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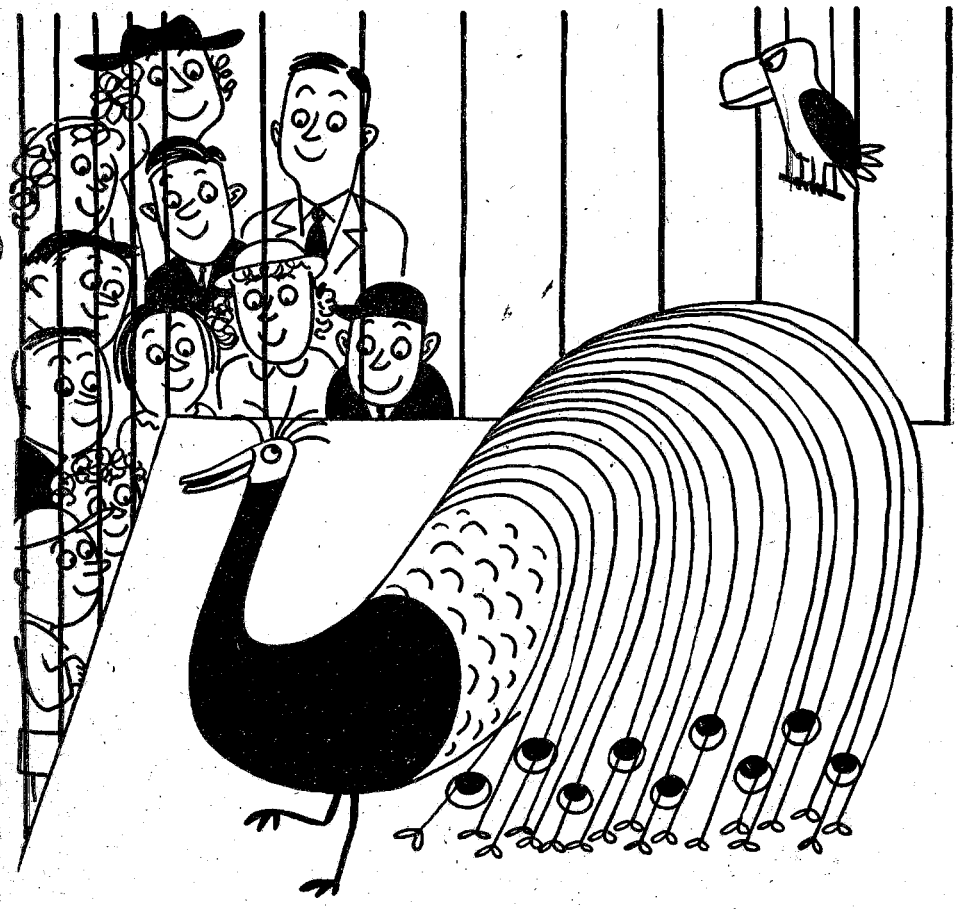

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JOURNAL of MILK and FOOD TECHNOLOGY

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JOURNAL of MILK and FOOD TECHNOLOGY

(*including* MILK AND FOOD SANITATION)

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Volume 11 July–August Number 4

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 the transactions.

Public Health Service Disease Outbreak Reports, 1946

The following table, supplementing that of last year, is presented principally for purposes of comparison. The 1944 figures for water and undetermined vehicles are not available at the time of writing.

NUMBER OF OUTBREAKS

	1944	1945	1946
Milk and milk products	36	24	12
Possibly conveyed through milk	5	5	6
Other foods	288	272	287
Possibly conveyed through other foods	10	3	12
Water	...	20	25
Possibly conveyed through water	...	6	7
Undetermined vehicles	...	12	6

The data concerning outbreaks "Possibly conveyed" through the specified vehicles or for which vehicles of transmission were not determined may be of passing interest as indicating that the outbreaks were discovered and investigated. Some of them offer opportunities for speculation. Two or three questions will be raised, further on, concerning their use. Otherwise the balance of this discussion will concern itself only with the outbreaks for which vehicles were determined.

WATER

Twenty-five outbreaks were reported as waterborne, 19 of them from New York State, the other 6 being divided between 4 states, Alaska and Puerto Rico. Gastroenteritis or diarrhea figured in 22, "dysentery" in 2 and typhoid fever in one. Puerto Rico reported an outbreak of bacillary dysentery (Flexner) involv-

ing 2,265 cases. Reported also as dysentery was an outbreak of about 100 cases at a Virginia colliery. The cases had not been reported, the explanatory notes said, and no stool examinations had been made. "Dead animals in reservoir" was the answer, on the face of the report, to the question "How was vehicle contaminated?" This leaves a doubt as to the sense in which the term "dysentery" was used.

Of the 19 outbreaks reported from New York State, 18 were gastroenteritis and 1 typhoid fever, 11 cases. Two gastroenteritis outbreaks were traced to rural village supplies, one privately owned. The other 17, including the one of typhoid fever, were associated with private supplies, chiefly of rural summer camps and resorts.

Pertinent here is an extract from a paper, "Analysis of Waterborne Outbreaks—1938–1945" by Eliassen and Cummings, published in the May, 1948, issue of the *Journal of the American Waterworks Association*. The authors called attention to the fact that New York State had reported 40 percent of the waterborne outbreaks reported in the 8-year period for the entire country and that many of them were small, "such as those reported from summer camps and small resort hotels". They then said: "This intensity of reporting reflects the close control which the New York State Department of Health exercises over its resort areas, particularly those in the congested districts of the Catskill Mountains. A special staff of sanitary engineers and inspectors patrols this and other areas each summer season, with the results that all minor outbreaks are reported. . . . It seems fair to assume that if other states exerted similar care in their congested recreational areas, the record of outbreaks attributable to small private water supplies might be higher."

A nationally recognized authority on water supplies, in a personal letter, puts it more positively. "Committee reports by the American Waterworks Association", he says, "conclusively indicate that such outbreaks are occurring in other states but they are not subject to inspection, investigation, etc."

That 44 states would have had no waterborne outbreaks in 1946 would seem too good to be true. As has been apparent concerning milkborne outbreaks for years, it is the states which are most active in discovering and investigating them which are most likely to have them to report.

Milk and Milk Products

Nine states (California, Georgia, Florida, Maryland, Massachusetts, Minnesota, New Hampshire, New York, Virginia) and Puerto Rico reported a total of 12 outbreaks. This was half the number reported in 1945 and one-third the number in 1943. While New York City reported 2 small outbreaks, New York State exclusive of New York City, usually a liberal contributor to these lists, for the first time since reports have been made to the Public Health Service, had none to report.

The diseases involved were undulant fever, in 5 outbreaks; gastroenteritis or food poisoning in 6; typhoid fever in one. Nine were attributed to milk or (in one instance) cream, 3 to cheese. The latter, with a few cases of gastroenteritis each, were charged to goat milk cheese, cottage cheese, and a native Puerto Rican cheese. With one exception unpasteurized products were involved in all outbreaks.

Of the 9 milkborne outbreaks, one of 11 cases of chemical poisoning, reported by New York City, involved pasteurized milk. It was caused by a brine leak in the cooler. Calcium chloride was found in milk samples but "no heavy metals or harmful chemicals." Another unusual feature of this list of milkborne outbreaks is that 5 of the 9 were undulant fever, including one of 29 cases.

A carrier on a dairy farm was responsible for the one small typhoid fever outbreak. The largest outbreak on the milk list was one of the 3 of gastroenteritis or food poisoning. Eighty cases were attributed to a *Staphylococcus aureus* udder infection, presumably with inadequate refrigeration.

FOODS OTHER THAN MILK

Thirty-one states, one territory and Washington, D.C., reported 287 outbreaks. It is an interesting coincidence that this total differs from the 1944 total by only one outbreak and from that for 1945 by only 15. Of the 1946 total, 127 or 44 percent were reported from New York State, 86 of them from New York City.

Outbreaks classified as food poisoning, gastroenteritis or diarrhea, as usual, vastly predominated, making up 92 percent of the total. Botulism heads the list with 6 small "outbreaks", 3 of them one case each. All were traced to home-canned food. To this list might have been added another 2-case outbreak which headed the list of outbreaks "Possibly conveyed through foods". Since botulism is *only* conveyed through food (A.P.H.A. Control of Communicable Diseases, p. 47) why the "Possibly"?

Typhoid fever figured in 6 outbreaks. Surprisingly the largest of these (20 cases), as well as the most interesting and unsual, was reported from New York City. A chronic typhoid carrier lived over a vegetable and fruit store and used a flush toilet. The main soil line became clogged, causing sewage to overflow. For several days it dripped on vegetables and fruit in the store below.

Completing the list were 4 outbreaks of septic sore throat and 5 of trichinosis. Food handlers with sore throat were responsible for 3 of the 4 septic sore throat outbreaks. In the other and largest, 176 known cases, the primary cases in a school, potato salad was suspected but the source of infection was not determined. A flood forced the closing of the school before the investigation was fully completed.

At the head of the voluminous list of outbreaks of food poisoning, gastroenteritis, etc. were 10 of chemical poisoning. Four resulted from careless use of insect and rat poisons. An "outbreak" of one case of copper poisoning was unique enough to justify its inclusion. A man who ate meat pie for lunch at a restaurant, immediately after lunch picked a particle of copper from his teeth. After returning to his office he became violently ill. Examination of the vomitus, which had been saved, showed numerous particles of copper and 0.01 gram of copper per 100 ml. The cause was use of a copper scouring pad without proper washing or rinsing afterward. Examination of other meat pies showed no copper.

In the other 256 outbreaks (exclusive of the 10 of chemical poisoning) staphylococci were indicated or suspected in 110 and salmonellae in 23. Poultry and poultry dishes were given as the vehicles in 73 outbreaks; other meats and meat dishes in 68; pastries, including "cream filled", in 57. Places most frequently mentioned as the sources of the foods were: hotels and restaurants, in 45; bakeries and other stores, 18; schools and colleges, 17; camps, 10; hospitals, 7 and "homes" (other than private homes), 6. Among the private parties listed, wedding parties appeared 12 times, 6 of the outbreaks developing from 40 to 100 cases. What a send-off for newly weds!

GENERAL COMMENT

A Public Health Service summary of outbreaks, covering 9 years, follows this discussion. Attention is called to the fact that the totals given there, for 1946

FEDERAL SECURITY AGENCY
U. S. Public Health Service
Washington, D. C.

Sanitary Engineering Division
Milk and Food Section

April 1948

SUMMARY OF DISEASE OUTBREAKS FROM WATER, MILK AND MILK PRODUCTS, OTHER FOODS AND UNDETERMINED VEHICLES[1]

Year	Water			Milk and Milk Products			Other Foods			Undetermined			Total		
	Out-breaks	Cases	Deaths	Out-breaks	Cases	Deaths	Out-breaks	Cases	Deaths	Out-breaks	Cases	Deaths	Out-breaks	Cases	Deaths
1938	48	31,693*	17	42	1,685	27	70	2,247	25	8	882	3	168	36,507*	72
1939	43	2,254	3	41	2,509	7	146	3,770	12	17	1,203	6	247	9,736	28
1940	43	44,184#	9	43	1,678	10	218	5,588	30	18	1,088	1	322	52,538#	50
1941	60	12,039	24	37	1,049	4	223	6,070	53	20	1,876	24	340	21,034	105
1942	53	13,271	9	45	2,142	2	245	11,420	101	37	1,878	10	380	28,711	122
1943	26	5,712	15	40	1,590	7	285	13,938	33	38	2,525	1	389	23,765	56
1944	32	2,686	1	41	1,449	20	298	14,558	45	22	1,683	1	393	20,376	67
1945	26	5,859	6	29	2,161	17	276	11,547	57	12	637	2	343	20,204	82
1946	32	4,512	2	19	795	0	299	12,526	17	6	312	1	356	18,145	20
Total	363	122,210	86	337	15,058	94	2,060	81,664	373	178	12,084	49	2,938	231,016	602

[1] As reported by State and municipal health departments.
*Including a water-borne outbreak of gastroenteritis with 29,250 cases.
#Including a water-borne outbreak of gastroenteritis with 35,000 cases.

and one or two previous years, include the numbers of outbreaks listed in the reports as "Possibly conveyed" through the different vehicles. The question is raised as to whether this is a good procedure. Should an outbreak be listed as milkborne for example, if it has not been *determined* to have been milkborne? Might not these figures be misleading to persons not familiar with the detailed reports?

Anyway—and finally—is the use of the word "Possibly" just the right term? As commonly used it carries an implication of improbability. Now and then, in connection with an outbreak listed below the line, it appears that there has been a belief or a strong suspicion that it was conveyed through the specified vehicle, although proof was lacking. Might not "May have been conveyed through" or "Suspected of having been conveyed" more nearly fit such situations?

P. B. B.

Food and Drug Officials Support Sanitary Standards Program

At the semi-annual meeting of the Mid-Continental Association of Food & Drug Officials, representing the states of Missouri, Kansas, Oklahoma, and Arkansas, held at Pittsburg, Kansas, on April 19, 1948, the following resolution was adopted:

> Whereas, the proper construction of utensils and equipment has a definite bearing on sanitizing procedures of such equipment,
>
> Therefore, be it resolved this organization join The INTERNATIONAL ASSOCIATION OF MILK & FOOD SANITARIANS in supporting and encouraging this program.
>
> That a copy of this resolution, if adopted, be sent to the chairman of the committee in the construction of utensils and equipment used in the food industry.

THEO. B. BENJAMIN
Secretary-Treasurer
Mid-Continental Association of Food & Drug Officials

Correction

In the article "An Improved Stain for the Direct Microscopic Examination of Milk" by Manley Mandel, this Journal, **11**, No. 1 (January–February), pages 36–37, (1948), second column, line 20: delete 0.034 gm. cetyl and substitute therefor the correct value of "0.34 gm. cetyl".

J. H. S.

Sanitary Engineering Division

FEDERAL SECURITY AGENCY
U. S. Public Health Service
Washington

Milk and Food Section

April 1948

SUMMARY OF MILK-BORNE DISEASE OUTBREAKS REPORTED BY STATE AND LOCAL HEALTH AUTHORITIES AS HAVING OCCURRED IN THE UNITED STATES DURING THE YEARS 1923-1946, INCLUSIVE

	Typhoid			Paratyphoid			Scarlet Fever & Septic Sore Throat			Diphtheria			Dysentery			Food Poisoning & Gastroenteritis			Undulant Fever			Miscellaneous			Total - All diseases		
Year	Outbreaks	Cases	Deaths	Outbreaks	Cases	Deaths	Outbreaks	Cases	Deaths	Outbreaks	Cases	Deaths	Outbreaks	Cases	Deaths	Outbreaks	Cases	Deaths	Outbreaks	Cases	Deaths	Outbreaks	Cases	Deaths	Outbreaks	Cases	Deaths
1923	15	423	31	0	0	0	7	406	6	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	23	834	37
1924	25	693	48	10	372	16	6	354	0	1	23	0	2	110	1	0	0	0	0	0	0	0	0	0	44	1552	65
1925	31	580	43	2	37	4	10	1108	8	1	14	1	0	0	0	0	0	0	0	0	0	0	0	0	44	1739	56
1926	49	1189	83	2	19	1	11	1789	10	2	24	0	0	0	0	1	150	0	0	0	0	3	192	1	68	3363	95
1927	24	430	35	2	53	0	4	389	5	2	15	0	0	0	0	1	50	0	3	17	1	0	0	0	36	954	41
1928	25	421	48	0	0	0	11	1449	55	2	48	0	1	126	17	2	104	0	5	21	0	0	0	0	46	2169	120
1929	29	541	36	1	38	1	19	1891	14	0	0	0	1	8	0	1	24	0	0	0	0	0	0	0	51	2502	51
1930	30	575	41	0	0	0	11	1158	7	0	0	0	1	64	2	6	171	6	0	0	0	0	0	0	48	1968	56
1931	21	217	16	1	22	0	9	1059	8	1	22	0	1	65	0	1	13	0	0	0	0	0	0	0	34	1398	24
1932	23	254	22	0	0	0	9	356	6	0	0	0	0	0	0	1	32	0	0	0	0	0	0	0	33	642	28
1933	25	299	26	1	17	0	10	753	9	2	19	3	0	0	0	0	0	0	0	0	0	4	260	1	42	1348	39
1934	26	345	27	1	400	0	9	478	8	1	9	0	0	0	0	5	292	0	0	0	0	0	0	0	42	1524	35
1935	16	172	14	2	50	0	11	1065	7	0	0	0	1	131	0	13	411	0	0	0	0	0	0	0	43	1829	21
1936	15	114	5	1	21	0	18	1553	23	0	0	0	0	0	0	4	188	0	4	15	0	0	0	0	42	1891	28
1937	15	208	11	0	0	0	14	1384	3	0	0	0	0	0	0	12	523	0	0	0	0	2	35	0	43	2150	14
1938	18	187	17	0	0	0	12	674	7	1	31	3	2	166	0	9	627	0	0	0	0	0	0	0	42	1685	27
1939	6	51	1	2	24	0	9	1324	6	0	0	0	2	324	0	19	749	0	1	4	0	2	33	0	41	2509	7
1940	14	120	10	0	0	0	5	482	0	0	0	0	2	197	0	17	855	0	4	19	0	1	5	0	43	1678	10
1941	12	120	4	0	0	0	3	219	0	1	5	0	3	126	0	15	483	0	3	96	0	0	0	0	37	1049	4
1942	5	42	0	1	4	0	6	620	0	1	36	0	1	40	0	23	1341	2	5	42	0	2	68	0	44	2193	2
1943	6	37	1	0	0	0	3	200	0	1	20	4	0	0	0	25	1278	0	4	22	2	1	33	0	40	1590	7
1944	7	359	18	1	6	0	2	171	0	0	0	0	2	34	0	23	816	0	3	20	0	2	43	2	40	1449	20
1945	3	72	4	0	0	0	3	308	0	1	53	2	1	22	0	18	1673	11	2	19	0	1	14	0	29	2161	17
1946	1	7	0	0	0	0	0	0	0	0	0	0	1	15	0	11	696	0	5	66	0	1	11	0	19	795	0
TOTAL 1923-1946	441	7456	541	27	1063	22	202	19,190	182	18	324	13	21	1428	20	207	10,476	19	39	341	3	19	694	4	974	40,972	804

A Study of Milking Machine Cleaning Methods*

I. THE SCRUB METHOD COMPARED TO THE FLUSH METHOD

S. M. Morrison,[1] H. E. Kaeser,[2] J. W. Hedges,[2]
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Introduction

An important problem for the dairy farmer is the cleaning of milking equipment. Improperly cleaned milking machines and accessories constitute a contributing factor to the production of milk with high bacterial count. Often the farmer has a problem of hard water which makes proper cleaning difficult. The time involved in clean-up operation at milking periods must always be considered. The proper use of a detergent like tri-sodium phosphate has given satisfactory results but there are some features in its use that are far from ideal.

A series of studies was made to evaluate methods of cleaning milking machines. A scrub cleaning method using tri-sodium phosphate was evaluated against a flush cleaning method using an alkyl sulfate type of detergent (Dreft (3)). The study reported here consists of a series of tests extending over a period of seven and one-half weeks.

Comparative observations on the effectiveness of the two cleaning methods were based on the following factors:

a) bacterial counts of the wash waters
b) bacterial counts of the milk
c) appearance of the milking machines
d) speed and ease of cleaning
e) the effect of hard water.

Materials and Methods

Animals—Two groups of six cows each were selected for the study. These animals remained in their usual stall positions in the University dairy herd. Milking of the test animals was done by one man who milked no other than test animals at the regular milking periods. Each cow was carefully checked for mastitis by a veterinarian for a period before the studies began and also during the course of the tests. All the cows were found to be normal, healthy animals with no clinical udder abnormalities.

