., Omaha, Neb.*, instead of 2901 Cuming St., Omaha.

Thompson, Donald I., *First Lieutenant, Camp Blanding, Fla.*, instead of Abbots Dairies, Madison, Wis.

Trish, Dr. Karl A., 7722 6th Ave., Kenosha, Wis.

*Wood, George R., 2448 Cambie St., Vancouver, B. C.

*Wood, Paul O., 6 Alden Court, Delmar, N. Y.

*Woodruff, Alfred C., *Moore & Ross, 165 N. Washington Ave., Columbus, Ohio,* instead of Averill Dairy Co., Akron, Ohio.

* Associate member.

MERRILL MACK, DECEASED

Merrill J. Mack, Professor of Dairy Manufacture, Massachusetts State College, died at 5:30 February 9, 1942 at Cooley Dickinson Hospital, Northampton, where he underwent an operation about two weeks previously. Until his sudden death, his recovery had apparently been satisfactory.

Born May 1, 1902, in Flicksville, Pa., he was a graduate of Pennsylvania State College in 1923. He came to Massachusetts State College the same year as an instructor in dairying, advancing to a full professorship two years ago. In 1925 he received a master's degree from the University of Wisconsin. During the past year he edited and revised a book on dairying with Professor Judkins of New York, and had published a number of college bulletins.

In 1935, Professor Mack went to Sweden to assist in the establishment of an ice cream factory in Stockholm. Before returning to this country he traveled in Norway and Finland.

He was a member of the American Dairy Science Association, the American Public Health Association, and the Scientific Society of Sigma XI and Phi Kappa Phi. He was also a member of First Congregational Church of Amherst, of the Amherst Rotary Club, and was chairman of the community service committee this year.

WALTER S. FRISBIE, DECEASED

Walter S. Frisbie, chief of the Office of State Coöperation of the Food and Drug Administration of the Federal Security Agency, died February 19, 1942 at his office in the south building of the Department of Agriculture.

"He is a loss not only to the Food and Drug Administration, but to the State food officials as well," said F. B. Linton, assistant to the Food and Drug Commissioner.

Mr. Frisbie, who served as chemist for several states before entering government service in 1921, was also chairman of the Food Standards Committee of the Security Agency.

He was assistant chemist of the New York State Pathological Laboratory at Buffalo from 1903 to 1905. Between 1905 and 1907, he was connected with the Colgate and Parke-Davis companies, and then for seven years was assistant chemist of the State of Iowa and later state chemist of Nebraska. From 1919 to 1921 he was chief of the Bureau of Food, Drugs, and Oil, State Department of Agriculture, in Lincoln, Nebraska.

Mr. Linton said Mr. Frisbie's work in Washington was to promote cooperation in the work of Federal, state, and local food chemists, and that he was known among food officials throughout the country.

He was a member of the Executive Committee of the Association of Food and Drug Officials of the United States, a fellow of the American Public Health Association, a member of the Association of Amercan Feed Control Officials, and a former president of the Association of Official Agricultural Chemists.

DR. HOLLINGSWORTH, DECEASED

Dr. John Burton Hollingsworth, aged 68 and for 33 years chief food inspector of the city health department, Ottawa, Canada, died at noon on Sunday, December 28, after a month's illness. His death is a great loss to his family, friends, and associates in the dairy and food technology fields. C. K. Johns, Central Experiment Farm of Canada, said of him, "He enjoyed the respect and confidence of the farmers to a degree seldom equaled."

Called "a Canadian pioneer" in food inspection and public health, Dr. Hollingsworth, in 1923, was the first Canadian to receive the honor of election to the presidency of the International Association of Dairy and Milk Inspectors. In 1911 the Royal Society of Arts and Commerce and the Royal Sanitary Institute of London both delegated him to their membership. He was also a charter member of the Central Canada Veterinary Association.

By appointment of the Veterinary Medical Association of the United States in 1928, Dr. Hollingsworth was one of a committee of six which revised the Standard Milk Control Code of the United States Public Health Service. Several years earlier, the Ontario government had embodied several of his recommendations in legislation for milk sanitation.

NICOTINIC ACID UNDER NEW NAME—NIACIN

Federal Security Administrator Paul V. McNutt has announced that he has accepted the recommendation of the Committee on Food and Nutrition of the National Research Council that the terms "niacin" and "niacin amide" be adopted as synonyms for the vitamin substances scientifically designated respectively as "nicotinic acid" and "nicotinic acid amide."

