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Editorial

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

Are We On the Right Road?

BACK in the days when tires and gasoline were plentiful most of us occasionally took a long motor trip. Usually we had a definite objective. Before we started we got out our road maps, located the objective and laid out our route. On the way, if we were wise, we stopped occasionally and read the signs to make sure that we were on the right road.

Those of us who are responsible for and engaged in work in the field of milk sanitation also have an objective. Are we entirely clear as to just what it is? Are we sure we are on the road which will lead us to it most directly? If not, perhaps we would do well to consult our maps and to stop and read a few signs.

The primary and principal purpose of the enactment of "milk regulations" and employment of milk sanitarians to secure compliance with them is and always has been to make milk safe for human consumption. That means insuring that it will not cause or transmit disease; that it will be conducive and not detrimental to health.

Many of our present regulatory requirements, to the application of which we devote a large part of our time and effort, were promulgated, substantially in their present form, forty or fifty years ago. At that time relatively little was known about pathogenic bacteria and milk-borne infection. Practically all milk was dirty and teeming with bacteria. The generally prevailing idea was reflected in the slogan, long ago discarded: "Clean milk is safe milk." Bacterial content was regarded, principally, as an index of dirtiness. According to the prevailing conception, the way to make milk safe was to get the *dirt* out of it.

Our milk supply, over the years, has been cleaned up to a degree probably scarcely dreamed of by the pioneers. But still, except for that which is pasteurized, our milk is not safe. It still is responsible for numerous cases and outbreaks of disease. Why?

The safety of milk, as we know today, depends on keeping out of it a certain few pathogenic organisms or, if they can not be kept out, destroying them. The most important ones are typhoid bacilli, hemolytic streptococci of human origin, and brucellae. These come not from buildings or parts of buildings and not from unclean equipment but from infected persons and animals. Important examples are the typhoid carrier, the milker with sore throat, the cow whose udder he has infected, the cow with Bang's disease. We can not depend on the "human element." Our one dependable safety measure is pasteurization—more and better pasteurization.

And "better pasteurization" is not a matter of appearance of buildings and equipment. It is a matter of having pasteurizing equipment that *works,* operated by people who are intelligent, informed, and honest, and of protecting the pasteurized product from contamination.

What all this is leading up to is that we ought to go into executive session and review our requirements and activities in the light of modern scientific knowledge. How many of them actually have the effect of making milk safe and how many are being carried along merely as traditions from the "dirty milk" days? To re-check our course will not cost much in time and effort. If by any chance, we are not on the right road—the one leading most directly to our objective—the sooner we wake up to the fact the less time, effort, and money will be wasted. Let's get out our maps!

P. B. B.

WISCONSIN DAIRY MANUFACTURERS' CONFERENCE

Thursday, March 30, 1944

The following day's program is to be held in conjunction with the first annual meeting of the Wisconsin Milk Sanitarian's Association.

1. What are your employees—laborers or dairymen?—Walter Simon, State Industrial Commission, Madison, Wisconsin.
2. The Problem of Special Taxes as they apply to the Dairy Industry—George L. Mooney, Wisconsin Cheese Makers' Association, Plymouth, Wisconsin.
3. Methods of Wisconsin Organizations Used in Improving the Quality of Milk—Evert Wallenfeldt, Department of Dairy Industry, University of Wisconsin.
4. Mastitis Control Methods Up-to-date—G. R. Spencer, Department of Veterinary Science, University of Wisconsin.
5. An Appraisal of the Wisconsin Milk Sanitarian's Problems—C. O. Widder, City Health Department, Sheboygan, Wisconsin.
6. Teaching Milking Machine Rapid Cleaning Methods—M. F. Helmbrecht, Kraft Cheese Co. of Wisconsin, Beaver Dam, Wisconsin.
7. Three Minute Milking—Theory and Results—Inspection of Procedure in Operation—E. E. Heizer, Department of Dairy Husbandry, University of Wisconsin.
8. Joint meeting—Wisconsin Dairy Technology Society, Wisconsin Milk Sanitarians' Association, Wisconsin Dairy Manufacturers' Conference. "Agriculture in South America." Illustrated. N. P. Neal, Department of Agronomy and Genetics, University of Wisconsin.