In each test the results obtained from one group of six cows was compared with the results obtained from another group of six. One herd was arbitrarily designated as A, the other herd as B. At the half-way point of each test period the cleaning methods for the groups were interchanged and the test completed. No other changes were made. This procedure made allowance for the normal difference in bacterial counts that was present in the two groups.

Milking Machines—Two new complete milking machines were used exclusively on the test cows during the test period. One machine with its inflations was cleaned only by the flush method; the other machine was cleaned only by the scrub method.

Water Hardness—To observe the effects of hardened water on the cleaning methods the equipment was washed in certain designated tests with water hardened with a mixture of magnesium and calcium salts. The ratio of calcium to magnesium was 2.9 to 1. Whereas the normal water supply in the barn

* A cooperative research contribution of the Procter and Gamble Company and The Ohio State University Research Foundation.

tested about 5 grains/gallon, the hardened water gave hardness readings in the vicinity of 21 grains/gallon.

Cleaning Agents—The scrub method of cleaning the milking machine was done with 0.2 percent tri-sodium phosphate solution. This was the type of agent regularly used in the barn. For the flush method 0.2 percent, and later 0.1 percent, Dreft solution was used.

Scrub Method—

1. After each milking, one pail of fresh cool water was flushed through the milker, raising and lowering the teat cups in the pail of water.
2. The unit was taken apart and the milker head, teat cups, inflations, and other rubber parts were scrubbed thoroughly inside and out using a stiff bristled brush with a solution of 0.2 percent tri-sodium phosphate. A special scraper with a long wire handle was used to clean the inside of the rubber tubing.
3. The unit was reassembled and flushed out with a pail of water at 160° F.
4. The milk pail and pail head were hung on a rack to dry.
5. The teat cup assembly was filled with a 0.5 percent lye solution and allowed to stand between milkings.
6. Just before the next milking, the lye solution was drained from the teat cup assembly and the milker unit was flushed out with clear, warm (120° F.) water.

Flush Method—

1. The milking unit was flushed out after milking with one pail of a Dreft solution at 130° F.
2. After all of the Dreft solution had been drawn into the milk pail, the rubber seal was removed from the pail head and both were brushed in the detergent. The outside of the unit was also brushed with the solution. After sloshing the solution around in the pail it was emptied.
3. The unit was reassembled and flush-rinsed with 160° F. water.
4. The pail, pail head, and teat cup assembly were hung up to dry.
5. Just before the next milking, the machine was flushed out with clear, warm water at 120° F.

Sampling—At each milking period samples of the wash waters and of the milk of each group were taken aseptically. The samples were drawn with sterile pipettes which were calibrated to deliver 20–21 ml. and were long enough to be used as stirring rods with little danger of contamination. The necks of the pipettes were constricted and were plugged with cotton to prevent contamination from the milker's moist hands.

As each cow was milked 20–21 ml. of milk was placed into the chilled sterile sample bottle for that group. This procedure gave a pooled group sample (six cows) of approximately 125 ml. All samples were kept in the cold until bacteriological sampling was completed.

The wash water samples were taken with similar equipment. Samples of the flush-water rinse of each unit before milking and the flush-water rinse of each unit after cleaning the machines were taken.

Bacteriological Testing—Each morning duplicate plate counts were run on each milk and water sample of the milkings of that morning and the previous evening. The samples in each case had been kept cold in a portable ice chest with two ice compartments. The plate counts were run in compliance with the recommendations of the eighth edition of *Standard Methods for the Examination of Dairy Products* of the A.P.H.A. and the A.O.A.C. No skimmed milk was added to the tryptone glucose agar because of the low dilution required for the milk samples in this series of tests.

RESULTS AND OBSERVATIONS

Bacterial Counts of Milk Samples—The average counts of the milk samples for each test period are presented in Table 1. These counts are broken

TABLE 1

BACTERIAL COUNTS* OF MILK SAMPLES

Test period	Approx. water hardness gms./gal.	Scrub Method: % Product	Group	A.M. Bacteria/ml. Ave. (min.–max.)	P.M. Bacteria/ml. Ave. (min.–max.)	Flush Method: % Product	Group	A.M. Bacteria/ml. Ave. (min.–max.)	P.M. Bacteria/ml. Ave. (min.–max.)
1/29–2/6	5	0.2 TSP**	A	862 (595–1570)	611 (265–965)	0.2 Dreft	B	2273 (1180–4100)	1618 (1205–2690)
Groups reversed									
2/6–2/17	5	0.2 TSP	B	3769 (2020–10500)	4659 (1040–15100)	0.2 Dreft	A	1190 (485–1995)	884 (505–1545)
2/17–2/24	21	0.2 TSP	B	2286 (1880–2820)	3404 (920–14900)	0.2 Dreft	A	1667 (760–4500)	847 (270–1230)
Groups reversed									
2/24–3/3	21	0.2 TSP	A	1114 (830–1390)	792 (495–1140)	0.2 Dreft	B	3179 (2345–6050)	2132 (1563–3850)
3/3–3/10	5	0.2 TSP	A	1772 (1135–3950)	1078 (780–1470)	0.1 Dreft	B	3024 (1380–5650)	3357 (1290–12300)
3/10–3/17	21	0.2 TSP	A	1749 (1065–3950)	1039 (695–1245)	0.1 Dreft	B	2164 (1070–4950)	1803 (1080–4950)
Groups reversed									
3/17–3/24	21	0.2 TSP	B	2065 (1300–2690)	1506 (1150–2035)	0.1 Dreft	A	1431 (1035–1915)	1032 (560–1685)
			Average	1945	1870			2133	1668
			Overall Average	1908				1900	

* These counts represent the average bacterial count in each test period. The figures in parentheses are the minimum and maximum counts for the period.

** TSP = Tri-sodium phosphate 0.12 H_2O.

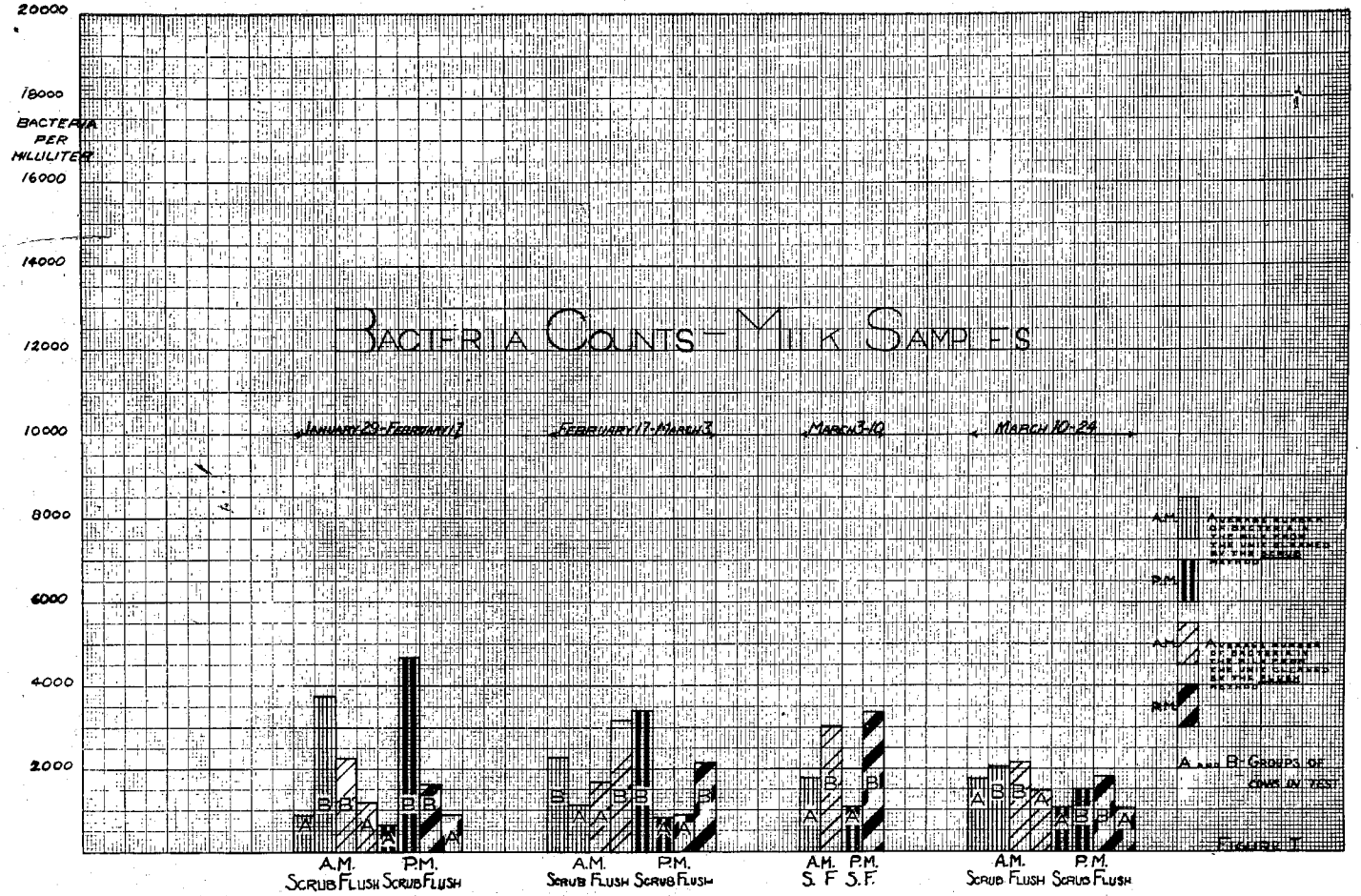

FIGURE 1. Graphic arrangement of average bacteria counts.

down into the A.M. and P.M. milk samples. With each average count the maximum and minimum bacterial counts for the test period are presented in parentheses. The group (A or B) involved in each test is indicated by an A or B beside the name of the cleaning agent used in each test. The average counts are presented in graphic form in Figure 1. The bacterial counts in every case were quite low, well within the requirements for highest quality milk.

It can be seen in the results that the plate counts for the A group are consistently lower than for the B herd in each test. No explanation for this other than normal group difference can be given. This factor must be considered in setting up comparative studies.

Analysis of the results shows little comparative difference in the plate counts for the milk samples between experiments in which relatively soft and moderately hard water were used. Neither tri-sodium phosphate nor Dreft were hindered as cleaning agents by hardened water, as judged by the bacterial counts of the milk samples.

When the amount of Dreft used in the tests was reduced from 0.2 percent to 0.1 percent, little change in bacterial counts was noted.

Although there were daily, test, herd, and milking period variations in plate counts between the flush and scrub method of cleaning milking equipment, the overall picture shows little difference in counts. An average of all the counts for the scrub and flush methods presented in Table 1 shows a difference of only 8 bacteria per ml. (flush = 1900 bacteria/ml. and scrub = 1908 bacteria/ml.). Although this comparison may not be as reliable as the agreement between these overall average figures would suggest, due to varying factors in the tests, there is no indication of a definite dissimilarity in efficiencies between the two methods.

The plate counts for morning samples were mostly higher than for the evening samples. To check our sample storage and delivery system the time of bacteriological testing was changed to the evening in later tests. In experiments not here reported the morning samples were still usually higher.

Bacterial Counts of Wash Water Samples—In only one test (3/17–3/24) did the wash water samples contain enough bacteria per ml., as determined by standard plate counts, to be considered significant (over 30 bacteria/ml.). In all the other tests the post-flush rinse and the pre-flush rinse samples for the scrub and the flush methods showed less than 30 bacteria/ml. In the 3/17–3/24 test, the A.M. pre-flush rinse samples for both the scrub and flush methods showed bacterial counts of approximately 60 bacteria/ml.

Relative Speed, Ease, and Efficiency of the Two Cleaning Methods—The average time for washing the milking machine by the flush method was five minutes; with the scrub method procedure nine minutes were required. This comparison shows that a saving of about 40 percent over the time consumed by the scrubbing process can be realized.

The effectiveness of the flush method of cleaning milking machines with Dreft was readily apparent from the appearance of the milking equipment after the washing operation. Whereas the tri-sodium phosphate left the metal somewhat dull, especially in hardened water, the Dreft-washed metal was bright and shiny. The addition of calcium and magnesium salts to the water to increase the hardness had no noticeable effect on the ability of Dreft to keep the metal bright.

SUMMARY AND CONCLUSIONS

To study the relative merits of cleaning milking machines by the conventional scrub method with 0.2 percent tri-sodium phosphate and the newer

(*Continued on page 205*)

Effects of Contemplated Changes in Standard Methods*

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INTRODUCTION

THE Eighth Edition of *Standard Methods for the Examination of Dairy Products* was published in 1941, and will soon be superseded by the Ninth Edition. In the next edition certain changes in procedure have been made which are intended to improve the accuracy and reliability of the results obtained by the respective methods. Already concern has been expressed by some that the changes to be made in the Ninth Edition in the procedures for the bacteriological examination of market milk may result in higher counts, and it has even been suggested that bacterial limits in milk ordinances and regulations be raised to compensate for this. It would appear that these suggestions reflect undue apprehension of the potential effects of the relatively few pertinent changes in the next edition of Standard Methods. Accordingly it seems advisable to review these changes and briefly outline their background and probable effects.

AGAR PLATE COUNTS

Apparently the item causing most apprehension has been the modification of the incubation temperature to be prescribed for agar plate counts, and some confusion appears to exist concerning the use of the present standard tryptone glucose extract milk agar. In the Seventh Edition of Standard Methods published in 1939, the incubation temperature specified was "as near 37° C. as possible—tolerance 35° to 37° C," the usual temperature then in use for most bacteriological cultures, although dairy bacteriologists had had for some time convincing proof that this temperature was above the optimum for many bacteria commonly present in milk. Likewise, the agar then in use was the same as that then used in water analysis, an extract agar medium devoid of carbohydrate and containing only ordinary peptone. In recognition of the deficiencies of this medium when used for milk analysis, as reported by numerous investigators, the Seventh Edition prescribed that an agar containing tryptone, glucose, and skim milk would become the standard medium after July 1, 1939, and this medium has been standard for milk analysis since that time.

In 1939, Abele and Damon (1) reporting upon a comparative study of 1,000 samples of raw milk, stated that

> "The numbers of samples (7.4 percent and 2.6 percent, respectively, of retail raw and prepasteurized milks) the grade of which was adversely affected by higher counts obtained by plating on T-G-E-M Agar were no greater than might have been expected to result from the plating of duplicate samples on Standard Nutrient Agar. The only logical conclusion to be drawn from this crucial finding is that, although the T-G-E-M Agar produces larger colonies and permits the growth of some organisms the multiplication of which is inhibited on Standard Nutrient Agar, the plate counts of low-bacterial-content milk are not (or only rarely) increased to an extent to jeopardize the grade. In the comparatively rare instances in which low counts on Standard Agar are increased on

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T-G-E-M Agar sufficiently to change the grade, it must be recognized that these organisms were nevertheless present in the milk, even though not developed by the Standard Nutrient Agar plate, and that the grade awarded on the Standard Nutrient Agar count was, to that extent, misleading.

"It appears that average plate count limits now fixed in milk ordinances and regulations need not be raised to avoid anticipated chaos in the grades of milk supplies resulting from the higher counts obtained by the use of the new Standard T-G-E-M Agar."

This same tryptone glucose extract milk agar will continue to be prescribed in the Ninth Edition of Standard Methods, and inasmuch as milk control officials have had since 1939 to adjust to this medium, they should have no misgivings on this requirement.

In recognition of the many advantages of a lower incubation temperature, the Eighth Edition of Standard Methods published in 1941, permitted an optional incubation temperature of 32° or 37° C. While recognizing that incubation at 32° C. will give a more nearly correct estimate of the number of bacteria in milk than will 37° C., the higher temperature was retained, especially since many smaller laboratories had only one incubator and were accustomed to use this for diagnostic bacteriology, water analysis, etc., and also because of the presumed difficulty of not exceeding 32° C. in some laboratories during hot summer weather and under other adverse conditions. In retaining 37° C. incubation, however, it was stipulated that this was the maximum to which the incubator temperature should rise, thus many incubators were adjusted to a range of 35°–37° C., the tolerance specified in the Seventh Edition. During the past several years various laboratories have become aware of the advantages of a slightly lower incubation temperature for diagnostic bacteriology and have been incubating at 35° C., and in the current Ninth Edition of Standard Methods for the Examination of Water and Sewage, a temperature of 35°–37° C. is stipulated as the standard incubation temperature for agar plate counts and for coliform tests.

Prior to the Annual Meeting of the A.P.H.A. at Cleveland in 1946, the Chairman of the A.P.H.A. Milk and Milk Products Committee submitted a questionnaire to approximately 150 directors of milk control laboratories concerning incubation temperatures for the agar plate method. According to the present Chairman of the Standard Methods Committee on Examination of Milk and Milk Products (2), "Replies to the questionnaire indicated that a majority of the laboratories would use 35° C. incubation temperature instead of 37° C. if the 35° C. incubation temperature was recognized officially. The compromise does give us a higher count and provides that many diagnostic laboratories can use the same incubator for the culture of pathogens and for incubating milk plates. Although many diagnostic laboratories had been using 35° C., some were loathe to acknowledge it. Furthermore, we could not ignore the desirability of incubating plates at 32° C. and, since some official agencies were using 32° C. instead of 35° or 37° C., it was felt desirable to include this also as an optional incubation temperature."

This change of incubation temperature from 37° to 35° C. to be made in the Ninth Edition of Standard Methods for Dairy Products is the only change in the Agar Plate Count procedure of any consequence from the standpoint of potential effect upon the grade of a given milk supply. Actually a number of laboratories have been approximating this temperature by their practice of incubating near the bottom of the 35°–37° C. range. We have carried out some comparative studies of plate counts following incubation at 37°, 35°, and 32° C. and as reported elsewhere (3) confirmed the general experience that counts are somewhat higher at 35° and still slightly higher at 32° C.

The conclusions reached from a

study of this and data available from various sources are inescapable that if a supply of either raw or pasteurized milk is well within the limits of the present local regulations by standard plate counts at 37° C., the bulk of the supply will still be within that same grade if plates are incubated at 35° or even at 32° C. However, those supplies now near the upper limits of the grade as judged by 37° C. counts, are likely to be beyond the grade limits if plates are incubated at 35° or 32° C.

In this connection some conclusions reached by Fay and Howard (4) in 1940 may be of interest, in reporting the effect of the ruling of the Boston Board of Health stipulating the use of 32° C. instead of 37° C. as the incubation temperature for bacterial counts on milk.

"Grade A milk (253 samples, raw milk counts): As a result of incubating plates at 32° C., 12 percent of the samples were moved from full to partial premium class, and 3 percent were deprived of premiums. . . . Tank car samples (140 raw milk counts): On a basis of 200,000 standard (37° C.), 2 percent of otherwise satisfactory samples were caused to exceed the standard by incubating the plates at 32° C. . . . The producers of grade A milk were not sufficiently penalized by the use of the lower temperature of incubation to warrant readjustment of the premium bases. It would seem more logical to correct this situation by intensified field work with the relatively few indicated producers, thereby benefiting by the change of methods, rather than loosening the requirements on all grade A producers. Since the fundamental purpose of making most bacterial analyses on milk is to point the way toward improvement of milk supplies, it seems reasonable to conclude that the lower temperature of incubation facilitates the attainment of that objective."

MICROSCOPIC COUNTS

No change will be made in the procedure now required in the Eighth Edition of Standard Methods for the preparation and examination of milk films by the direct microscopic method. This procedure is basically the same as appeared in editions of Standard Methods as far back as 1927, and it is suggested that those persons apprehensive of the effects of improvements made in other procedures in the next (Ninth) edition might prefer to utilize the direct microscopic method for ascertaining the bacterial counts of raw milk.