In explanation, Mr. McNutt said, "The Food, Drug, and Cosmetic Act requires that the ingredients of foods be declared by their common names. There has been some well-founded concern on the part of nutritionists and others that the label declaration of the chemical names 'nicotinic acid' and 'nicotinic acid amide' may cause unwarranted apprehension in the minds of the uninformed consumer because many do not recognize these names as designations of forms of a vitamin essential in human nutrition. As I have stated on a number of occasions, I have been entirely willing to consider any synonyms for these technical names that may be adopted by properly qualified nutritional authorities.

"In my opinion, use of 'niacin' and 'niacin amide,' the synonyms adopted by the Committee, for the purpose of declaring the presence of nicotinic acid and nicotinic acid amide, respectively, in products subject to the Federal Food, Drug, and Cosmetic Act, will not be inconsistent with the requirements of that law."

FREE LITERATURE

(Continued from page 116)

Servicised Products Corp., Chicago, Ill.
Snead & Company, 204 Pine St., Jersey City, N. J.
Stark Brick Co., Canton, Ohio.
Stonhard Co., Philadelphia, Pa.
Trucson Steel Co., Youngstown, Ohio.
United Cork Companies, Kearny, N. J.

WHAT TO DO IN CASE OF AN AIR RAID *

1. As soon as the bombs start dropping, run like blazes. (It doesn't matter where as long as you run.)
   Wear track shoes if possible—if the people in front of you are slow you won't have any trouble getting over them.
2. Take advantage of opportunities afforded you when air raid sirens sound the warning of attack, for example:
   A. If in a bakery, grab some pie or cake, etc.
   B. If in a tavern, grab a bottle.
   C. If in a movie, grab a blonde.
3. If you find an unexploded bomb, always pick it up and shake it like —— (maybe the firing pin is stuck). If that doesn't work, heave it in the furnace. The Fire Department will come later and take care of things.
4. If an incendiary bomb is found burning in a building, throw gasoline on it—(you can't put it out anyhow, you might just as well have a little fun). If no gasoline is available, throw a bucket of water on it and lie down—you're dead.
   P.S. The properties of the bomb free the hydrogen from the water causing rather rapid combustion. In fact it will explode with a helluva crash.
5. Always get excited and holler bloody murder. It will add to the fun and confusion, and scare —— outa the kids.
6. Drink heavily, eat onions, limburger cheese, etc., before entering a crowded air raid shelter. (It will make you very unpopular with the people within your immediate vicinity, eliminating any unnecessary discomfiture that would be more prevalent if people crowded too closely.)
7. If you should be the victim of a direct bomb hit, don't go to pieces. (Lie still and you won't be noticed.)
8. Knock the air raid wardens down if they start to tell you what to do—they always save the best seats for themselves and their friends anyway.

* Sent to us by W. B. Palmer

DISEASE OUTBREAKS FROM WATER, MILK, AND OTHER FOODS IN 1939—CORRECTION *

In the article with the above title, by Senior Sanitary Engineer A. W. Fuchs, which appeared in the PUBLIC HEALTH REPORTS of November 28, 1941, table 5, page 2281, shows a water-borne outbreak involving 325 cases as occurring in the State of New Jersey. This table should be corrected by the addition of a footnote referring to this outbreak, as follows: In this outbreak, involving 325 cases of gastroenteritis, ice was suspected as the vehicle. Attention is called to footnote 1 of table 3, which also refers to this outbreak.

* *Pub. Health Repts.*, **56**, 2468 (1941).

"Dr. Jones" Says—*

WHEN I was making some calls over't the Center the other day, one place I stopped the woman had a rigging on the stove. I said: "What's that you're doing? Pasteurizing milk?" "Why," she says; "am I breaking some law or something?" That's what you get for being health officer.

Anyway, the situation over there: there ain't to exceed a hundred and fifty people and all of 'em that don't keep cows themselves, they get their milk from some neighbor. They've had two or three cases of undulant fever out there. One woman's been laid up for a matter of eight months. Finally the Home Bureau got interested and several of 'em have started home pasteurization.

There's been some talk of getting one of the dealers here in town to deliver pasteurized milk out there. But the milk they're getting now (they go after it with their own pails)—it only costs 'em something like ten cents a quart. And any of the fellows here —they won't deliver out there for less'n fifteen or sixteen. And, of course, the folks over that way—they haven't been very strong on this pasteurization idea; they weren't, anyway, until they found out about the undulant fever cases.

And, you know, it's a wonder to me a lot of those folks'll take a chance selling milk—the little they get out of it. Just recently I heard of a case: this fellow had a herd that was tested for Bang's disease but every time they tested they found some reactors. He'd been talking for some time about pasteurizing but put it off. Finally a girl had undulant fever and she started a damage suit. I guess he thought she had a good case. They say he settled out of court. And now he's pasteurizing.