Friday, March 31, 1944

Symposium on Post War Planning in the Dairy Industry

1. Planning on equipment in the dairy industry—A. W. Farrall, Creamery Package Mfg. Co., Chicago, Illinois.
2. Developments to come in condensary operations—H. H. Sommer, Department of Dairy Industry, University of Wisconsin.
3. Planning for future operations in the dairy industry—P. H. Tracy, Department of Dairy Manufactures, University of Illinois, Urbana, Illinois.
4. What the ice cream industry may look forward to—H. L. Templeton, Fairmont Creamery Company, Omaha, Nebraska.
5. The powdered milk industry, its problems, its future—P. H. Tracy.
6. Experience of dairy plants in paying for milk on the basis of fat and solids not fat content—Clifford M. Hardin, Department of Agr. Economics, University of Wisconsin.
7. Butter Oil Manufacture—its problems, its future—M. S. El-Rafey, Department of Dairy Industry, University of Wisconsin.

The Viability of Certain Udder Infection Bacteria In Butter Made from Raw Cream*

C. S. Bryan and P. S. Bryan

Michigan Agricultural Experiment Station, East Lansing, Michigan

The major portion of the commercial butter in the United States is made from pasteurized cream, which insures the freedom of the butter from viable pathogens that may contaminate the cream.

Because of the shortage of butter on the civilian market, increasing numbers of consumers are obtaining some or all of their butter directly from the farm producer. Very little of this "farm made" butter is manufactured from pasteurized cream.

Investigators concerned with the survival of human pathogens have inoculated butter with pathogenic organisms, stored it at 50° F., and then made periodic examinations for survival of the pathogens. Under such conditions, Berry (1) reported the survival time to be 212 days for paratyphoid B, 117 days for paratyphoid A, 7 days for the dysentery organisms, 17 days for *Streptococcus scarlatinae*, and 22 to 110 days for different strains of *Eberthella typhosa*. Carpenter and Boak (2) reported that *Brucella abortus* survived 142 days in butter that was inoculated with the brucella and then stored at 46° F. More recently Fitch and Bishop (3) made sweet cream butter from naturally infected cream and reported that the brucella were isolated from the salted and unsalted butter and the buttermilk.

In all of these cases, except the latter, the butter was inoculated with the pathogen studied, while in farm practice certain pathogen bacteria, notably brucella, streptococci, and staphylococci, may cause udder infection, thus insuring their presence in the cream produced. This study was made to determine the fate of certain pathogens in butter made from raw cream containing pathogenic organisms of the bovine type that are transmissible to man.

Source of the Cream

To insure the presence of pathogens in the milk, a cow was infected with *Streptococcus agalactiae* in the right rear quarter, *Streptococcus pyogenes* in the right front quarter, a non-hemolytic *Staphylococcus aureus* in the left front quarter, and a hemolytic *Staphylococcus aureus* in the left rear quarter by injecting 10 ml. of a 24 hour broth culture of the proper organism into the respective quarters. During the time that the cream was saved repeated examinations were made of the milk from each quarter to be certain that udder infection had resulted.

All milk produced during a period of one week was used. The cream was allowed to separate by gravity and then skimmed off with a cup. The cream was stored in the icebox (40° F.), and each day's supply was added for one week, thus allowing the accumulation of sufficient cream for churning. At the end of the week the cream was further contaminated by the addition of 200 milliliters of a 48 hour broth culture of *Brucella abortus*. The presence of all of the pathogens in the cream was confirmed by appropriate cultural procedures.

* Journal article number 686 (n.s.) from the Michigan Agricultural Experiment Station.

PREPARING THE CREAM FOR CHURNING

The cream was divided into two parts: one half was pasteurized in the laboratory by heating to 145° F. for 30 minutes and the other half was not pasteurized. Bacteriological examination of the pasteurized cream revealed destruction of all pathogens. The raw and the pasteurized cream was further divided into three portions. Portion one was immediately churned while the remaining two portions were held at 70° F. for varying periods before churning. Portion two was thus ripened for 6 days and portion three for 12 days.

Recently Trout, Devereux, and Bryan (4) presented a practical and effective means for the home pasteurization of milk or cream. This consists of heating the water in the bottom part of a kitchen double boiler to a vigorous boil, then putting in place for 10 minutes the top part containing the material to be pasteurized. It is important that the water be kept at a vigorous boil for the 10 minute period. Some contaminated cream was effectively pasteurized by this method.

MAKING AND STORAGE OF THE BUTTER

A small hand churn was used for making the butter. It was carefully washed and sanitized between churnings. One half of the butter made from each portion of cream was made without salt while to the other half, 2 percent of salt was added. All butter was shaped into patties (individual size) and separately wrapped in parchment. All portions were stored in the icebox at approximately 45° F.

EXAMINATION OF THE BUTTER FOR PATHOGENS

The butter made from the pasteurized cream was examined with negative results, thus confirming the destruction of the pathogens by pasteurization of the cream prior to churning.