It has been our experience (3) that clump counts properly made according to Standard Methods will be the most selective of the various tests for estimating the sanitary quality of milk; and it follows that their use will result in exclusion of more milk from Grade A than will plate counts or reduction tests. However, the results obtained in microscopic counts are based on examination of a materially smaller portion of milk than by the other procedures for estimating bacterial content, and hence becomes subject to greater sampling and other errors, particularly if the examinations are made by individuals not thoroughly qualified and experienced in this technique. Furthermore, our observations indicate that low counts are frequently reported by those using this procedure, apparently due to overstaining, unsuitable illumination and for one reason or another, failure to observe bacteria actually present.

REDUCTION TESTS

In the Ninth Edition of Standard Methods, the procedure for methylene blue reduction will be changed to require the hourly inversion of each tube to redistribute the bacteria, a modification designed to result in a closer correlation of reduction tests with plate and microscopic counts. It has been generally recognized that by the present procedure the methylene blue reduction times often show little correlation with other methods for estimating the sanitary quality of a milk supply. A recent review of this by Able (5) concludes:

"It appears that the methylene-blue reduction test, when conducted in accordance with current Standard Methods procedure, does not yield results commensurate with plate counts made of the same samples; and

that, consequently, the employment of this reduction test, by current procedure, as a substitute for the plate count in the determination of the suitability of raw milk for pasteurization, on the basis of numerical bacterial content, is certain to result in fallacious conclusions.

"In view of the higher—though still imperfect—degree of correspondence between plate counts and reduction times, and the nearly complete agreement with respect to percentages of plate counts over 200,000 per ml. and reduction times shorter than 6 hours, obtained by the examination of 1,000 samples, by a test procedure modified by periodic inversion of the tubes during the incubation period, to re-disperse the fat, it appears desirable that the Committee on Standard Methods for the Examination of Dairy Products give consideration to the inclusion of this modification in the recommended test procedure."

There is no question but that the modified technique to be required in the Ninth Edition gives much better correlation than did the method described in the current edition. However, even by the modified test requiring hourly inversion of tubes, individual samples of milk and even groups of samples at a given season of the year, although apparently meeting "Grade A" standards as evaluated by the methylene blue reduction test, may still yield counts of bacteria by plate or microscopic methods which are materially higher than allowable for milk of "Grade A" quality. For example, in one series of 47 raw milk samples reported upon (3) which were apparently "Grade A" as judged by methylene blue reduction, only 68 percent were below 200,000 per ml. by 37° C. plate count; only 47 percent by 35°, and only 45 percent by 32° C. plate counts, furthermore only 19 percent were below 200,000 by direct microscopic clump counts. Similar figures for 80 samples, apparently "Grade A" by resazurin reduction, yielded only 65 percent below 200,000 per ml. by 37° C. plate count, only 55 percent by 35°, and only 53 percent by 32° C. plate counts, with only 19 percent below 200,000 by direct microscopic clump counts.

RESAZURIN REDUCTION

An alternative reduction test using resazurin has been included in the Ninth Edition of Standard Methods. Considerable evidence has been adduced to show the correlation of this test with that obtained by methylene blue, although the resazurin test is known to be influenced more by other factors in the milk, such as leucocytes, and may thus be more sensitive than methylene blue. The principal advantage claimed for this test, however, is that it can be completed in 3 hours instead of the 8 required by the methylene blue procedure. Then also, the resazurin test can be read only once, for example after one hour of incubation, and the results interpreted on the basis of the shade of color reached, but obviously this introduces certain potential errors in reading and interpreting closely related shades of color. Hence this "one-hour" test is considered less satisfactory for control purposes than repeating the reading hourly for three hours and noting the time required to reach a certain single color standard, the "triple reading test." By its proponents, the triple reading test (6) is considered superior to other modifications of the resazurin test or to the methylene blue test, because it reflects mastitis and other abnormal milk more accurately, while indicating the bacterial content as well, or better.

RELATIVE ACCURACY OF METHODS

In discussing the Relative Accuracy of Methods for Measuring Sanitary Quality, the Ninth Edition of Standard Methods states (7)

"Estimates of the number of bacteria in dairy products should be sufficiently accurate to distinguish between satisfactory and unsatisfactory products. No method is sufficiently reliable in single borderline cases to establish whether or not the milk meets a definite quality standard. Practically all methods of determining whether samples of milk or cream conform to prescribed sanitary requirements have shortcomings of one kind or another, and this is especially true of methods for determining the bacterial

content. Such limitations are not serious providing they are not ignored when interpreting results of tests. Since each method depends in part upon a different principle, the variables differ both in character and in magnitude. Because each method is subject to these inherent and uncontrollable variables, both bacterial counts and reduction times should be regarded essentially as 'estimates,' and furthermore, *in the case of individual samples,* the results by one method should not be interpreted or reported in terms of results by another method. Implications that one method is in all cases indisputably more accurate than another are not valid.

"Many attempts have been made to establish the relationship between results obtained with different methods by setting up corresponding ranges for a large number of samples, according to major differences in bacterial content as indicated by numerical estimates of the bacteria and by reduction time intervals. Although such comparisons usually reveal a surprisingly high percentage of disagreements, since results on individual samples do not always exhibit the expected conformance to groupings, still there is enough correlation by groups to conclude that the results agree fairly well as 'estimates.' Where a sample falls in a lower class or grade by any one method than it does by another, the method which places it in the better class probably *has failed to reveal* some peculiar bacterial condition in the sample which was detectable by the other method."

EQUIVALENT STANDARDS

We have been particularly concerned with the formulation of equitable equivalent standards by the several methods for the same grade of milk. As has been indicated, corresponding ranges for a large number of samples can be set up, and in general there is sufficient correlation to allow use of the various tests. Assuming that each test is properly performed according to the procedures to be stipulated in the Ninth Edition of Standard Methods, the Direct Microscopic Clump count should be most selective, followed in order by plate counts at 32°, and at 35° C., and then by resazurin and lastly by methylene blue reduction tests.

The implication and practical application of these relations are substantiated by studies showing that when direct microscopic clump counts are used to evaluate a raw-to-plant milk for pasteurization, and a series of samples are "Grade A" by that procedure, they are similarly "Grade A" by plate counts and reduction tests. Conversely, the fact that a sample of raw milk is "Grade A" by the methylene blue reduction test is no assurance that it will be so by resazurin reduction and particularly by plate counts or microscopic clump counts, or that following pasteurization the resulting milk will comply with the requirements for "Grade A" pasteurized milk.

SUMMARY

Relatively few changes have been made in the Ninth Edition of Standard Methods in the procedures for the bacteriological examination of milk. The standardization of the incubation temperatures for plate counts at 32° or 35° C. is in line with current practises, has been recognized as desirable for many years, and is intended to result in a more nearly correct estimate of the number of bacteria present. Similarly, the modification of inverting the tubes hourly in the methylene blue reduction test tends to improve its accuracy and reliability, and provides a better correlation with results by plate counts and by microscopic clump counts. The introduction of the resazurin reduction test permits shortening the period of observation of such tests.

It has been pointed out that each test is based on different principles and affected in varying degree by different factors, and that while equivalent values can be set up for groups of samples, any individual sample may not conform to the average. These inherent characteristics are reflected in differences in selectivity between methods. Nevertheless supplies of milk now well within the maximum limit of bacteria permitted for a grade when examined by methods prescribed in the current edition of Standard Methods, should still be within that same grade if examined by the pro-

cedures to appear in the Ninth Edition. Difficulties may be encountered at first where supplies are near the upper limit of the grade by current procedures, particularly if reduction methods are used for grading the raw milk to be pasteurized.

The importance of adherence to the requirements of Standard Methods is stressed. Certainly progressive sanitary milk control should be based on improved laboratory methods such as those to appear in the Ninth Edition of Standard Methods. These methods are designed to yield the most nearly correct information on a milk supply, as only then can we expect reasonably good correlation between farm and plant conditions, care and handling, cooling, age, and bacterial content of the milk.

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A Study of Milking Machine Cleaning Methods

(*Continued from page 199*)

flush method with an alkyl sulfate type detergent, a series of tests was run over a two month period. The alkyl sulfate type of detergent used was Dreft, 0.2 and 0.1 percent. Two herds of six cows each were used in the study. The flush method required no scrubbing, but only thorough flushing in a 130° F. solution of detergent followed by a 160° F. clear water rinse.

Standard plate counts of milk samples drawn at each milking showed daily, herd, test and milking period differences but the average bacterial counts for the tests showed no significant difference between the flush and scrub methods. The bacterial counts of the wash water samples were mostly below 30/ml. so were not considered significant.

The cleaning of a milking machine by the flush method took five minutes as compared to nine minutes required for the scrub method. The flush method with Dreft left a brighter appearing milking machine than did tri-sodium phosphate in the scrub method.

An increase in the hardness of the wash water from 5 gr./gallon to 21 gr./gallon had no significant effect upon the bacterial counts of the milk in either washing method, and had no effect upon the appearance of the equipment in the flush method.

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1. Department of Bacteriology.
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3. Dreft is the Procter & Gamble trademark for a household synthetic detergent.

Abstracts of the Literature of Milk and Food During 1947

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Abstracts as published in several journals during the year 1947 are the basis for the following summary of literature in the field of the dairy industry. Consequently some of these papers were printed in 1946. However, the summary is not restricted to either of these calendar years. Limited space made it impossible for us to include all articles that are worthy of mention, but we estimate that about four-fifths of the available literature has been covered.

The following abbreviations have been used:

CA means *Chemical Abstracts,* vol. 41 (1947).

DSA means *Dairy Science Abstracts,* vol. 8 (1947).

JDS means *Journal of Dairy Science,* vol. 30 (1947).

In a few cases, the volume and year of a reference is different from those of the year 1947; in such cases, specific publication data are fully given.

ANALYSIS

Rowlson & Mickle (45) report on application of Babcock's and Richmond's formulas in detection of watered and skimmed milk.

Tests listed by Crawford (50) as essential in determination of milk quality as it enters and leaves plant.

Of 27 unhomogenized and 84 homogenized milk samples, the Mojonnier method gave higher results than the Babcock test in 22 unhomogenized and 80 homogenized samples according to Harland and Davis. (76)

Sanders & Sager report modifications concerned with use of substrate and precipitant in the phosphatase test as applied to cheddar cheese and fluid milk. (165)

Cook & Steers (197) reported on the use of trypsin and alkaline phosphatase activity of feces in the detection of fecal matter in food products.

Improvements in the ferric thiocyanate method of estimating peroxide in butter-fat were described by Loftus Hills & Thiel. (198)

The Mojonnier, Babcock, Gerber, Minnesota, and Pennsylvania methods for determining the fat content of homogenized milk were compared by Trout & Lucas (199). The latter two methods were not considered satisfactory.

The effects of dilution, amount of indicator, etc. were studied by Zilliox *et al.* (200). They recommend dilution of milk with twice the volume of CO_2-free water, with 1 ml. of 2% phenolphthalein in neutral alcohol.

Eastman & Maybee (201) found the Pennsylvania modification of the Babcock test gave higher readings.

Carter (202) describes another method of estimating D.D.T. in milk, based on the determination of organic chlorine.

Schechter *et al.* (203) describes a colorimetric method for measuring D.D.T. in milk and fatty products. It will detect 1 p.p.m.

The polarimetric determination of the carbohydrates in canned milk products was given by Laĭkovskiĭ (204). Formulas are presented.

A method for determining acetoin and biacetyl in acid cultures in sour cream is described. (205) Various factors that may influence the Voges-Proskauer reaction were investigated.

Twenty-six samples of mare's milk, one Palomino, and four Percheron were assayed for water, protein, ascorbic acid, P. K. Mg and Ca. Comparisons

were made of these values with cow, goat and human milk by Holmes *et al.* (206)

Kahane & (Jeanne) Levy (207) reported that analysis of the different portions of the milking gave practically constant choline contents; which shows that the phosphoaminolipides are not constituents of the fat globules.

The use of parchment beakers instead of glass in the acidobutyrometric determination of fat is recommended by Hostettler & Künzle. (208)

The filtration method for Cu in butter was adapted to cream. The method is outlined by DeAth, Lightfoot, & Moir in a New Zealand report. (209)

When milk is preserved with CH_2O in the ratio 1:20,000 Mucciolo & Cerveira (210) found: (1) the peroxide test is not influenced at ordinary temperature in 72 hours (2) the reductase test is reduced to 1.5 hours at ordinary temperature in 24 hours, and to 4 minutes in 72 hours. The phosphatase test is not appreciably affected.

The polarigraphic estimation of ascorbic acid in milk is described by Perrin (211).

Numerous sample analyses of powdered milk were made by Anselmi & Cetari (Cesari) (212) in Italy. The methods of analysis were given.

The effects of water on the constants of different types of milk were determined by Romani & Liuzzi. (213)

Addition of varying amounts of 2–2.5% H_2O_2 was found by Anselmi to be unsatisfactory for preserving milk; to replace present accepted methods. (214)

A method for determining the presence of urine in cow milk is given by Martinez & Ramalls (215).

Freezing point determinations made by Anselmi & Rossi (216) on milk from the same cow over a period of one year indicated no significant difference between milk collected in the morning or evening.

The determination of filth and extraneous matter was discussed by Clarke. (217) He pointed out that methods for determining extraneous matter in various dairy products have been developed and are used.

A study of the methods of testing cream for fat in Belgium was made by Bernaerts. (218)

A wartime problem in the Netherlands was to identify milk fats from different sources. Van Voorst (219) presents analysis of fats from cows, goats, and sheep. Only 1.5 g of fat are needed to distinguish on the basis of volatile fatty acids.

Janse (220) of Friesland discusses the fat determination of dairy products. He suggests the Rose-Gottlieb method be discarded in favor of the Weibull method.

Lucchetti *et al.* (221) find the Schiff-Sorensen reaction gives good results on the protein fractions of whole milk and casein but entails difficulties in gradually deproteinized liquids.

Lawrence (222) provides data on the specific gravity (by hydrometer and total solids) of condensed whey.

Talenti (223) compared the H, quinhydrone, glass, and Sb electrodes for the measurement of pH in milk. The Sb electrode was most accurate, especially in the presence of CO_2. It is also simple, strong and cheap.

Romani *et al.* (224) state that the increase in specific gravity of milk on standing or cooling has no effect on the specific gravity of the serum or the dry fat-free residue. Therefore the dry fat-free residue should be determined in such cases and not calculated from the altered specific gravity.

In a study of moisture in dry products of milk, Choi *et al.* (225) report the dehydration of lactose monohydrate in boiling toluene to be a first order reaction. Particle size and rate of distillation are factors.

A study of the accuracy of methods of sampling milk deliveries at milk plants by Tracy *et al.* (226) lead to the conclusion that composite samples need not be taken in aliquot portions

but that Association tests should be double-checked occasionally.

Factors influencing the keeping quality of milk and butter have been studied by measuring the oxidation-reduction potential (Saal & Heukelom) (227).

Methods for the determination of quaternary ammonium compounds in foods have been developed by Wilson (228). As little as 0.5 p.p.m. in milk may be detected.

The effect of watering milk with isotonic solutions was studied by Romani & Liuzzi (229). The milk was diluted with (1) a 0.90% by vol. soln. of NaCl, (2) with a sugar soln., and (3) with the two solutions combined.

From India comes support for the value of the refractive constant in determination of the purity of milk, and a table showing density, SNF, n and k for both cow and buffalo milk, prepared by Rangappa. (230)

Harris (231) has prepared an annotated bibliography of methods for the examination of foods for filth.

A comparative study of the protein and nonprotein nitrogen of human and cow milk was made by Escudero & Waisman (232). The samplings from twenty-seven women varied from 1.520 to 1.876 g/l., with an average of 1.726g.

ANIMAL HEALTH

The control of bovine tuberculosis in the United States is traced and the statement included that in November 1940 after 23 years of concerted effort, every one of the 3,071 counties in the United States including the District of Columbia was a modified accredited free area. (14)

Prevention of mastitis through managed milking and proper housing of cows described by Fincher. (36)

Bryan (71) lists methods for control bovine mastitis, including penicillin.

A review is given by Klussendorf (80) on the diseases of animals transmissible to man through milk and milk products.

Chase (92) reports on salmonella studies in fowl.

Samples of milk from Bang's disease reactors were cultured and inoculated into guinea pigs with recovery of *Br. melitensis,* report Dawson & Fagan. (97)

Francis (116) discusses various tuberculin tests, including intradermal; also bovine tuberculosis eradication in Great Britain.

Mullen (176) reviews the laws enacted by Parliament for the purpose of controlling diseases of cattle transmissible to man.

Fly control measures reported by Matthysso (179) to be responsible for absence of "pink eye" in milking herd. Recommends two DDT syrayings a year in northern latitudes and continuation of farm sanitation and manure disposal practices.

Dairy cows ingesting silage treated with one pound DDT per ton showed no toxicosis after 141 days of feeding according to report of Allen, Lardy, & Wilson. (181)

Massive, repeated doses of penicillin caused only a temporary reduction in number of *Staphylococcus aureus* shed in milk from infected quarters, reports McCulloch. (233)

Although hypocalcemia is a characteristic symptom of milk fever, it appears to be secondary to a parturient alkalosis, according to Craige & Stoll. (234)

Abortion of cattle due to infection with "vibrio fetus" was reported by Plastridge *et al.* (235)

Bryan (236) discussed prevention, control, and treatment of mastitis.

Raising heifer calves on mastitis milk had no detrimental results, reported Johnson (237).

Resistance to brucellosis following vaccination with Strain 19 may be overcome by exposure to massive field infections, Haring *et al.* (238) report in discussing the value of vaccination.

Vaccination against bovine trichomoniasis, according to Morgan (239) is of limited value.

Craige (240) described experimental studies designed to reveal the cause of milk fever.

Coliform organisms were much more resistant than mastitis streptococci to penicillin in *in vitro* tests, reported Heishman. (241)

That staphylococci may be causative agents in abortion in cattle was suggested by Pounden & Krauss. (242)

Wiese *et al.* (243) continuing their study of a cow's nutritional requirements have shown that riboflavin deficiency produces pathological symptoms which disappear rapidly upon treatment with riboflavin.

Emphasizing the need for extreme care in the taking of samples, Cunningham *et al.* (244) report the results of extensive comparative studies on the bacteriological diagnosis of mastitis.

The comparative effectiveness of various methods of administering penicillin in the treatment of clinical streptococcal and staphylococcal infections of cow udders is reported by Murname. (245)

The *in vitro* action of disinfectants and the application of CTAB in the control of Str. *agalactiae* are reported by Hughes & Edwards. (246) The teat infection rate rose sharply as a result of chapping when a CTAB cream was used on the teats.

Injection of 40 ml of evaporated milk is claimed by Winter (247) to cure "pink eye" or keratoconjunctivitis in cattle.

The majority of cases of brucellosis in the United States, according to Schmidt, (248) "are of the abortus variety". The widespread distribution of the organism in milk and the attenuation of it by the cow has resuted in a chronic and obscure disease, difficult to diagnose and obstinate to treat.

Watts *et al.* (249), found no penicillin in milk with intramuscular doses up to 1 million units. *Strept. agalactiae* and *Staph. aureus* from bovine mastitis had the same order of sensitivity as the Oxford Staphylococcus. Fresh serum increases the inhibitory action of penicillin.

BACTERIOLOGY

Winter, Greco, & Stewart (6) report on pasteurization of liquid egg products. Both temperature and time were found to be important factors in destruction of bacteria in liquid egg.

Destruction of Salmonella in liquid whole egg by pasteurization reported practicable by Winter. (7)

McCulloch's (37) text on disinfection and sterilization contains valuable information to research and practical worker alike.

"Microbes of Merit" by Rahn (38) is a text of special interest to layman and scientist alike.