Pasteurizing at home—it's a simple matter: just takes a little time. All they need is a double cooker—one dish inside of another—and a dairy thermometer that you can get at any dairy supply place. All there is to it is heating the water up until the milk gets to 160 degrees, then cooling it right down (the milk, that is) and putting it in the refrigerator. The Department, up there to Albany—if you're interested in the details you can send up and get their milk pamphlet.

Milk that's already pasteurized and bottled—it's less bother and liable to be full as satisfactory in the end, but if you can't get it—well, it's like Henry Smith said once about horses: "If you can't get the hoss you want", Henry says, "You better take the one you can get. You can always trade him off later."

PAUL B. BROOKS, M.D.

---

* New York State *Health News*, September 29, 1941.

AMERICA AT WAR

NEEDS

FULLY PROTECTED MILK!

Obviously this is no time to "let down the bars" on milk protection.

Now more than ever, America's milk deserves to be *fully* protected—from dairy to doorstep.

The sanitary Sealright hood provides the most efficient post-pasteurization protection ever perfected for bottled milk during delivery. Milk sanitarians indorse this modern safeguard.

Look for messages in forthcoming national magazines emphasizing the importance of the work health officials are doing in the national emergency. These messages, sponsored by Sealright, will strongly back up your own efforts in the protection of public health.

The Sealright hood—made of specially-prepared, specially-treated, *sterilized* paper — sealed on the bottle at 500° F. — keeps the pouring-rim sterile-clean . . . prevents human contact until the milk reaches the consumer. It's water-proof and tamper-proof.

The Sealright hood is a small safeguard that can accomplish great good. We believe it is worthy of your attention.

PROTECT HEALTH...WITH FULLY PROTECTED MILK!

Index to Advertisers

Application for Membership

.....194.....

TO THE INTERNATIONAL ASSOCIATION OF MILK SANITARIANS, INC.:

Application for ☐ Active ☐ Associate Membership (See reverse side of Sheet)

(Membership includes subscription to Journal of Milk Technology)

Name .....

Address (mailing) .....

PRESENT POSITION

Title ..... Length of Service .....

Organization .....

PREVIOUS POSITION

Title ..... Length of Service .....

Organization .....

Title ..... Length of Service .....

Organization .....

GIVE FOLLOWING INFORMATON

Education: Name Schools attended	Years of Attendance	Graduate	Degree
College			
University			
Technical School			
Other			

Give additional information you desire to have considered

.....

.....

.....

Application endorsed by

Active or Associate member } .....

.....

Mail this application and annual dues, $3.00 Active, $2.00 Associate, which includes $1.00 for subscription to Journal of Milk Technology:

C. SIDNEY LEETE, *Secretary-Treasurer,*
International Association of Milk Sanitarians, Inc.
State Department of Health, Albany, N. Y.

Active Membership open to Government Officials and Employees.

Associate Membership open to Members of Industry and others.

Culture Media for Examination of MILK and DAIRY PRODUCTS

for Plate Counts

Bacto-Tryptone Glucose Extract Agar is recommended for routine plate counts of bacteria in milk. This medium conforms to all requirements of "Standard Methods for the Examination of Dairy Products" of the American Public Health Association, except that it does not contain skim milk. **Bacto-Proteose Tryptone Agar** is recommended for determinations of the total bacterial plate count of certified milk. This medium is prepared according to the specifications of "Methods and Standards for Certified Milk" of the American Association of Medical Milk Commissions.

for Detection of Coliform Bacteria

Bacto-Violet Red Bile Agar is widely used for direct plate counts of coliform bacteria. Upon plates of this medium accurate counts of these organisms are readily obtained.
Bacto-Brilliant Green Bile 2% and
Bacto-Formate Ricinoleate Broth are very useful liquid media for detection of coliform bacteria in milk. Use of these media is approved in "Standard Methods."

for Detection of Molds

Bacto-Potato Dextrose Agar is an excellent medium for detection and enumeration of molds and yeasts in butter and other dairy products. The formula of this medium corresponds exactly with that specified in "Standard Methods."
Bacto-Malt Agar is also widely used for determinations of the mold and yeast count of dairy products and for control of the sanitary conditions of manufacture.

for Cultivation of Lactobacilli

Bacto-Tomato Juice Agar and
Bacto-Trypsin Digest Agar support luxuriant and characteristic growth of *Lactobacillus acidophilus,* and are well adapted for use in establishing the number of viable organisms in acidophilus products. These media are also widely used for estimation of the degree of implantation by *L. acidophilus.*