Twice weekly a patty of raw cream butter from each group was examined bacteriologically. Each patty was unwrapped and placed into a sterile 100 ml. flask in a 37° C. water bath to melt. Direct 0.3 ml. plantings were made into tryptose blood agar containing 0.05 percent of sodium azide for streptococcus isolation, into tryptose blood agar containing 1 to 200,000 gentian violet for staphylococcus isolation, and 0.3 ml. was plated on the surface of liver infusion agar containing 1-to-700,000 gentian violet for brucella isolation. The plates for staphylococcus and streptococcus isolation were incubated at 37° C. for 72 hours, while the plates for brucella isolation were placed into a 10 percent carbon dioxide atmosphere and incubated at 37° C. for 5 days. Typical colonies were picked and identified in each instance.

SURVIVAL OF THE PATHOGENS IN THE BUTTER

The results of survival of the pathogens are presented in Table 1. No pathogens were isolated from the butter made from the pasteurized cream. Brucella abortus persisted for 4 months in the salted and unsalted butter churned from the raw sweet

TABLE 1

THE MONTHS OF SURVIVAL OF THE PATHOGEN IN BUTTER

Pathogen	*Raw Cream Butter*					
	Sweet Cream		*Ripened 6 days*		*Ripened 12 days*	
	Salted	*Unsalted*	*Salted*	*Unsalted*	*Salted*	*Unsalted*
Brucella.	4	4	3	3	3	3
Streptococci	6	6	6	6	6	6
Staphylococci.	6	6	6	6	6	6

cream and for 3 months each in the butter made from the raw ripened cream. The animal and human streptococci, and the hemolytic and non-hemolytic staphylococci were recovered for 6 months from the salted and unsalted butter made from raw sweet cream, and cream ripened for either 6 or 12 days.

DISCUSSION

To simulate natural conditions of udder infection among dairy cattle, the quarters of a cow were infected with pathogens. The injection of the streptococci (*Str. agalactiae,* and *Str. pyogenes*) and staphylococci (an hemolytic and a non-hemolytic strain of *Staph. aureus*) into individual quarters of a cow resulted in udder infection; this assured the presence of these organisms in the milk.

Although some of the pathogens remained in the skim milk a large number were concentrated in the gravity separated cream. This naturally infected cream, further contaminated by the addition of *Br. abortus*, was used to make raw cream butter. The survival of the pathogens in this butter for a considerable period of time indicates a public health hazard. This hazard does not exist where the cream is pasteurized prior to churning, therefore the importance of pasteurizing cream for butter making is reemphasized by these results.

SUMMARY

Butter made from raw cream containing bovine pathogens transmissible to humans presents a health hazard because: (a) *Brucella abortus* remained viable for 4 months in raw sweet cream and ripened cream butter, and (b) *Streptococcus agalactiae* and *Streptococcus pyogenes* and both a hemolytic and a non-hemolytic strain of *Staphylococcus aureus* persisted for 6 months in raw sweet cream and in butter made from raw cream which was ripened prior to churning. The results were similar in butter made without salt and in butter made with 2 percent of salt added.

Pasteurization of the cream prior to churning removes this health hazard by destroying all of the pathogens tested. The effective methods of pasteurization studied were (a) heating to 145° F. for 30 minutes, and (b) the double boiler home pasteurization method.

LITERATURE CITED

1. Berry, A. E. Viability of Pathogenic Organisms in Butter. *J. Prev. Med.,* 1, 429 (1927).

2. Carpenter, C. M., and Boak, Ruth. *Brucella abortus* in Milk and Dairy Products. *Amer. J. Public Health,* 18, 743 (1928).

3. Fitch, C. P., and Bishop, Lucille. Presence of *Bact. abortus Bang* in Raw Milk, Butter, and Ice Cream. *Proc. Soc. Exp. Biol. Med.,* 30, 1205 (1933).

4. Trout, G. M., Devereux, E. D., and Bryan, C. S. Practical Methods for Home Pasteurization of Milk. *Mich. Agr. Exp. Sta. Quart. Bul. 26,* (1) 61 (1943).

A Gastroenteritis Outbreak From Food

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An outbreak of illness of 57 known cases suggestive of food poisoning from staphylococcus toxin occurred among the employees of a defense plant in the city of Attleboro, Massachusetts.

The outbreak occurred on July 28, 1943. Investigation by the local and district state health officials disclosed that there were fourteen foods eaten at one or more of the three times of serving, namely, at 10:00 A.M., at 12 noon, and at 3 P.M. The foods were prepared, for the first time, at the plant cafeteria. The 10 A.M. menu consisted of raw milk, hot coffee (the pasteurized cream used being diluted with raw milk) and doughnuts. The noon meal consisted of raw milk, hot coffee (same as above), hamburg, potato salad, watermelon, iced coffee (the cream used was also diluted with raw milk), bottled pasteurized milk-drink, and soda. The foods served at the 3 P.M. meal were raw milk, hot coffee (same as above), iced coffee (same as above), soda, and cake.