Various methods of sterilization of micro-organisms in dairy equipment are presented by Rahn. (40)

Analysis of coliform tests on pasteurized milk lead Buchbinder & Fertiz (49) to conclude that two standards should be used, one for May through November, and a lower count for November through April.

DuBois & Dibblee (51) report that concentrations of cationic germicides varying from 1:500 to 1:20,000 can easily be determined in milk.

Bacteriological tests in connection with H.T.S.T. pasteurization were described by MacLean. (66)

Archambault (88) discusses routine examination of milk samples with emphasis on coliform densities.

Recommendations for control of thermoduric streptococcus in a herd or milk supply listed by Bryan. (91)

At 200 to 250 p.p.m. Roccal reduced bacteria count in milk but 10 p.p.m. and up imparted disagreeable flavors, according to Mull & Fouts. (129)

How the laboratory aids the milk sanitation program is described by Geiger, Engle, & Marshall. (138)

By comparisons made on 2588

samples of raw milk Anderson & Wilson (139) concluded that the methylene blue test gave the best indirect index of the keeping quality.

Studies made by Jensen (141) using various bactericidal agents for sanitizing creamery water supplies indicate that sodium hypochlorite and the surface active compounds studied are highly effective germicides in the treatment of previously filtered and pH adjusted water.

Alkyl dimethyl benzyl ammonium chloride substantially reduced bacterial counts on food and milk utensils, according to DuBois & Dibblee (151) who conclude that their unscrupulous addition to milk cannot cover up insanitary practices.

Anderson, (153) in comprehensively reporting on use of direct microscopic test on raw and pasteurized milk, lists history, value, limitation of plate counts and reductase tests, and correlation of coliform test with direct count.

Coliform bacteria are probably recontaminants not subjected to heat treatment, reports Dahlberg (158) after tests on 108 lots of pasteurized milk. Necessity of making coliform tests on freshly pasteurized milk if results are to be significant is stressed.

Quaternary ammonium and phosphonium compounds studied by Mueller, Bennett, & Fuller (164) reportedly retained effectiveness, and were satisfactory insofar as corrosiveness to metals, solubility, odor, taste, and color after 2½ years storage.

In Milan, Italy, area complete sterilization of milk in about 8 hours are reported by adding 2 cc. of hydrogen peroxide to a liter of milk; effective for 3 days. (167)

Craige (168) lists factors to consider when applying results of coliform tests, and reports pasteurized milk unsatisfactory if positive for coliform in more than two of five 1 ml. samples.

Fabian (169) discusses sources of heat-resistant bacteria and lists eight measures for their control in milk.

Johnson & Bryan (175) report that tests on 83 herds prove efficacy of microscopic examination of incubated producer milk samples in detecting streptococcus mastitis in dairy herds.

Removal of milkstone with subsequent cleaning and disinfecting necessary for control of thermoduric and thermophilic bacteria in dairy plants reports Noyes. (188)

Various phases of the laboratory examination of milk were discussed by Breed (250). He suggested that coliform standards might vary from one area to another.

Johns & Pritchard (251) investigated the possible misuse of quaternary ammonium compounds as preservatives in milk. They were ineffective compared with formaldehyde.

What is meant by coliform bacteria is discussed by Doetsch. (252)

The value of microscopic examination in detecting sources of poor quality milk was reported by Bryan (253) who gave details of the several technics.

Flash pasteurization of liquid egg at 60°C greatly reduced the number of Salmonella and other Gram-negative bacteria, report Solowey *et al.* (254)

Types and numbers of moulds in spray-dried whole egg powder are reported by Watson & McFarlane. (255)

Germicidal powers of glycols, glycol benzoates, and related compounds were studied by Heim & Poe. (256)

Effectiveness of a number of cationic germicides against a variety of test organisms was reported by Hucker *et al.* (257)

Pederson (258) deals with the significance of bacteria in frozen vegetables.

Incidence and degree of *Esch. coli* contamination in dried egg were studied by Sutton & McFarlane. (259)

Microbiology of egg powders prepared by lyophilization, with special reference to resazurin reduction test, was studied by Hirschmann & Lightbody. (260)

Survival of food-poisoning staphylococci on nut meats was studied by Smith & Iba. (261)

McFarlane *et al.* (262) presented data for plate and direct counts on over 6,000 samples of spray-dried whole egg.

Vinton *et al.* (263) discussed the effect of substrate upon the thermal resistance of spores in canned meat products.

Gross & Vinton (264) studied the thermal death time of a food-poisoning staphylococcus in meat.

Unusually heat-resistant butyric acid-producing, spore-forming anaerobes isolated from spoiled canned tomatoes were studied by Clark & Dehr. (265)

Thermophiles, their sources and control in a cannery, are dealt with by Lipske & Hubbard. (266)

Pederson (267) discussed relationship between *Lact. acidophilus* and *L. casei.* He believed these were rough and smooth strains of a single type.

Alff & Buchbinder (268) discussed the practical significance of so-called heat-resistant coliform organisms in the coliform testing of pasteurized milk.

"Reversal", neutralization and selectivity of cationic germicides was investigated by Klein & Kardon. (269) Zephiran had a high degree of selectivity and showed several hundred-fold greater activity against Gram-positive than against Gram-negative bacteria.

Lawrence (270) tested a number of compounds for their suitability as inactivators in germicidal testing of quaternary ammonium compounds. A sulfonic acid derivative gave best results.

Edwards & Morris (271) investigated heat-resistant reducing substances produced by bacteria which affected results in methylene blue and resazurin tests for milk quality.

Johns (272) compared germicidal speed of 4 quaternary ammonium compounds and 2 hypochlorites against a variety of test organisms, using a glass slide technique. Quaternaries were generally more effective against Gram-positive species, hypochlorites against Gram-negative.

Both penicillin and streptomycin in low concentrations in milk were found to stimulate the growth of several spore-formers as well as *Staph. aureus* and *Strep. agalactiae,* according to Curran & Evans. (273)

Phosphate in an agar medium combines with some constituent of agar to form a substance promoting growth of lactic acid bacteria, according to Hunter. (274)

Fine mists of hypochlorite were effective in destroying air-borne phage provided relative humidity was above 50%, reported Wolf *et al.* (275)

Mallmann (276) reported excellent results using either quaternary ammonium or hypochlorite solutions to sanitize washed beverage glasses.

Wolf & Batchelor (277) reported the germicidal efficiency of sodium hypochlorite against Gram-negative organisms resistant to penicillin.

Resazurin was preferable to methylene blue for testing milk, da Silva (278) reported. Results were obtained one hour instead of four, while resazurin was more sensitive to weakly reducing organisms and showed a sharper color change.

The relation of various food-processing operations to the bacterial growth curve was discussed by Stumbo (279) and recommendations made for control of micro-organisms.

Washing dirty eggs in 400 p.p.m. Emulsept or 100 p.p.m. chlorine reduced the bacteria count of egg meat from 1.5 million to 3000, according to Penniston & Hedrick. (280)

That the concentration of undissociated hypochlorous acid may not always be the dominant factor determining the germicidal efficiency of hypochlorites against vegetative cells was indicated by the studies of Wolf & Cousins. (281)

McDonald (282) describes an "oil seal" technique for the protection of mother cultures and bulk starters from

bacteriophage which has proved successful over many months.

Tanon (283) reports on the addition of 0.01% Microlysine (Cl_3CNO_2) proposed by Bertrand to destroy or retard the growth of bacteria in milk.

Tanon (284) claims that Microlysine (chloropicrin) 1/10,000 in milk destroys all but lactic acid bacteria and prevents souring for 6–8 days.

Shew (285) describes a simple technique for the detection of phage infection in bulk starter or in the cheese vat.

Skar (286) compared his modification of the methylene blue reduction test with several others, and found his gave the shortest reduction times.

Proof has been obtained by Mosimann & Ritter (287) that bacteriophages active against the aroma bacteria are responsible for the failure of aroma production in butter cultures.

Thomas *et al.* (288) found the appearance of shipping cans correlates well with the colony count of rinsings. They recommend the resazurin test carried out on the rinsings as a simple routine method of detecting heavily contaminated churns.

Davis *et al.* (289) report on the effect of varying methods of washing and sterilizing shipping cans on the bacteriological quality of milk subsequently introduced.

Following laboratory pasteurization, thermoduric counts exceeding 50,000 per ml. were obtained with 12.8% of farm samples and 39.5% of bulk milk samples, report McKenzie & Morrison. (290) Milking machines were the principle sources of heavy contamination.

Bird & Egdell (291) found few thermoduric organisms in milk from selected farms in the West of England, but from unselected farms 1.5% gave a count exceeding 100,000 per ml. after laboratory pasteurization. Examination for thermophiles showed only 1.7% with counts exceeding 100 per ml. and none exceeding 10,000 per ml.

When cation-active agents are used as bactericides in detergent compounds, Guiteras & Shapiro (292) emphasize that the detergent be emulsifying and not saponifying, else the resulting soap will inactivate the cation-active agent.

That heavy contamination of the exterior of the teat may result in the recovery of *B. coli* from the interior has been shown by McEwen & Samuel. (293)

Although *B. subtilis* spores were destroyed most readily by hypochlorite as the pH of the solution was lowered, dried films containing *Staph. aureus* and micrococci were found by Wolf & Cousins (294) to behave quite differently. Maximum germicidal efficiency was noted at pH values from 9.4 to 11.0 for solutions of 25 to 200 p.p.m. available chlorine. They suggest that the formation of chloroamines at the higher pH values may explain their findings.

The effect of penicillin upon heated bacterial spores was extremely variable, and penicillin has no application in the preservation of food, report Curran & Evans. (295)

Cox (296) investigated the effect of acidity on the production of biacetyl by betacocci in milk. He found a considerable variation in the amount of biacetyl produced by different strains. They produced and subsequently destroyed biacetyl. The rate of growth of the organisms was progressively slower the lower the pH but as much biacetyl was produced at low as at high pH values. Capacity to produce diacetyl could not be correlated with any other property of the organism. The results furnish an explanation of the rapid production of biacetyl by mixed cultures.

Albert *et al.* (297) in their fourth paper in the series classifying important dairy product organisms deal with *Bacterium linens*.

BUTTER

Thirteen of the more important developments and improvements in equipment and processes used in the butter industry are summarized by Wilster. (34)

Leggatt (39) reports imperfectly cleaned equipment responsible for presence of yeasts and molds in butter after pasteurization.

The Creamery Package process of continuous butter-making is described in detail. (43)

McDowall (298) describes six different methods for continuous butter production.

Unwashed butter showed significantly inferior keeping quality in experiments conducted in Australia by Pont. (299)

White (300) stressed the importance of correct neutralizing procedure to obtain the recommended pH (6.7–7.2) of butter.

Methods of preserving butter and butterfat in Germany are reviewed by Mohr. (301)

Nilsen (302) has confirmed the claims of Virtanen that his special AIV salt improved the keeping quality of ripened cream butter; it also practically precluded the formation of oily flavor.

In the Senn process for making butter by a continuous process, the cream is churned with CO_2 under pressure in a cylinder of stainless steel with an agitator revolving 3,000 r.p.m. The machine is run by one man and the fat loss is reduced to about one percent compared to 3 to 4 percent by the usual method. The buttermilk is of excellent quality. (303)

Mulder (304) studied the effect of fat content of cream on the hardness, moisture content, and other properties of the butter. The lower fat cream took longer to churn and the butter made from it contained more moisture, more buttermilk and was harder to dry than butter made from the higher fat cream.

Catalysis of oxidation of fat in cold storage butter by salt and acid present in the water phase at 40° F. was studied by Hills & Conochie. (305) Dispersed water alone in butterfat accelerated oxidation. Catalysis of fat oxidation by commercial NaCl in acid solution was found to be due to the combined effects of halide and H ions, which is a direct one and the presence of other butter constituents is not necessary. A mechanism for the catalysis is suggested and supported by expl. evidence. The oxidant effect of traces of $MgCl_2$ in com. NaCl when the salt is dispersed in the dry state is similarly explained. Practical implications of these findings are discussed.

Luchetti (306) found ultraviolet rays can decolorize and oxidize butter in air, but only to a small degree in dry CO_2. Carotene is decomposed by ultraviolet rays.

Ritter (307) reported that the use of remelted Al alloys without abnormally high Cu content offers no danger for the manufacture of boxes for melted butter.

Fishy and oily flavors in butter were almost entirely eliminated according to Hietaranta (Finland) (308) by raising the pH of the butter to 6–7 by addition of a mixture of NaCl, Na_2HPO_4, and Na_2CO_3.

Continued investigations of Danish butterfat were reported by Winther and co-workers. (309) Over 60 pages of tables were reported.

CHEESE

Arguments pro and con the manufacturing of cheddar cheese from pasteurized milk are listed by Wilster. (35)

Minimum sanitary requirements of National Cheese Institute, standards for milk quality, premises, equipment, and personnel, included in article by Reichart. (120)

Modifications in technique of cheddar cheese-making to compensate for high cooking temperatures are discussed by Babel (310), who also reports on the effect of growth at various temperatures upon the rate of acid production by starters.

Methods for precipitating proteins from sweet whey are described by Burkey & Walter (311); curd so obtained shows promise for making cottage or Roquefort-type cheese.

Development of flavor in Cheddar cheese was discussed by Dahlberg & Kosikowsky. (312) Much remains to be learned.

Streamlined cheddar cheesemaking, wherein a centrifuge was used to remove the whey from the curd, was described by Foust. (313)

Development of greater acidity tended to inhibit lipase activity and thus reduce amount of lipolytic flavor defects in Cheddar cheese, according to Hlynka *et al.* (314)

The "pink test," based upon reduction of resazurin to pink in five minutes, was proposed by Hlynka *et al.* to determine setting time in Cheddar cheesemaking. (315)

Manufacture of various types of cheese from milk pasteurized at high temperatures was investigated by Andersen (316) in Denmark.

Addition of $KClO_3$ to cheese milk to prevent early gas defect was advocated by Galesloot (317) in Holland.

Differences between Gruyere and Emmenthaler cheese are discussed by Koestler. (318)

A method of adjusting the fat content of cheese milk, based upon formol titration method of estimating total protein and the Gerber method for fat, was found by Pettersen (319) to be sufficiently accurate for plant use.

Pette & Van Beynum (320) describe a lactose fermenting organism causing blowing in Dutch cheese, which they have named *Lactobacillus bifermentans.*

Editorial discussion (321) of cheese and its relation to health. Extracts from National Dairy Council's reference book, "Newer Knowledge of Cheese" and Fabian's article in A.P.H.A. Journal, August, 1947.

Dahlberg (322) reports on the canning of cheese and suggests (1) milk be pasteurized, (2) $Mg(OH)_2$ be placed on parchment wrapping paper, and (3) cans be closed under 25 in. of vacuum to control CO_2 developed during ripening.

Faivre (323) reviews physicochemical properties of casein and other phenomena in cheese processing. Emulsifying salts and practical indications are mentioned.

Butterfat balance in a cheese factory is discussed by Shew. (324) A loss of 3–4% must be expected.

The effect of salting and the conditions of maturing on the quality of Pecorino-, Romano-, and Roquefort-type cheese was studied by Kugenev. (325).

A short and rapid method for the determination of volatile fatty acids in cheese was presented by Kosikowsky & Dahlberg. (326)

A method for preparing cottage cream cheese was described. (327)

Pien (328) pointed out the need for a new yield coefficient in cheese making. The yield coefficient (K) has been defined as the weight of nonfat solids yielded as cheese by 1 l. of milk.

Lack of fuel and transportation lead to investigation of the possibility of preparing Edam cheese at 20 instead of 30° C. Details of the method are given. After nine months, the physical, chemical, and organoleptic properties as well as the chemical analysis satisfied official requirements. (329)

FOOD INDUSTRIES

Shellfish sanitation is covered in detail in this manual of recommended practices. (11)

Lythgoe (15) abstracted Volumes 1 and 2 of Jacobs books on the "Chemistry and Technology of Food and Food Products."

Bacterial count standards are contemplated for frozen pack vegetables according to Jones & Pierce. (67) No reported outbreaks of food poisoning have been attributed to these products so far.

Various methods of disinfecting raw vegetables, fruits or whole lettuces to reduce high bacterial contamination are discussed by Mann. (68)

Mathias describes the physiology of

the oyster and discusses requirements shellfish industry must meet in State of Washington. (69)

The activities of the Department of Health, Hawaii, including new regulatory provisions and educational courses for producers and plant operators, are described by Nutting. (100)

Planning for future, including discussion on decentralization of Federal meat inspection and advice to packers on meat preservation is included in article by Miller. (124)

H. Thorton recommends nationalization of slaughter and inspection of meat and discusses reasons for historical religious scruples pertaining to consumption of certain meats. (132)

Etchells & Jones (155) classify certain brined, salted, and pickled products and give procedures for bacterial examination.

"Sanitary Sam Program" by Beatrice Foods Company, incorporating prizes and bonus awards to employees for machine and personal cleanliness, has improved sanitation. (166)

Useful information concerning the properties of solutions of sucrose and of mixtures of sucrose and invert sugar is presented by Junk *et al.* (330)

Fermentation of egg white by yeast for removal of sugar before drying is recommended by Ayres & Stewart. (331)

Jarvis & Nilson (332) review new technics in commercial preservation of fish and fishery products.

Obold & Hutchings (333) review sanitary practices and standards essential in frozen food plants.

The importance of quality control in the frozen food industry is emphasized by Fitzgerald. (334) Standards of sanitation are discussed.

Pros and cons of standards of identity for food products are discussed by Peters. (335)

K. F. Meyer (336) relates how California instituted sanitary control in food plants.

The place of salt in the food industry was described by Dunn. (337)

Problems in the production of precooked frozen foods were indicated by Hutchings & Eyers. (338)

Evidence was presented by Hirschmann & Lightbody (339) that deteriorative changes in stored egg powders (lyophilized) are related to bacterial content before drying.

Elliott (340) states evaluation of surface pH as an index of freshness for fish fillets is of limited value.

From Norway, Aschehoug & Vesterhus (341) reported bacteriological investigations of spoilage of winter herring during storage.

Bacteriological control in poultry boning plants is discussed by Gunderson *et al.* (342)

Sanitary practise in a carbonated beverage plant is described by Knowlton. (343)

Designing and constructing sanitary food equipment is discussed by Feiner. (344)

A quality control program for frozen cooked foods was described by Fitzgerald. (345)

Addition of carbohydrates to whole egg before spray drying exerts protective effect during drying and prolongs shelf life, reported Dawson *et al.* (346)

Fundamental principles of heat sterilization and their application in food processing are dealt with by Ball. (347)

Barron (348) describes how to work out a sanitation program in a food plant.

A discussion of the wartime production of foods in Germany by Carlin (349) includes dairy products.

FOOD POISONING

Observations made after 350 food poisoning cases, due to ingestion of cheese contaminated with *Salmonella typhimurium,* showed these organisms remained viable for at least 302 days in cheese kept between 43–48° F. according to Tucker *et al.* (8)

D'Albora, Ingegno, & Edson (10) describe a food poisoning outbreak due to *Salmonella montevideo* in which 350 persons were affected.

Cherry, Lentz, & Barnes (22) present epidemiology of outbreak of gastroenteritis from food with implication of *Proteus mirabilis*.

Williams *et al.* (28) describe three outbreaks of staphylococcal food poisoning involving approximately 648 cases from ice cream. Pasteurization of mix now required.

Food poisoning outbreaks in London during 6 years of war are classified and tabulated. (47)

A milk borne epidemic of diarrhea attributed to *Pseudomonas acruginosa* is described by Ensign & Hunter. (87) Insanitary conditions found in dairies.

Cyanosis due to methemoglobin produced by ingestion of sausage containing $NaNO_2$, and treatment, reported by Barilari & Benedetto. (118)

"Problems and errors in assigning causes of bacterial food poisoning" by Dack (125) describes misconceptions of part played by harmless bacteria in food poisoning.

Pastry fillings supporting growth of *S. aureus* listed by Cathcart, Godkin & Barnett. (126)

High incidence of mussel poisoning in California leads Health Department to invoke quarantine on gathering from May 1st through October 31st. (145)

From prolonged tests on rats Dudley & Neal (146) consider it unlikely that small amounts of methyl bromide or bromide residues on commercially fumigated foods are harmful to man.

Curing salt, containing 92 percent sodium nitrite was added to oatmeal and 11 of 125 who had breakfast were poisoned. (147)

Staphylococcus auréus isolated from digestive tract of flies indicates probable role in transmission of food poisoning according to Moorehead & Weiser. (172)

Evidence presented by Mitchell and his associates (182) indicated that outbreak of 423 cases of gastroenteritis could be attributed to ingestion of food prepared from uncooked eggs infected with *S. pullorum*.

Food poisoning by micrococcus (Staphylococcus) enterotoxin has been reviewed by Haynes & Hucker. (350)

Macdonald (351) reports that the great majority of strains of *Staph. aureus* isolated from accredited milk fall into one phage type, 42D, in contrast with the multiplicity of types in human infections. This may be of value in tracing food-poisoning and other human infections of bovine origin.

Staphylococcus food poisoning is still a serious problem according to Dack (352) who discusses sources of contamination, foods affected, and methods of controlling the growth of the organism and production of toxin in foods.

Telford (353) has studied the toxicity of milk, cream, and butter from goats fed varying doses of DDT, using rats and flies as criteria.

Pathogenic staphylococci were isolated from sweetened condensed milk found to produce serious illness in infants, report Buttiaux & Lesne. (354)

HUMAN DISEASE

"California's Health", (20) reports 7 cases of typhoid fever traced to raw milk contaminated by a carrier employed as a milker.

Fabian (25) reviews cheese epidemics and concludes pasteurization is only safe procedure.

Epidemiology of two cases of typhoid fever revealed food handler to be carrier according to Crocker. (29)

Groulx (30) gives a resumé of milk sanitation in Montreal, stressing decline in milk-borne diseases as a result of increased attention to producing farms and pasteurization plants and improved laboratory facilities.

Importance of proper cooking and processing of pork stressed by Gould (32) for the control of trichinosis.

Jordan & Borts (33) report on oc-

currence of *Brucella melitensis* in Iowa.

Shookhoff, Bernkrant, & Greenberg (75) report an outbreak of 84 cases of trichinosis with no fatalities in New York City. The precipitin test was found more useful than the intradermal test for early diagnosis.

Alice Evans (81) discusses prevalence of Brucellosis in the United States and lists control mesaures.

In opinion of Gilman, Dahlberg, & Marquardt (122) an ageing period of not less than 60 days is assurance against viable *Brucella abortus* organisms in commercial Cheddar cheese.

"Milk-Borne Disease in Massachusetts, 1941–45" is a comprehensive report by Feemster. (123)

Properly trained men experienced in milk sanitation and standard milk ordinance cited by Carter (127) as means of controlling milk borne diseases.

An outbreak of 55 cases of Q fever among stockyard and slaughter house employees reported by Topping, Shepard, & Irons. (131) The etiological factor was present among cattle though they presented no evidence of disease.

Mallam & Alhadeff (135) show how ducks' eggs may become infected at coitus or from contact with ground and moisture and pass Salmonella infections to man.

The factors contributing to the spread of communicable disease through food are discussed by Boyd & Woolsey. (136)

Murphy, Petrie, & Work (143) report epidemiological evidence on 10 cases of infectious hepatitis and conclude that possibility of outbreak being unrelated to milk supply appears remote.

By means of bacteriophage, Desranleau (144) isolated new strain type (D_5) of *B. typhosum* in outbreak of typhoid fever involving 41 cases with 8 deaths.

Eleven cases of trichinosis were reported by Oregon State Board of Health (156) from eating infected pork. Need for thorough cooking of pork emphasized as inspection will not guarantee absence of *Trichinella spiralis*.

Ober (157) reports most frequent clinical findings as fever, malaise, orbital edema, and muscle pains, and most constant laboratory finding eosinophilia, after review of 70 of a total of 287 cases of trichinosis reported in Massachusetts from 1936 to 1945.

Three cases of acute gastroenteritis are described by Camps (160) in which tinned meat was found uninfected in the tins but infected in butcher's shop by *S. typhimurium;* presumably raw meat was the infectious agent.

Epidemiology of an outbreak of 20 found cases of typhoid fever reported in New York revealed overflow of sewage onto fruits and vegetables used by all patients. (161)

Major outbreaks of gastroenteritis aboard ships were attributed to Shigella, Salmonella, and unknown causes with food handlers, contaminated food and convalescent carriers listed as sources of infection. (163)

An outbreak of Salmonella infection from infected chicken eggs is reported by Watt. (174)

An excellent discussion of the character of milk-borne outbreaks of human disease, sound suggestion to investigators of epidemics and a review of the most important milk-borne diseases is presented by Goldie. (178)

An epidemic of several hundred cases of typhoid fever in Paris in June 1944 was traced to butter (Cambessédès & Boyer). (355)

Legal liability for trichinosis is dealt with by Tobey. (356)

Editorial discussion (357) of report by Staphne & Lovestedt (Mayo Clinic) indicating damage to dental structure resulting from routine consumption of lemon juice.

Doyle (358) discusses milk sickness, its etiology, clinical manifestations and treatment. In the past year 3 cases seen, one fatal. An intoxication caused

by ingestion of milk from cows which have eaten white snakeroot or rayless goldenrod. Toxic principle is an alcohol called tremetol.

Fabian (359) made a compilation of 61 epidemics with 2930 cases of disease and 118 deaths in the U. S. A. and Canada due to cheese for the years 1883 to 1945 inc. In addition, lists 16 epidemics due to cheese from other countries with 53 references.

ICE CREAM

Progress report on standards for ice cream, sherbets, ice milk and ices released by committee on definitions and standards of the International Association of Ice Cream Manufacturers. (59)

The early history of the ice cream industry in Baltimore. (60)

Pyenson (83) gives a review of the manufacture of powdered ice cream mix and lists promising markets.

Good raw materials, clean and sterile equipment, and proper composition and properties are principal factors in maintaining quality in ice cream, reports England. (103)

Joint standard methods committee reports on frozen desserts and ingredients. (111)

Report of the Committee on Frozen Desserts (133) summarizes problems of frozen dessert industry, emphasizes importance of quality products, and gives credit to special reports of its members.

Serum solids stored for use in ice cream should be from high quality milk, time and temperature combinations should destroy all pathogens, and processing equipment should be clean, rustproof and free of copper, reports Sheuring. (150)

Vacreation of ice cream mix by heating, boiling, and reboiling in 3 separate chambers improves flavor and has less tendency to develop stale, oxidized, or metallic flavor, according to Wilster. (152)

Pederson (360) discussing plant sanitation, referred to sources of sediment in ice cream.

Methods of avoiding oxidized flavor and "oiling off" on defrosting of frozen cream were indicated by Trout. (361)

Six years experience indicated vacreation will produce ice cream mix of superior flavor and lower viscosity than that processed in the conventional manner, Hagen (362) reported.

Algin and agar were recommended as stabilizers for ice cream by Antonov. (363)

Average counts of 2,500,000 per ml. of bacteria in ice cream and 200,000 per ml. of bacteria in fruit ice were reported by Hoffmann (364) from Switzerland.

MILK

Rapid platform tests for detecting unsatisfactory milk investigated by Barkworth *et al.* (5)

Five improper and two proper recording thermometer charts for 143° F. 30 minute pasteurization are presented by Gotta (26) for interpretation.

The component parts of a milk quality improvement program are listed by Weckel. (46)

Breed (48) presents sixteen farm inspection problems and four plant problems all affecting sanitation.

Fuchs (98) states health officials are opposed to local milk requirements being used as trade barriers. Plan for uniformity offered.

Parran (104) announces plan to publish periodically list of sanitary ratings of interstate milk shippers.

Baker (112) reporting for committee on dairy farm method stresses need for improved sanitation of milking machines and discourages substituting low cooling temperatures for sanitation.

Report of milk pasteurization committee in Victoria, Australia, reveals unsafe milk supply in Melbourne; lists difficulties in enforcing pasteurization act; and recommends uniform equipment, establishment of adequate depots securing supply from approved farms, and education of public on care of milk in the home. (148)

Relative keeping qualities of frozen milk and spray-dried whole milk are covered by Hetrick, Krienke & Tracy. (183)

Cows in Hawaii utilized the nitrogen from urea for milk production less efficiently than nitrogen from natural sources, concluded Willett *et al.* (365)

Drenching of cows with cod liver oil increased the ascorbic acid content of milk but the oil had no effect when mixed with the feed. Either feeding or drenching usually increased the oxidized flavor. (366)

Increasing the total digestible nutrients by 25% checked the decline in body weight and milk production following feeding of iodinated protein to dairy cows, reports Moore. (367)

An incentive to the producer, regular checking and reporting of quality and field service are essential to procurement of quality milk, according to Thompson. (368)

An effective farm dairy sanitation program involves co-operation between the receiving room, trucker, fieldman and producer, according to Scherschel. (369)

Duties of a fieldman are thoroughly gone into by Brakel. (370)

In a series of articles, Bryant (371) presented a wealth of information covering the causes of excessive sediment in milk.

A close relationship between atmospheric temperature of milk quality was reported from Devonshire, England, by Mitchell. (372)

Various methods of pasture management for the prevention of onion milk were suggested by Wylie & Hinton. (373)

Managed milking is defined and discussed by Parkin. (374)

Josephson & Keeney (375) showed that "cowy" or "barny" flavored milk is often due to acetone bodies secreted in the milk by cows suffering from Ketosis. Some "feed" flavors may also be due to this.

The trend toward mechanical cooling of milk on the farm is shown in a survey recently reported (376). Temperature limits are shown for 52 cities.

Engel (377) has compiled the recent literature dealing with composition of cow and human milk and colostrum.

The work of the Imperial Agricultural Research Institute of New Delhi, India, in developing milk production in breeds suitable for hot climates was reported by Ogilvie. (378)

Louis (379) reviewed numerous phases of the production of milk of superior hygiene quality in France.

Snyder (380) of the Pennsylvania Milk Control Commission, discussed the trends in the milk industry.

When iodinated casein was fed to dairy cows, milk production and the nicotinic acid content of milk were significantly increased, while the riboflavin content was decreased, report Kemmerer *et al.* (381)

Rowland (382) reports on the factors responsible for the deterioration in solids-not-fat content of milk in Britain.

The effect of underfeeding on the milk yield of the newly-calved cow was studied by Kajanoja (383) who found that the cow would call upon her body reserves of fat to supply the required nutrients.

Interesting data on herd testing and average production are given in the first annual report of milk recording for England and Wales. (384)

Eskedal (385) again reports that hand-milked cows declined in yield less rapidly than machine-milked cows.

As a result of an extensive investigation of the influence of the lipoid content of the blood plasma on milk fat production, Saarinen (386) in Finland concludes that cholesterol esters are of first importance as parent substances of milk fat.

Pedersen (387) reports that milk from herds fed A.I.V. silage produced butter of slightly higher grade than that from herds receiving no silage. For making Danish Swiss cheese, the reverse held true.

Davis (388) discusses routine chemical, physical, and bacteriological tests of milk and dairy products, especially new instruments for detecting abnormal milk by measurement of conductivity.

Extensive studies on the colloid chemistry of skim milk were reported by Eilers & Korff. (389)

Moore & Trout (390) discuss the detection of raw milk contamination in homogenized milk by means of the phosphatase test and by organoleptic examination.

Surface cooling of the milk and sterilization of utensils were found to be the factors of major importance affecting milk quality, according to Davis *et al.* (391)

The keeping quality of pasteurized milk was sufficiently good to permit every other day delivery if the milk was subsequently stored below 50°F. The total and coliform counts increased slightly when held at room temperature for 6 hours, according to Dahlberg. (392)

Land cress (*Coronopus didymus*) when consumed by cows causes the milk and cream to be tainted. The flavor may or may not be noticed in the cold products but appears on heating and persists after heating as a "burnt" or "scorched" flavor. Normally the taint is not removed by the vacreator. (393)

Changes in composition of milk during milking were studied by Lucchetti *et al.* (394) Only important change was fat content—1.10–1.60% at beginning and 7.10–8.20% at end of milking. Evening milk had a slightly higher dry residue.

Achaya *et al.* (395) report an inverse relationship between lower fatty acids and oleic acid in buffalo milk fats. Cottonseed feed produces milk with high stearic acid and low palmitic acid contents.

Data submitted by Krukovsky (396) showed that the photoinactivation of lipase in milk is an independent reaction. Experiments also showed how a bitter flavor could be produced in milk by chemical changes in the fat and fat globules.

In both dry and wet seasons low S.N.F. values were associated with low lactose contents in a study in Kenya, by Purchase *et al.* (397)

Feeding cobaltous acetate as a supplement to the rations of 8 cows for a period of two months was found by Archibald (398) to raise consistently the amount of cobalt in the milk.

A very definite and significant seasonal trend in the solids-not-fat and fat contents of market milk was observed in a three-year study by Rees. (399)

The replacement of two pounds of concentrates in the cows' ration with two pounds cottonseed produced an increase in the fat content for the first twenty days, according to Davis & Harland. (400) The fat test for the last eight days of the experiment was slightly lower than that of the control.

MILK PROCESSING

The Mallorizer system of sterilizing milk and milk products is illustrated and discussed by Wood (17) in this article dealing with heat transfer.

Six phases of H.T.S.T. process necessary to safeguard milk supply, Weber states. (56)

Tiedeman & Smith (58) present evidence indicating that freedom from coliform organism in 1 ml. portions of pasteurized milk in well operated plants is an attainable goal.

Myers (62) lists significance and traces causes for presence of coliform bacteria in pasteurized milk and milk products.

Reduction in bacteria counts in the dairy industry through use of ultraviolet are described by Dusault. (63)

The history and successful operation of the Tarboro, N. C. municipal milk pasteurization plant is described by Hughes. (89)

Weber (93) discusses safety factors involved in H.T.S.T. pasteurization.

A comprehensive analysis of the mechanics of H.T.S.T. pasteurization is prescribed by Bixby. (99)

Eleven advantages of H.T.S.T. operation are listed by Simpson. (193)

Herreid *et al.* (401) found that the English Whitehead centrifugal separator, the bowl of which can be cleaned by flushing without dismantling, successfully produced cream with a low bacteria count.

North (402) indicated necessary steps in making sweetened condensed milk of high quality.

Sources of sediment in bulk sweetened condensed milk were detailed by Day. (403)

Factors affecting viscosity of sweetened condensed milk were indicated by Webb. (404)

Webb (405) discussed the history of the concentrated milk industry, composition of various concentrated milks, methods of manufacture, etc.

Pros and cons of homogenized milk were listed by Iverson. (406)

Synthetic rubber gaskets on short-time pasteurizers gave trouble, according to Kloser. (407) This equipment successfully processed milk, cream, buttermilk, cocoa, and milk for cottage cheese.

Causes of unsatisfactory results with chocolate milk were listed by Simonet. (408)

By separating and homogenizing only the cream portion of 10–12% fat, homogenizing capacity may be greatly increased states Doan. (409)

High heat treatment delays onset of oxidation and deterioration of flavor of frozen milk, according to Doan & Warren. (410)

High viscosity and progressive thickening occurred where milk was homogenized at 80°F. or lower, reported Moore & Trout. (411)

Cooked flavor and browning of evaporated milk are associated with oxygen uptake and carbon dioxide production, reports Tarassuk. (412)

In an extensive article, Parker & Stateler (413) discuss "What's Ahead in Milk Processing."

Milk must be heated to 80° C. under sanitary conditions to yield a sufficiently germ-free milk, reported Fischer (414) in Switzerland.

A Danish kettle-type cream pasteurizer with a drum stirrer handled 10% more cream, consumed 10% less steam, and destroyed bacteria at least as well as one equipped with an ordinary stirrer. (415)

Cold pasteurization of milk by means of the Siemens ultraviolet machine in Germany is described in considerable detail by Ball. (416) Bacteriological data were vague and of doubtful value.

Clarification of HTST milk either before or after pasteurization had no effect upon phosphatase content, bacterial count, renneting power or precipitation of albumin but did decrease creaming power, report Pedersen & Andersen. (417)

Comparative tests in England on holder and HTST pasteurization show the former to be more efficient in destroying bacteria, according to Reid. (418)

Reporting on the Hofius-Richter-Crespi process for treating milk with oxygen at 10 atmospheres pressure, Gorini (419) states the surviving bacteria have lost their proteolytic and gasforming properties but partly retain their acid-forming ability.

General pasteurization of milk and milk products advocated editorially (420). A.M.A. Council on Foods and Nutrition grants recognition only to pasteurized milk.

Nicholson (421) describes pasteurization of milk with ultraviolet light. Its effectiveness against pathogens is not mentioned.

MISCELLANEOUS

H. Harold Scott (1) in English summary reports on ice manufacture in Santiago, Chile, listing methods used and precautions being taken to improve sanitary quality.

The qualifications and responsibilities of a milk sanitarian are detailed by Bendixen. (9)

Factors considered by Thomson (41) in appraising safety of farm or milk plant water supply.

Results are reported by Stoltz (42) on container costs in milk distribution.

Information on rats is presented by Lewis (52) with emphasis on four control methods: elimination of food, ratproofing, eradication, and maintenance of first three.

History of discovery of DDT and its present use and effectiveness outlined by Taggert. (53)

Outwater (55) describes method for transferring unsatisfactory dairies between health jurisdictions.

Fisher (57) describes use of DDT in dairy plants. Plant sanitation is a prerequisite to effective use.

Type, location, construction, and operation of dairy water supplies are described by Miller (61) as factors influencing their safety.

Maybury & Shrader (65) abstract 370 references on milk and its products.

McFarland's (74) book on milk marketing under Federal control describes in detail the background, content, administration, and operation of this statute.

Fly and roach control in dairies are discussed by McDaniel. (82)

Fisher (101) discusses the control of flies and other insects on dairy farms by the application of sanitary practices and insecticides.

Henderson (94) finds sanitation important in insect control at dairy plants. List of sprays, with their applications, is given.

Cleanliness by good housekeeping may be more important than application of insecticides in dairy plants, according to Henderson. (105)

Results of field investigations to determine effectiveness of DDT as residual spray described by Baker, Scudder, & Guy. (108)

Joint committee reports on new methods of analysis and changes proposed for inclusion in ninth edition of *Standard Methods for Examination of Dairy Products.* (110)

The part played by pests in reducing normal milk production and contamination of milk and milk products is discussed by Dove. (113)

Film bibliography on food and milk topics released by Public Health Service includes brief description and source. (115)

Water and sewage problems in milk sanitation discussed by Warrick & Wisniewski (173) include well construction, plumbing, cross connections, and milk waste treatment.

A summary of a quality symposium is offered. (184)

Noyes (186) discusses the careful training of dairy plant employees as essential for company success and personal advancement.

Gerlach (422) discussed DDT and insect control on dairy farms and in dairy plants.

Agricultural marketing agreements covering milk were reviewed by Welden. (423)

Insect control in relation to farm dairying was discussed by Fisher. (424)

Korff (425) reports increased attention given to insect and rodent infestation in the dairy industry and discusses control measures.

Insect and rodent control in the dairy plant is discussed by Searls (426), who instances the high percentages of convictions by the F.D.A. due to these pests.

Sanitation should come first in farm insect control, then the application of insecticides will finish the job, according to Searls. (427)

Temperature of storage influenced cream quality far more than separator cleanliness, according to Jensen & Bortree. (428)

Fouassier (429) spoke on "The Dairy Industries."

A new journal (430) started in

November 1946, published by Verlag Hans Carl Breite Gasse 58/60 Nuremberg, Germany covers the chemistry bacteriology, physics, and technology of the milk industry.

Shechter *et al.* (431) discuss the role of fats in reference to DDT. A small daily intake of DDT can bring about high concentrations in body fat. Cows ingesting DDT pass it on to the milk and up to 25 p.p.m. have been found in milk and over 500 p.p.m. in butterfat.

Hereditary hypoplasia of the sexual glands in Improved Highland breed of Swedish cattle was reduced in incidence from 26% to 8% in 7 years by systematic culling of affected bulls, and to a lesser extent of affected cows, reports Eriksson. (432)

Martjugin (433) reports measurements of the extent of the vacuum, also of the subsequent pressure, set up by calves in the sucking act.

Methods of testing and handling human milk in Copenhagen are described by Christensen. (434)

Proper instruction of mothers in manual manipulation to produce the most effective milk secretion was found by Waller (435) to double the number still breast-feeding after 6 months.

After visiting western Germany in 1945, Taylor *et al.* (436) report on a number of developments in dairying there during the war.

Results of 10 years experiments with hay-crop silage are summarized by Hayden *et al.* (437), who conclude that the dry matter content of the material being ensiled may influence silage quality more than the preservation method employed.

Verbeek (438) reports favorably on young oats and wheat as grazing for high producing cows.

Allen *et al.* (439) report on the effect of ingestion of DDT upon dairy cows and their milk. Milk from a Jersey cow fed 24 g. daily for 157 days contained 44 p.p.m. DDT and inhibited the growth of rats.

NUTRITION

Making a comparison of growth-promoting properties of butterfat, margarine, and vegetable oils in experiments with rats, Henry, Kon, *et al.* (190) concluded that it is unlikely that butterfat possesses superior nutritive properties to those of other fats.

From feeding rats diets of liquid fatty acids and volatile fatty acids, Bloor (195) concluded that the latter were less efficient as the rats grew least and stored less vitamin A.

Determinations of the biological value of albumin, casein, and soy bean protein by several methods were carried out by Supplee *et al.* (440) Giving albumin a value of 100, casein would be around 80 and soybean protein about 50 to 60.

Mean values of 117, 112, and 139 mg. calcium per 100 ml. milk from herds in Nova Scotia, Ontario, and B. C. were reported by Robinson *et al.* (441)

The second edition of Maynard's "Animal Nutrition" (442) contains extensive revisions and additions, bringing it up to date.

High casein diets had a sparing action on pantothenic acid requirement of the rat, according to Nelson *et al.* (443)

Kon *et al.* (444) failed to demonstrate wrist stiffness in guinea pigs receiving skim-milk diets.

Pasteurized or boiled milk fed *ad lib.* to rats was adequate for normal growth reproduction and lactation, according to Forti. (445)

Butter showed no advantage over various vegetable oils and margarine in supporting the growth of rats, report Deuel *et al.* (446)

Dried whey cannot entirely replace buttermilk in chick rations without causing edema, according to Slinger *et al.* (447)

Whey obtained by acid precipitation of casein produced in rats smaller gains in weight than did skim milk,

while purified casein gave the least growth, report Euler *et al.* (448) The concentration of cholesterol in the livers increased with the quality of the supplement.

Rats whose diet was supplemented by skim milk made significantly greater weight gains than those receiving water, while their livers contained 0.17% cholesterol as against 0.03% in those receiving water, according to Euler *et al.* (449)

Female rats showed better performance and longer periods of fertility when Swedish margarine was fed than did those receiving butter report Euler *et al.* (450)

Calcium retention was improved by the addition of 6% of fat to a fat-free diet for men. This held true for mustard oil, peanut oil, sesame oil, and butterfat; coconut oil, on the other hand, caused a marked negative Ca balance report Basu & Nath. (451)

Editorial discussion (452) of iodine in table salt. Legislation to require addition of specified amounts failed in previous Congress, due to opposition. New bill to be introduced. Council on Foods and Nutrition (A.M.A) finds no reason to anticipate any injurious effects from addition of specified amounts.

Editorial (453) indicating that A.M.A. Council on Foods and Nutrition, after careful study, concluded that addition to table salt of a specified amount of iodine was desirable. Favor amendment to Federal Food, Drug and Cosmetic Act to require it.

Laboratory mice fed wholly on whole wheat bread were much more susceptible to experimental infection with pneumococci than others fed wholly on white bread. Nutritional physiologists, however, consider whole wheat superior for general nutrition. Editorial discussion (454) of reports by Hitchens & Falco and Robinson & Siegel.

Farm animals estimated to consume nearly four times as much "food energy" as people. When feed scarce, must determine most efficient use of the animal as a converter of energy. Comparison of nutritional value of certain meats, poultry, and milk favors milk. Editorial discussion (455) of reports by Forbes & Maynard.

Mueller & Cox (456) experimenting with four well adults, found that casein and lactalbumin were equally effective in maintaining nitrogen balance in man.

Eseudero *et al.* (457) found that rats retained more Ca from Argentine cheeses (89%) than from powdered milk (81%).

Geyer and co-workers (458) fractionated butterfat. A liquid fraction obtained from September, 1945, butter, allowed rats to grow at a superior rate while a solid fraction prepared from this butter caused a very slow rate of growth. This was not repeated to the same extent in subsequent trials.

Boer *et al.* (459) conclude after a detailed study that vaccenic acid is the growth-promoting factor in summer butter.

It was found by Riggs, Beaty, & Johnson (460) that the addition of 6% non-fat dry milk solids improved the nutritional value of water bread, enriched water bread, and whole-wheat bread.

POWDERED MILK

The manufacture of dried milks is reviewed by Holm. (95) Data are presented showing the nutritive value of these products.

Mattick, Hiscox, *et al.* (189) reported the effect of temperature of preheating, of clarification, and of bacteriological quality of the raw milk on the keeping properties of whole milk powder dried by the Kestner spray process.

Milk spray-dried in an atmosphere of nitrogen or CO_2 had the same keeping quality as air-dried powder packed at the same O_2 content, reports Coulter. (461)

Effect of season of production upon keeping quality of skim and whole-milk

powders was studied by Pearce & Bryce. (462)

Wide variations in titratable acidity of reconstituted roller-dried milk powders may be found if they are not thoroughly agitated before testing, reported White. (463)

Preheating to 180–200°F. improved initial flavor, shelf life, and bacteria count of spray-dried whole milk powder, Scottish workers reported. (464)

Coulter (465) reviewed present-day knowledge regarding the manufacture of powdered whole milk.

The problem of removing sorbed gases in dry milks was discussed at length by Haller & Holm. (466)

A new quantitative method for determining the solubility of milk powders by reconstituting the milk by a standardized shaking procedure is described. The method is especially applicable to whole milk powders. (467)

Hodson *et al.* (468) correlate the flavor and color changes in dry skim milk on prolonged storage with the changes in amino acid content. Marked losses of arginine, histidine, lysine, and methionine were found in discolored samples.

A grading test for powdered milk by Leighton (469) consists of reconstitution of the milk aseptically, incubation at room temperature, and noting characteristics of coagulum.

REGULATION

The purpose and functions of milk ordinances are reviewed by Weckel. (13) Variations in requirements are discussed and the need for industry's support for uniform standards of inspection is pointed out.

Ackerman (79) lists among the reasons for inefficiency in the ice cream industry the laxity of many health officials in establishing and enforcing regulations.

Tiedeman (134) believes lack of uniformity in regulations, interpretations, and enforcement of milk codes must be replaced by system of uniform sanitary supervision.

From a comprehensive review of the Public Health Service and the Connecticut Health Department milk codes, Robertson (149) concludes each has limitations. Suggestions for improvement are offered.

Concept that qualified and licensed personnel following standardized methods be employed on a state-supervised, industry-maintained, dairy control program is presented by Levowitz. (171)

Osborn (180) reports an amendment to the Connecticut sanitary code regulation for shellfish which stipulates conditions of sale and provides for posting of unapproved areas.

Elimination of multiple inspections and appraisal for various plants and localities was discussed by Wentwerth. (470)

RESTAURANT SANITATION

Restaurant court cases are increasing, reports State Department of Health in California Health Bulletin (2). Flashlight photographs are particularly effective evidence in securing convictions.

"California's Health" (3) compares sanitary conditions in establishments operating under licenses with payment of annual inspection fee as against insanitary conditions in those not so regulated.

The need and organization of food handler courses described by Mendell. (16)

Tanner (18) summarizes his views on controlling food handling operations, stressing the use of education rather than strict law enforcement.

An analysis of a school for food handlers is presented by Wilson & Ostrolenk. (21)

Mann (64) examines methods of disinfecting mess tins in British Army; recommends a rinse in 80°C. water for 5 seconds immediately after the meal and a rinse in boiling water immedi-

ately before the following meal.

Hutchinson *et al.* (72) in their investigation of 25 kitchens found that lack of washing machines, soap, etc. contributed to insanitary conditions. Education program reported desirable.

Fuchs (90) summarizes Public Health Service activities in restaurant sanitation program and lists assistance available for training of food handlers.

Brooks (96) explains that because of cost and possibility of not finding carrier by examination, routine medical examinations for food handlers are being replaced by special schools of training.

Laboratory and field studies on use of quaternary ammonium compound as supplement to heat in mechanical dishwashing are prescribed by Mallmann & Zackowski (106). The speed-reaction test for measuring rate of kill of disinfectants also explained.

Data are presented by Harwood (109) on germicidal treatment of dishes by various rinse temperatures and opinion is expressed that germicidal treatment not necessary for sterilizing utensils where adequate preliminary desoiling is practised.

Tyler (117) in describing British sanitary conditions in food handling establishments during last 40 years concludes education of food handlers offsets inadequacies of requirements.

Buchbinder *et al.* (128) recommend using a 3-inch applicator broken off before plating, use of non-absorbent cotton, and controlling pH of rinse water in swab rinse techniques for examination of food utensils.

West Virginia State Health Department (159) prepares 14-page pamphlet for distribution to food handlers attending course of instruction.

Recommendations list physical and laboratory examinations of food handlers, personal hygiene, and water supply as important factors in control of dysentery on naval vessels. (162)

Training courses for food handlers have resulted in improved relationships, with owners, health departments, employees, and patrons all benefiting, reports McGee. (170)

The need for an adequate sanitation program for soda fountains was stressed by Palmer. (471)

TECHNOLOGY

Kosikowsky (4) in technical survey of commercial cultured skim milk or buttermilk manufacture in the United States reports wheying off and viscosity greatest problems.

A detailed discussion of ammonia as refrigerant is discussed by Hughey (12) and advantages and disadvantages under different uses with various types of equipment and operating costs are given.

Certain features of food preservation by refrigeration and equipment are outlined by Adams. (19) Different temperature ranges are recommended.

Mann & Ruchoft (23) describe experimental method for sequestration of calcium and magnesium in the presence of alkaline detergents.

Five methods of preparing and processing tomato juice are summarized by Cameron. (24)

Methods for applying electronic heat to meats for sterilization are described by Benjamin & Ecklund. (31)

Causes for deterioration of milking machine inflations are reported by Jensen & Bortree. (44)

Properties of newer dairy cleaners are described by Trebler. (54)

The results of mechanical washing tests on dried milk films applied to glass using five different types of detergents and five methods are described by Jensen. (70)

The need for careful planning and engineering of milk receiving room to permit smooth operations is stressed by Schwarzkopf. (73)

The development and economy in plant handling and low container and cap closure costs of square milk bottles are discussed by Hall. (77)

Customer convenience leads Baselt

(78) to predict continuation of prewar trend toward the use of fiber milk containers.

Important factors to be considered in the design of dairy plants are presented by Southmayd. (84)

A comprehensive report on technical advances in the development of new methods and new types of dairy products is presented by Wilster. (85)

The 1946 annual report (86) of the Committee on Sanitary Procedure lists progress in developing standard tests for H.T.S.T. pasteurizers and need for adopting 3A standards as a guide in acceptance of equipment for milk and milk product plants.

Methods for eliminating scale formations on the washer and clouding and etching of bottles are discussed in detail by Jacobsen. (102)

An article (107) describes several approaches to the type of training needed by food technologists to fulfill requirements laid down in definition by Institute of Food Technologist.

Future status of paper milk containers reported by Baselt. (114)

Abele & Randolph (119) list faulty design; poor maintenance of linings, vents, agitators, doors, valves, inlets; defective insulation; and inadequate regulatory control as difficulties to overcome in proper care of milk transportation tanks.

"The Freezing Preservation of Foods", by Tressler and Evers (121) contains chapters of particular interest to public health workers while giving full details on handling frozen foods.

Britton (130) reviews dairy equipment exhibit shown at Atlantic City meeting of International Association of Milk Sanitarians, Inc.

The growth of the frozen food industry and the freezing and handling of precooked frozen foods are discussed by Carlton. (137)

Olson (140) succinctly reviews new developments in thermometers and controls for dairy equipment.

Changes in flavor, color, and vitamin content of frozen foods stored at −10° F., 0° F. and 10° F. are discussed by Tressler. (142)

Procedures are delineated by Larson (154) for milk byproducts including cottage cheese, chocolate drink, buttermilk, and sour cream. Pasteurization of products desirable.

A unique sampling device for determining the effect of high temperatures on bacteria in milk is described by Gilcreas & O'Brien. (177)

Marked improvement in sanitary and bacteriological condition of milk cans resulted from use of acid washing solutions, reports Bryant. (185)

Smith (187) lists practical suggestions for dairy plant sanitation, emphasizing cleaning operations, plant layout, and proper facilities.

Kelley (191) summarizes experiences in change-over to square milk bottle and states advantages far surpass the disadvantages.

Sanitary Standards Subcommittee of the Dairy Industry Committee report on current status of specifications covering milk storage tanks, fittings, cans, tanks, weigh can, pumps, homogenizers, and others. (192)

Residues to be removed, type of water, qualities and composition of cleaners, and value to dairy industry are discussed by Graham & Turner. (194)

As an aid in determining effectiveness of dairy detergents in waters of varying composition, Fouts & Freeman (196) developed the Deterg-O-Meter which mechanically washes slides containing baked-on milk film.

Sanitary standards for storage tanks for milk and milk products, promulgated March 13, 1946, (27) cover size, material, fabrication, openings, agitators, tilt, motors, access to top of tank.

Briscoe (472) presented a very practical discussion of the mechanical aspects of can washing.

England (473) reviewed the literature on testing and reporting strength of alkaline detergents, and outlined system of reporting results.

Developments in cleaning compounds for the dairy industry were reviewed by Minor. (474)

The conventional and conservation methods of washing, sterilizing, and drying milk cans were compared by Schwartzkopf. (475)

Various phases of the bottle-washing problem were dealt with by Jacobsen. (476)

Promises and limitation of electronics in the dairy industry were discussed by Olsen. (477)

Rishoi (478) indicated what and how to check on short-time pasteurizers.

Numerous factors entering into a plant sanitation program were discussed by White. (479)

Advantages of quaternary ammonium compounds, and directions for their use in the dairy industry, were listed by Davis. (480)

Methods of keeping dairy waste to a minimum and the various systems involved in treatment of necessary wastes were described by Dean. (481)

The role of milking machines as contributors of thermoduric bacteria, and methods for caring for the former, were discussed by Cordes. (482)

Suitability of various metals for dairy equipment and utensils was reported upon by Pattison (483) who mentioned the protective film formed by hot milk on a nickel surface.

Thomas & Jones-Evans (484) investigated the efficiency of three types of farm sterilizers (steam). Thermoduric counts were 3,500 per utensil for sterilized equipment, 133,000 for utensils merely washed in warm water.

Cleaning and sanitizing of milk cans, using either hand or mechanical washing, were discussed by Scarlett. (485) Steam sterilization was preferred.

High counts on milk bottles are due to recontamination from rinse water. Methods for avoiding this are presented by Josephson. (486)

A new non-foaming quaternary ammonium compound which combines strong bactericidal powers with detergency, has promise for bottle-washing, report Resuggan & Davis. (487)

Waste disposal for dairy plants is considered at some length by Trebler & Harding. (488)

Methods used by the dairy industry to improve sanitary control through equipment design are described by Parfitt. (489)

Improving sanitation in the meat products industry through equipment design is reviewed by Kingman. (490)

Dunn (491) reviews various chemical agents used as detergents, sanitizers, anti-oxidants, etc. in fishery plants.

The role of food technology in the enforcement of the Food Drug & Cosmetic Act was discussed by Hunter. (492)

Harding & Trebler (493) discussed dairy detergents and methods for their evaluation.

Acid-proof brick or tile floors for food plants are described by Sheppard. (494)

Gross *et al.* (495) studied odor sources in egg storage and methods of removal.

Nutting (496) dealt with air filtration methods for food processing plants.

Sharp *et al.* (497) described a continuous process for deaerating milk to preserve Vitamin C and retard certain off-flavors.

Whittleston (498) concludes that rate of pulsation is not critical and does not aid the mechanical efficiency of machine milking but is a necessary stimulus to the "let down" reflex.

Ritter (499) describes methods for the extraction of both lactose and soluble protein from whey.

For artificial whipped cream, skimmilk powder or similar material is mixed with a gelatinized starch derivative and the mixture of the two mixed with H_2O whipped to a voluminous foam, in accordance with the Dutch investigators Groen & Krizkovsky. (500)

Babcock *et al.* (501) have studied the effect of freezing and storage temperature on homogenized milk. A cold (—40°) and uniform temperature kept it normal for over 100 days. No significant chemical changes were found.

Brownlee *et al.* (502) indicate that break-point chlorination of cannery water supply was not a cure-all but aided in reducing material contamination and made slime removal easier.

In a statistical analysis of milk sampling data James (503) concludes that pre-stirring decreases and a strainer increases the standard deviation. The dip test and the drip method are compared.

Chilingworth *et al.* (504) compared factory milk-sampling methods and concluded the drip method is the most satisfactory.

Butterfat balance in a milk and butter factory is discussed by Sharp (505) and detailed results given for a day's operation.

Methods were described and formulas given by Strakhov (506) for the control of drying of milk curd and casein, both in pressed and granular forms.

Flavones as illustrated by quercitin, quercitrin, and rutin have been shown to be effective antioxidants for milk fat and lard. (507)

VITAMINS

Administration of vitamins A, B, and D to calves during first month of life was of no measurable benefit, according to Gilmore *et al.* (508)

Ellenberger *et al.* (509) report variations in vitamin A and carotene content in retail market butter in Pennsylvania and discuss methods of assay.

Editorial discussion (510) of apparent desirability and advantage of enrichment of bread with "pure vitamins", rather than natural products containing the vitamins. Reference to opposition to the enrichment program.

The average vitamin A content of 10 samples of cow butter was 17.7 I.U./g. and carotene 8.4 I.U./g. Ghee prepared from the above butter averaged 14.1 and 6.8 I.U./g. respectively. Buffalo ghee average value for vitamin A was 1.9 I.U. and only traces of carotene were found. (511)

By feeding young calves a biotin-free liquid diet Wiese *et al.* (512) induced a paralysis of the hindquarters, curable by biotin.

Both carotene and "vitamin A itself" contribute to the vitamin A potency of milk fat. Vitamin A, being an alcohol, can exist either free or esterified with a fatty acid. Found in esterified form in milk of four breeds, whereas found in alcohol form in blood of same animals. Editorial discussion (513) of reports by Bannon, Steenbock, Beeson & Rupel and of Parrish, Wise & Hughes.

Editorial statement (514) of requirements for securing Seal of Acceptance of Council on Foods and Nutrition (A.M.A.) for vitamin D milk. Physicians should inquire of state and local health departments whether such milks are subjected to routine control to insure vitamin D content.

McDowall *et al.* (515) found that the thiamine and riboflavin contents of Jersey milks were regularly higher than those of the Friesian milks but that the niacin content was independent of the breed of cow. Feeding of meal to cows on pasture did not affect the niacin and riboflavin content of the milk from either breed but appeared to cause a rise in the thiamine content of the milk from Jersey but not Friesian cows. Poor vs. good wintering conditions did not affect the thiamine, niacin, and riboflavin content of the milks provided the two groups were kept under the same feeding conditions.

The distribution of vitamins A, B_1 and C, carotenoids and riboflavin between the milk, whey and curd was

studied by Dearden *et al.* (516) for Cheddar, Cheshire and Stilton cheese made from summer and winter milk. Values are given for the three types of cheese made in summer and winter.

Canadian cheddar cheese retains about 9% of the thiamine in the milk which is more than predicted by water solubility. Over half of the vitamin is lost in a year's aging, reports Evans *et al.* (517)

Gezelius (518) reports the vitamin D content of reindeer milk about the same as cow milk in summer.

Mouriquand *et al.* (519) have been test feeding powdered buttermilk to rats, pigeons, and guinea pigs and find no significant amounts of vitamins A, B, and C.

It was observed by Holmes *et al.* (520) that the vitamin loss in three varieties of ice cream stored for seven months at —10° F. was riboflavin 5.4, and carotene 15.7%.

Over 500 samples of cheese, chiefly of the Cheddar and Swiss types, were collected and analyzed for their carotene and vitamin A contents. (521)

The pantothenic acid content of commercial market and Guernsey milks for the year 1942–43 averaged 3.4 and 3.2 per ml. respectively, it was reported by Stefaniak & Peterson. (522) Analyses for niacin and biotin were also reported.

Miller (523) reported that as produced in Hawaii, winter milk was 35 I.U. vitamin D per quart—values similar to those found elsewhere.

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Missouri Organizes Milk Sanitation Council

Although the Division of Health Standard Milk Ordinance and its regulations are used throughout the state, the enforcement of the program is becoming increasingly complex due to: (1) more cities developing milk control programs, (2) increased milk production within the state and a growing demand for interstate shipment, and (3) expansion of sanitation control to frozen desserts and milk products plants.

The fact now becomes increasingly apparent that the health department must meet a growing need for leadership and guidance in the field of milk sanitation with considered and well-planned action necessary to assure uniform standards, uniform inspection procedures, uniform acceptance of approved types of dairy equipment, and uniform interpretation and application of accepted standards of satisfactory compliance for the ordinance provisions. To do this, the Director of the Division of Health has appointed a Milk Sanitation Advisory Council consisting of seven members and two *ex officio* members, selected from official public health agencies in different areas. The members of the Council are as follows:

M. R. Fisher, D.V.M., St. Louis, *Chairman*
Charles E. Carl .. Jefferson City, *Secretary*
I. H. Baird, D.V.M., ... St. Joseph
Raymond Bishop ..... Boonville
W. J. Dixon ..... Kansas City
R. W. Hart (*ex officio*) ..... Kansas City
W. Scott Johnson (*ex officio*) Jefferson City
L. W. Pickles ..... Clayton
Jack K. Smith ..... Independence

The first problem for consideration was the revision of the Division of Health Standards for dairy barn and milk house construction.

MILK and FOOD SANITATION

Control of Frozen Food Locker Plants*

The following document represents a review of the problem of control of frozen food locker plants prepared for the Committee on Sanitary Engineering and Environment, by a Subcommittee consisting of Walter D. Tiedeman, Victor M. Ehlers, and Louis F. Warrick.

The Committee on Sanitary Engineering and Environment consists of Gordon M. Fair, William A. Hardenbergh, Theodore F. Hatch, Ray E. Lawrence, Kenneth F. Maxcy, W. George Parks, Paul A. Russell, Walter D. Tiedeman, Harold A. Whittaker, C. P. Yaglou and Abel Wolman, Chairman.

Health Problem

Frozen foods are being used in increasing quantities. The advantages of freezing, as compared with canning foods, are ease of processing, improved flavor and appearance, and preservation of nutritional properties.

The perishable nature of foods makes it essential to freeze them promptly before they deteriorate, as well as to maintain them continuously in a frozen state until used. The retention of good flavor and appearance, as well as the control of bacterial growth, are contingent upon quick processing, freezing, and the maintenance of a constant degree of coldness. The temperature should be kept at 0° F., or less, during storage at the packing plant, shipment to the retailer, while on display in the retail store, and until used by the consumer. The requirment for continuous storage at low temperature applies equally to foods processed at the factory, locker plant, or at home.

The number of bacteria in packaged creamed products is reported as being higher than in other frozen foods. Gravies and creamed sauces support abundant bacterial growth at favorable temperatures. Except for the destruction of trichinella in pork during cold storage, little work has been done to determine what combinations of time and temperature are necessary to kill pathogenic organisms in foods, whether specific organisms survive or are destroyed during prolonged frozen storage, and the effect, if any, of low temperatures on preformed toxins.

This report deals primarily with locker plants. The problem of the survival or growth of organisms in frozen foods, as well as those problems connected with maintaining frozen foods at low temperatures during shipment and storage, should be given further study.

Many locker plants are equipped to process, freeze, and store foods for home use. There are indications that the functioning of these plants introduces public health problems. The operator of a locker plant who purchases animals on the hoof, and fruits and vegetables in quantity, is able to slaughter the animals, process the meats, fruits, and vegetables on the premises, and thus sell additional services. This, however, may create local nuisances unless adequate space is provided, and the necessary plans made for the efficient operation of the plant and the sanitary disposal of the waste.

There are few records of outbreaks of gastroenteritis, or food poisoning, traced to frozen food. But it may be that if a large number of widely separated people contracted gastroenteritis from contaminated food prepared at a locker plant, the disease might not be traced to the source, and the problem may be more serious than the absence of records suggests.

Home Freezer Locker Units

The development of household units for freezing and storing foods may

* Released by the National Research Council, Division of Medical Sciences, May 1948.

eliminate locker plants and the health problems connected with them. In an attempt to determine whether or not food processing services and storage facilities offered by locker plants are continuing to be in demand, an experiment is under way at Cornell University. Five leading retail houses are attempting to saturate Ithaca, New York, and the surrounding Tompkins County with home freezers and storage cabinets. Residents of these areas are given priority on all units they are willing to buy or rent. Patrons of the locker plant are encouraged to surrender space.

The space made available may be used for other purposes, such as storing complete meals which could be sold from slot machines.

Looking ahead, locker plant operators may install bakeries or restaurants in which frozen meals might be served. The food for a complete meal could be frozen and stored on blue plates; the food could be cooked electronically in a few seconds as it was released from the machine. Such a service would be useful in offices and factories too small to support cafeterias. There is also some demand on the part of the householder for frozen prepared meals.

Even though the Cornell experiment may show that the services of the present locker plants are obsolete, it is anticipated that new developments will continue to keep them in use.

OPERATIONS THAT MAY AFFECT HEALTH

Because of the value of the foods in storage, it is possible that an operator would try to refreeze articles which, because they have been defrosted, developed toxins. Even though patrons may know that the material has been refrozen there is a tendency to eat the foods if they have not developed an offensive odor or taste. Thus, plants should be adequately insulated and provided with standby service to cover interruptions of electric service which would allow defrosting of the stored materials.

Plants originally designed only for freezing and storing food may add facilities for slaughtering animals and for processing meats and vegetables. Space for erecting an addition may not be available within the building or on the lot. There may be no facilities for disposing of the wastes. These conditions may result in the creation of nuisances or in contaminating the foods.

APPROVAL OF PLANS

Business men, before constructing a locker plant, should submit their plans to the state health authority. A check could then be made to see that the site was satisfactory for all purposes; that sufficient working room for important operations had been provided; that insulation was adequate; and that standby service had been considered.

STATE LAWS AND REGULATIONS

For the protection of public health, a number of states have enacted laws governing frozen food locker plants. The enforcement of these sanitary regulations rests for the most part with the Department of Agriculture, but in a few instances, with the Department of Health. These laws are sometimes supplemented by rules and regulations of the Commissioner of Agriculture or the Commissioner of Health. The Comprehensive Oklahoma Frozen Food Locker Plant Act, effective July 1, 1945, and the Interpretive Code promulgated by the State Board of Health, includes the desirable requirement that plans be prepared by a licensed engineer and be submitted to, and approved by, the State Commissioner of Health before a license will be issued for the erection of a new locker plant.

ACTIVITIES OF LOCKER PLANTS

The basic requirements for frozen food or refrigerated locker plants are that they provide facilities (1) for stor-

ing foods at about 34° F. for aging, (2) for freezing foods quickly, and (3) for separate locker cabinets for rent. In addition, the plant may provide facilities for processing and packaging fruits and vegetables, facilities for processing and packaging meats, facilities for slaughtering animals, and possibly means for curing and smoking certain foodstuffs. Regulations appropriate for the sanitary operation of slaughter houses, meat processing plants, and canning plants should be applied to these same operations when carried on at a locker plant. Special regulations, except those concerned with integrated plans for the whole plant, need apply only to the operations of chilling, freezing, and storing frozen foods. Some locker plants maintain branches equipped only for storing foods that have been prepared and frozen at the main plant.

RECOMMENDATIONS ON CONSTRUCTION AND OPERATION

Health authorities will find information and recommendations relating to the arrangement, construction, equipment, and operation of locker plants in the report [1] of a special Committee on Frozen Food Locker Plants and Home Units at Cornell University headed by F. S. Erdman of the School of Mechanical Engineering, and also in recommendations [1] of the National Frozen Food Locker Association.

TEMPERATURE REQUIREMENTS

There is uniformity among various state laws and regulations as to the temperatures to be maintained in different parts of frozen food locker plants; probably because one law was patterned after another law and not because each state made an investigation and determined the optimum temperatures. The temperature of the chill room is usually set at 34° F. with a tolerance of plus or minus 2 degrees and of 10 degrees for a "reasonable" period after fresh food is put in for chilling. Oklahoma regulations allow only a 5 degree rise in temperature after loading. For the sharp-freeze room or compartment, a temperature of 10 degrees below zero F. is required. If there is a forced circulation of air, zero degrees F. is considered adequate. A rise of 10 degrees is permitted with either method for a "reasonable" time after fresh food is put in for freezing. None of the laws or regulations examined define the term "reasonable". Some regulations interpret "reasonable" as meaning not more than one hour. The temperature to be maintained in the locker room for the storage of pre-frozen food is zero degrees F. with a tolerance of plus 5 degrees, or in Oklahoma, plus 3 degrees. The temperature limits prescribed for these operations are not to be construed as prohibiting variations which may occur during short periods of time incidental to defrosting.

THERMOMETERS

It is common practise to require that accurate, open scale, direct reading, indicating thermometers be maintained in the chill and sharp-freeze rooms and that a recording thermometer be installed to record the temperature of the cold storage room. Existing regulations require that for recorders, instruments with moisture-proof cases, accurate within one degree plus or minus in the working range and with the bulb installed at the warmer level of the room and out of the direct blast from cooling units, be used. A seven day clock and a chart making one revolution in seven days is required. The range is minus 30 to plus 70 degrees F., or more. The charts are required to be of the reverse type, i.e., with the low temperature on the outside of the chart, which has one degree scale divisions measuring not less than 1/27 inch each between minus 5 and plus 5 degrees F.

INSULATION

The insulation of the chill, sharp-freeze, and storage rooms cannot readily be changed after the plant is built,

so it is important to have it right in the first place. If material is used which settles or becomes displaced, much of the insulating effect will be lost and the refrigerating machines may not have capacity to carry the extra cooling load. Furthermore, an effort to save on initial cost of insulation may increase the cost of maintaining the required low temperatures, so much so, that the operator may carry the temperatures too high to save expense. Also, it is important at the start to see that the floors of rooms on the ground, maintained at low temperatures, are well under-drained so that they will not heave and crack with the frost. The conductivities and conductances of the various materials proposed for use in building the walls and insulating them should be studied, and safe values should be established before the plans are approved and building commenced.

PROTECTION FROM TOXIC GASES

Because of the possibility of breaks in refrigeration lines, at least one gas mask, approved by the U. S. Bureau of Mines, should be provided. This will permit the operator to enter the gas filled room, shut off the supply of refrigerant, and air the room before necessary repairs are made. While Freon gas is non-toxic, heat will decompose it into its toxic constituents so that torches must be used with caution in repairing Freon lines.

RECOMMENDATIONS

1. It appears to be most important that operators who propose to build locker plants be required to have plans drawn up under the supervision of a competent engineer and to secure the approval of the state health authority for these plans before any construction work is commenced.

2. To prevent heat infiltration and thus encourage the maintenance of low temperatures, special attention should be given to the construction of the floors, walls, and ceilings of cold rooms and to the conductance of building materials.

3. Separate compressors of the same make should be provided for the chill room, the sharp-freeze and storage rooms. Each of these compressors should have sufficient capacity to carry the whole cooling load and should be installed so that they can readily be used for any one of the services.

4. Standby electric service should be provided wherever possible.

5. Locker plant operators should consider future developments; such as, operating slaughter houses, meat processing plants, food processing plants, kitchens, and bakeries in conjunction with their locker plants.

6. Locker plant regulations should safeguard the public health, provide for sanitary operation of plants, but avoid unnecessary details which might obstruct individual initiative and progress.

REFERENCE

1. Guide Book of the Frozen Food Locker Industry, 1945. Locker Publications, Des Moines, Iowa.

Studies on Enterococcal Food Poisoning

A Study of the Incidence of Enterococci and Staphylococci in Suspected Food in Outbreaks of Food Poisoning

GERTRUDE DANGLER AND GUSTAV I. STEFFEN, PH.D.

Bureau of Laboratories, Department of Health, New York City.

Although it now seems clear that enterococci are the streptococci most frequently implicated in food poisoning outbreaks (1), a number of questions concerning enterococcal food poisoning still remain to be clarified. The present study gives a possible answer to one of these, namely, the comparative frequency of enterococci in suspected foods. The presence of one million or more enterococci or staphylococci per gram in a suspected food was considered significant. The foods studied were all negative for other enteric bacteria.

METHOD

Eleven grams of the suspected food were mascerated in sterile tap water in a mortar, and plates poured with dilutions ranging from 10^{-1} to 10^{-6} in Chapman's agar (2) for staphylococci and sodium azide agar without penicillin for enterococci (3). After the plates were incubated at 37° C. for 24–48 hours, colony counts were made. Ten isolated colonies of suspected staphylococci were then fished from the counted Chapman plate. Each was then streaked on a fresh plate of the same medium to determine purity of the culture and to obtain material for subsequent tests. These were incubated for 42–43 hours. The growth on each plate was next tested for coagulase and gelatinase production, mannite fermentation, and pigment production; the last three tests being carried out directly from the plate according to Chapman's method (2). Cultures positive for the coagulase test were streaked on blood agar plates and hemolysin production determined after 24 hours incubation. A staphylococcus culture was considered to be a potential producer of enterotoxin when the coagulase test and three of the remaining four tests were positive.

Twenty-five colonies of suspected enterococci were picked from the sodium azide plates. This medium is not as specific for enterococci as Chapman's medium is for staphylococci and therefore a larger number of colonies were identified. The fishings were inoculated into beef heart infusion broth and were incubated at 37° C. for 24–48 hours. Gram stains were then made and all cultures containing gram positive cocci in pairs and short chains were further studied for the following characteristics: resistance to heat at 60° C. for one-half hour, growth at 10° C. and at 45° C. and in beef infusion broth containing 6.5 percent NaCl, growth in 0.1 percent methylene blue in skimmed milk with reduction and coagulation of milk, growth in Andrade skimmed milk with production of acid and coagulation of milk, growth in gelatin with or without liquefaction, and growth on blood agar plates with or without production of hemolysin (3). The first four tests were considered absolute.

The percentage of colonies satisfying the selected criteria was multiplied by the total colony count on each medium in the calculation of the approximate number of organisms per gram of food.

RESULTS

A total of 230 samples of food were studied. Thirty of these were found

to contain significant numbers of bacteria. In suspected foods in outbreaks, four had significant numbers of enterococci only, four had significant numbers of both enterococci and staphylococci, and fourteen had significant numbers of staphylococci only (table 1). Similarly, in three instances enterococci alone were isolated from "check-up" foods, in two instances both enterococci and staphylococci were isolated from such foods, and in three instances staphylococci alone were isolated.

SUMMARY

A comparison is made between the frequency of enterococci and staphylococci occuring in food suspected in food poisoning outbreaks. Whether all strains of enterococci can cause food poisoning is not yet known. Excluding this possible limitation, it seems that on the basis of one million or more enterococci or staphylococci per gram, this one year survey incriminates enterococci almost half as frequently as it does staphylococci.

While the role of staphylococci in food poisoning has been well established for a long time, that of enterococci has not been as clear. The above findings when considered with other evidence indicate that enterococci may be an important factor in outbreaks of gastronenteritis.

REFERENCES

1. Buchbinder, L., Osler, A. G., and Steffen, G. I. Studies on Enterococcal Food Poisoning I The Isolation of Enterococci from Foods Implicated in Several Outbreaks of Food Poisoning. *Pub. Health Rep.* **63**, 109, 1948; Osler, A. G., Buchbinder, L., and Steffen, G. I. Experimental Enterococcal Food Poisoning in Man. *Proc. Soc. Exp. Biol. Med.* In Press 1948.

2. Chapman, George H.: The Staphylococci, *Transactions of New York Academy of Science.* December 1946, Section II, Vol. 9.

3. White, J. C., and Sherman, J. M.: Occurrence of Enterococci in Milk. *J. Bacteriology* **48**, 262 (1944).

4. Sherman, James M. *Bacteriological Reviews* 1, 3–97 (1937).

COMPARATIVE FREQUENCY OF ENTEROCOCCI AND STAPHYLOCOCCUS AUREUS IN FOOD POISONING OUTBREAKS

Foods Directly Implicated in Outbreaks

Organisms Isolated	*No. of Outbreaks*	*Foods Implicated*	*Range of No. of Organisms per Gram (In millions)*
Enterococci	4	Goat Cheese, Duck Turkey	14–156
Enterococci* and Staphylococcus Aureus**	4	Turkey, Chicken & Rice	2–380*
Staphylococcus Aureus	14	Roast Pork & Cake	47–5000**
		Meats, Poultry, Cake	2–17000
		Potato Salad	

"Check-up" Foods Similar to Foods Implicated in Outbreaks

Organisms Isolated	*No. of Foods*	*Foods Implicated*	*Range of No. of Organisms per Gram (In millions)*
Enterococci	3	Mexican Cheese, Goat Cheese	64–145
Enterococci* and Staphylococcus Aureus**	2	Corned Beef, Turkey &	185–750*
		Veal Salad	33–102**
Staphylococcus Aureus	3	Cake, Ricotta Cheese (raw)	22–6000
		Opened Can of Sardines	

Asterisks to indicate the range of enterococci and staphylococci when they are found together in a sample of mixed cultures. For example: turkey had from 2 to 380 million enterococci and 47 to 5000 million staphylococci.

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(*including* MILK AND FOOD SANITATION)

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Florida Association Meets in Gainesville

Members of the Florida Association of Milk Sanitarians met at the Dairy Products Laboratory on the University of Florida campus April 21, 22, and 23, for the 4th Annual Meeting and Conference. A total of 60 registered for the 3-day meeting.

Those appearing on the program included George E. Heller, of the Taylor Instrument Companies; W. G. Bruce, of the U. S. D. A. Bureau of Entomology; Ernest Kelly, formerly of the U. S. D. A. Bureau of Animal Industry; and members of the Florida Association.

At a business meeting of the organization the following named men were elected to honorary membership in the Association: B. W. Hammer, Sarasota; E. G. Hastings, Orlando; C. H. Parsons, Tampa; Ernest Kelly, Orlando; C. B. Matthews, Kendall; C. H. Willoughby, Gainesville; and John Mohler, Orlando.

L. R. ARRINGTON
Secretary-Treasurer

Michigan Association of Sanitarians

At the last annual meeting, May 19th, the Michigan Association of Dairy & Milk Inspectors had a joint meeting with the Michigan Association of Sanitarians. The two associations amalgamated and the name of the new organization will be the Michigan Association of Sanitarians. The purpose of the Association as expressed in its new constitution is ". . . . to create and maintain a deeper interest in sanitation and to assist in carrying on the work in a more effective manner." Provision is made for four classes of members: active, associate, affiliate, and honorary. Qualifications for active membership are: official employment in some phase of sanitation control or research or education, an undergraduate degree or equivalent or experience of at least three years in an official agency; for associate membership, those who are interested in this work (but they may not vote nor hold major offices); for affiliate membership, those who are commercially engaged; and honorary members who have all the rights of active members but are exempt from payment of dues. The dues of all members alike are three dollars per year.

Wisconsin Milk Sanitarians Association

The 1948 annual meeting of the Wisconsin Milk Sanitarians Association will be held September 7th at the Loraine Hotel, Madison. A copy of the program may be obtained by writing to the secretary.

L. W. BROWN
Secretary-Treasurer

Metropolitan Dairy Technology Society

The Metropolitan Dairy Technology Society held its first annual outing at the Long Island Agricultural & Technical Institute, Farmingdale, L. I. After a buffet luncheon, the guests were conducted through the campus and buildings of this well equipped institution, then games of golf and softball, a fine dinner in the evening, a short address by Mr. Knapp, the Director of the Institute. The gavel of the 1947 president, Mr. Richard Doughty of Janssen Dairy, was returned to him with a brass plate bearing the appreciation of the Society suitably engraved thereon.

D. X. CLARIN
President

Birmingham Terminates Former Standardization Practise

The use of Grade A skimmed condensed milk in Birmingham and Jefferson County, Alabama, for standardization purposes was terminated on March 25 of this year.

The program of supplementing locally supervised supplies by standardizing with skim milk concentrates reconstituted as skim milk had its beginning in the fall of 1943 when the development of acute shortages required the institution of measures to meet adequately the consumer demand for milk of safe, wholesome, and nutritious quality. Because of the high average butterfat content (5 to 5.4 percent) for milk supplied by dairies of the Birmingham milk shed, standardization by the use of skim milk was effective to meet adequately consumer demands during the shortage months for 3.5 percent milk. Moreover, until comparatively recent date, late 1947, whole milk supplies of satisfactory quality to qualify for fluid purposes were not available in the quantities required to make up shortages which at certain periods represented as much as 50 percent of the total distribution. Specifically, from 1940 to 1947 distribution in the Birmingham area increased 57 percent while receipts increased only 34 percent.

The program was originally developed by establishing the "Reconstituted Pasteurized" grade which made provisions for the use of extra grade quality non-fat dry milk solids. However, poor consumer acceptance because of a caramelized flavor and use of the term reconstituted built up sales resistance to the extent that children in school lunch rooms, high school groups, refused it outright. The following year the use of Grade A skimmed condensed which, with the exception of removing a part of the water content, complied in every respect with Standard Milk Ordinance Grade A fluid milk standards, was introduced and its use for standardization overcame the objections of milk powder. As a whole it proved to be satisfactory as a supplementary supply. By establishing standards with regard to temperature, age, acidity, and plate counts, the use of the term reconstituted was not required to be expressed on the label.

The Board of Health entered into the program as being a realistic and practical means of alleviating serious shortages which if as an alternative was permitted to run its course or open the market to receiving ungraded or less than Grade A quality milk would have invited a control problem and distribution evils which would have required years to overcome.

A consistent improvement in the supply of locally produced milk and increased supplies of Grade A whole milk from other milk sheds were instrumental in terminating what served as an emergency program.

Massachusetts In-Service Sanitation Course

A one-week in-service training course, conducted from Monday, September 13, 1948, through Friday, September 17, 1948, will be held at the University of Massachusetts for persons in the field of public health inter-

ested in environmental sanitation. The course is designed specifically as a practical refresher course for qualified public health personnel. Although this training program is intended for residents of Massachusetts, registration is not limited to this group.

The program is sponsored by the University Department of Bacteriology and Public Health, in cooperation with other University departments and federal and state agencies.

The program will be as follows:

Monday:

Milk Sanitation.

Chairman—Dr. H. D. Hankinson, Department of Dairy Industry, University of Massachusetts.

Tuesday:

A.M. Session: Industrial Sanitation.

Chairman—Mr. John B. Skinner, Director, Division of Occupational Hygiene, Department of Labor and Industries.

P.M. Session: Food Technology.

Chairman—Dr. Carl R. Fellers, Department of Food Technology, University of Massachusetts.

Wednesday:

Restaurant Sanitation.

Chairman—Mr. A. A. Robertson, State Department of Public Health.

Thursday:

Water and Sewage Sanitation.

Chairman—Mr. Arthur D. Weston, Director, Division of Sanitary Engineering, Massachusetts Department of Public Health.

Friday:

A.M. Session: Rodent Control.

Chairman—Carl B. Henry, Assistant District Agent, Fish and Wildlife Service, U. S. Department of the Interior.

P.M. Session: Insect Control.

Chairman — Dr. Harvey L. Sweetman, Department of Entomology, University of Massachusetts.

For application forms, apply to the Director of Short Courses; for details write to the Department of Bacteriology and Public Health, University of Massachusetts, Amherst.

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For *Most* Visitors Admission Is Free

FREE
- All Dairy Processors
- Milk Inspectors and Health Officials
- Other Federal, State and Local Government People Having a Valid Interest
- Dairy Educators and Their Students
- Equipment and Supply Jobbers or Distributors (who are not also manufacturers), Invited at Request of Exhibitors

VARYING BUT STANDARD FEES CHARGED TO:
- Supply and Equipment Jobbers Not Invited by Exhibitors
- Non-Exhibiting Supply and Equipment Manufacturers

The Dairy Industries Exposition is staged for dairy industrial guests. To let them derive its full educational and commercial benefits unhampered, the general public is not admitted.

If you are uncertain of your eligibility to attend or as to the admissions category into which you will fall, communicate with DISA, Albee Building, Washington 5, D. C. The Exposition Credentials Committee will promptly advise you.

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Harris, L. C., 1018 N. E. 15th St., Oklahoma City, Okla.
Kelso, Gilbert L., State Hygienic Lab., Iowa City, Iowa.
King, James A., 2845 Niagara St., Denver 7, Colo.
Kreamer, F. W., 804 E. Union St., Manchester, Iowa.
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Schafroth, Ed., City Health Dept., Des Moines, Iowa.
Shulkin, I. A., Industrial Control Lab., Storm Lake, Iowa.
Smith, Jess, 219 East California, Walters, Okla.
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White, George E., Court House Annex, Evansville 8, Indiana.
Woosley, Douglas R., c/o Milk Bd. of W. A., Box 11.836, G.P.O. Perth, Australia.
York, A. F., State Dept. of Health, 3400 No. Eastern, Oklahoma City, Okla.

CORRECTION

George W. Kelly, Health Dept., City Hall, Winnipeg, Man., should have been listed as an Active member (*not* Associate).

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Chalker, S. T., Jr., 2708 St. Johns Ave., Jacksonville, Fla., to 4441 Blackburn Rd., Jacksonville, Fla.
Darger, H. C., Room 1449, One N. La Salle St., Chicago, to 2022 Lincoln St., Evanston, Ill.
DeWees, Fred. M., 1032 Marine Way, Clearwater, Fla., to 1601 Grove St., Clearwater, Fla.
Dinsmore, D. R., 1508 Hastings St., Vancouver, B. C., to 3277 Cambia St., Vancouver, B. C.
Ferreira, H. H., Box 157, Pearl City, Ill., to Box 217, Huntley, Ill.
Fowler, O. W., 1837 N. Laurel Ave., Phoenix, Ariz., to Rt. 8, Box 641 G, Phoenix, Ariz.
Freeman, Stanley, 214 Trenor Drive, New Rochelle, N. Y., to 4 Sylvan Rd., Waban, Mass.
Hansen, Glen M., 4544 N. 42nd St., Milwaukee 9, Wis., to 1252 So. Farwell St., Eau Claire, Wisconsin.
Hawkins, J. V., Jr., 102 E. A. St., Apr. B, Grants Pass, Oregon, to 2050 S. E. 176th St., Portland 16, Oregon.
Kihlstrum, E. E., 201 Bishop St., Peoria, Ill., to 10160 So. Homan Ave., Evergreen Park, Ill.
Kranaskas, Anthony, c/o Am. Embassy, Quito, Ecuador, to c/o American Embassy, Asuncion, Paraguay, S. A.
Kuder, Al. J., 604½ West Main St., Centralia, Washington, to 113 North Oak St., Centralia, Wash.
LaRue, John C., Jr., Arden, N. Y., to 12 New Market St., Poughkeepsie, N. Y.
Michels, E. P., Greenwood, Wis., to 806 St. George St., Green Bay, Wisconsin.
Nisbet, Ruth, 1512 Curtis, Denver 2, Colo., to 718 Boston Bldg., Denver, Colorado.
Okarma, T. J., R.F.D. 1, Warwick, N. Y., to Sunny Vale Farms, R.D. #1, Lafayette, N. J.
Peterson, D. L., Meier Ice Cream Co., Platteville, Wis., to Pet Milk Co., North Prairie, Wis.
Scatterday, J. E., Box 633, Gainesville, Fla., to State Bd. of Health, P. O. Box 210, Jacksonville 1, Fla.
Signorelli, John, 60–71 Metropolitan Ave., Brooklyn 27, N. Y., to 269 Wilson Ave., Brooklyn 21, N. Y.
Turgeon, J. P., 4340 Boulevard Pie IX, Montreal, to 19 Marien St., Montreal East, P. Q.
Wheadon, Willard, 68 A Cedar St., Malden, Mass., to 12 Hollis Ave., Lynn, Mass.

"Doctor Jones" Says—*

PAUL B. BROOKS, M.D.

Did you ever pop corn? No, that ain't public health, exactly, but what brought it to mind, I was thinking about these county health districts: the way they've been popping out lately, various parts of the State. The popcorn—it's accumulation of heat that starts it going, slowly at first, then faster 'til your popper's full. The county unit business: instead of heat it's accumulation of knowledge and understanding.

Most everybody's in favor of good health (Yes, even the doctors! In fact I'd say: *especially* the doctors.) But it's taken time for enough thoughtful and influential folks to satisfy 'emselves that there's a direct connection between good health administration and good community health. Now they've had time to see some efficient county health departments in action and see the results. And the law being changed so's to give 'em more State aid: that's helped some, too.

Speaking of the law: there's provisions in it for abolishing a county health district, after it's established, if they don't like it. But maybe you've noticed: no county in this State that's established one has ever abolished it.

I heard of a city that's included in one of 'em: the officials or somebody got the idea that maybe they'd be better off running their own show again. They hired an unbiased outsider to go in and study the situation and give 'em a report. Apparently it satisfied 'em it was to their advantage to stay in. Anyhow, they did.

No, public health, today, is a science: one that requires the full time of trained and experienced people. Folks 're realizing that they're entitled to have competent health service near enough at hand so't they can get at it. They couldn't have it under the small-unit, part-time system.

The county health departments serve their people in a lot of different ways. But, actually, one of the most useful things they do is helping their constituents to get an understanding of personal hygiene and public health. And, you know, I was just thinking: a county health district where a majority of the people really had a clear understanding of what it was all about and cooperated actively with their health department—they could make a health record that'd put 'em on the map. They'd be likely to make the front pages—even in a presidential election year.

* *Health News*, N. Y. State Dept. Health, Albany, Apr. 19, 1948.

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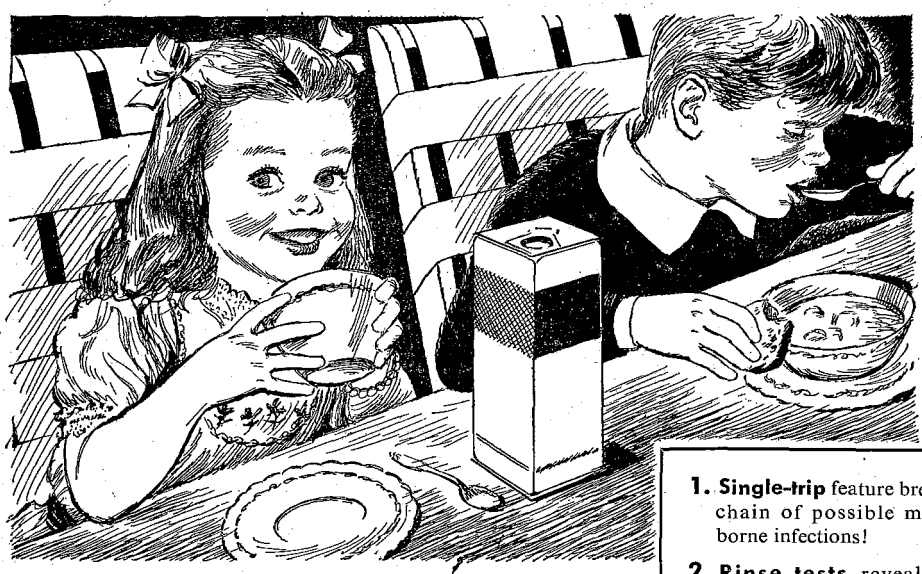

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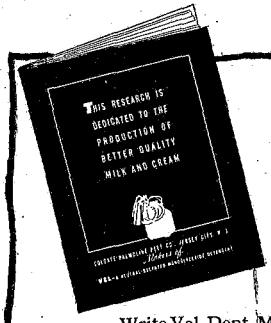

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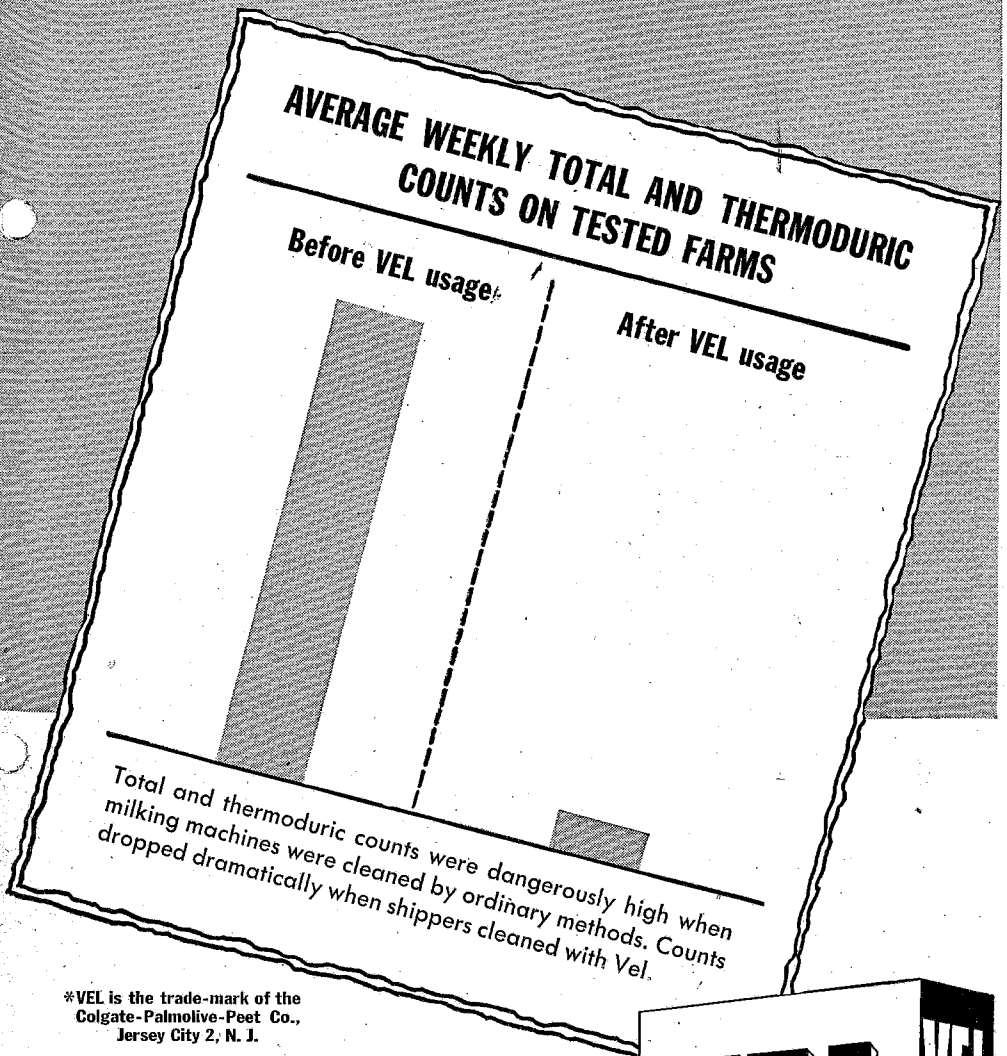

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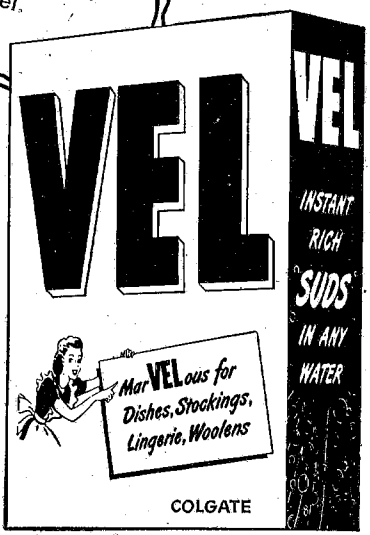

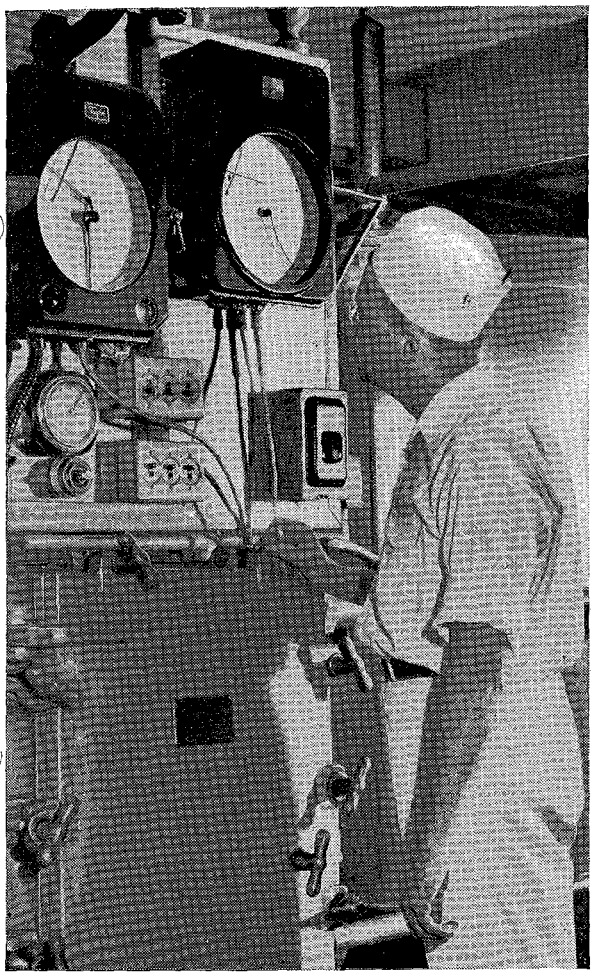

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