Incubation Period

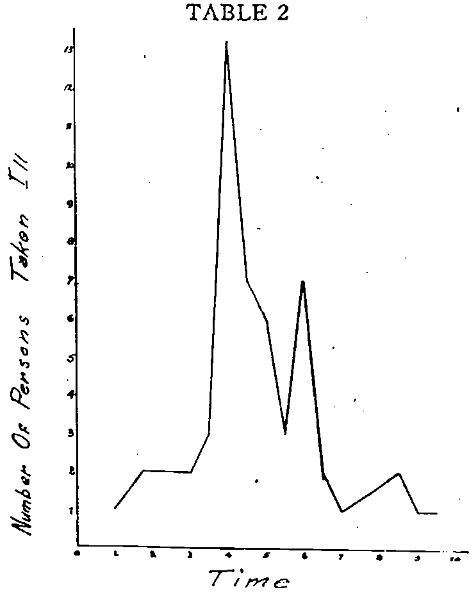
The first person became ill between 1:00 P.M. and 1:30 P.M. and the peak of the onset was between 3:30 P.M. and 4:00 P.M. (See Tables 1 and 2.)

TABLE 1

Estimation of Incubation Period

Time	*Number of persons taken ill*
1:00–1:30	1
1:30–2:00	2
2:00–2:30	2
2:30–3:00	2
3:00–3:30	3
3:30–4:00	13
4:00–4:30	7
4:30–5:00	6
5:00–5:30	3
5:30–6:00	7
6:00–6:30	2
7:00	1
8:30	2
9:00	1
9:30	1

TABLE 2



THE CLINICAL PICTURE

The illness was acute with severe vomiting, prostration, diarrhea, and abdominal cramps. There were no fatalities. Thirty-four of the employees were treated at the local hospital, and 23 others, who were ill, were treated at home by their family physicians or received home treatment. Twenty of the 34 persons treated at the hospital were released and 14 were confined to the hospital. (See Table 3.)

Of the 14 who were confined to the hospital, 9 were released the second day, and 5 remained at the hospital. Of these, 4 were released the third day, and the last patient was released on the fifth day after the outbreak.

Among 23 persons who were interviewed but who *were not* ill, 23 were exposed to drinks containing raw milk, 6 were exposed to potato salad, and 11 were exposed to hamburg steak. There were 10 individuals who did not eat the noon meal but had eaten at the morning or afternoon meals, or both, and none became ill. All of these 10 persons were exposed to drinks containing raw milk. Of the 53 individuals who were ill and interviewed, 49 were exposed to drinks containing raw milk, and 4 were not exposed to raw milk but were exposed to potato salad. It was learned that 50 of these same 53 individuals were exposed to potato salad and that 3 were not exposed to the salad, but were exposed to the raw milk.

TABLE 3

SUMMARY OF THE CLINICAL PICTURE OF THE INDIVIDUALS WHO WERE HOSPITALIZED

Persons	*Number of hours hospitalized*	*Temperature*	*Pulse*	*Respiration*
1	24	96.2–98.6	90–80	20
2	24	99.8–98.6	100–85	20
3	48	96.8–98.6	80–80	20
4	24	100–98.6	110–80	20
5	120	99–98.6	95–70	25–20
6	48	96.8–97	90–60	20
7	48	98.6–98.6	80–73	20
8	48	97.8–98	72–80	20
9	24	98–98.6	88–80	20
10	24	97.8–99.2	75–89	24–20
11	24	98–98.6	79–88	20
12	24	99.5–98	95–75	20
13	24	98.6–98.2	68–56	17–20
14	24	98.6–98.6	82	20

THE INCIDENCE OF CASES AMONG THE 80 WORKERS OF THE DAY SHIFT AT THE PLANT

On the day of the outbreak 20 persons were interviewed at the hospital, and information was obtained concerning the foods eaten. It is interesting to note that in all but two cases this original information was not consistent with the data obtained at a later date.

On August 2, 1943, all of the 74 employees of the day shift, who were present at the plant, were interviewed. The data obtained included information concerning the foods eaten, particular symptoms, time of onset of attack, time of eating, and facts of illness.

Inquiry also revealed (see Table 4) that among 70 persons exposed to the 10 A.M. foods, 47 persons or 67 percent became ill. Among the 63 persons exposed to the noon meal foods, 50 individuals or 79 percent became ill. It was also learned that among the 57 persons exposed to the 3 P.M. foods, 36 or 63 percent became ill. Further study of Table 4 discloses that among 73 persons exposed to raw milk drinks, 50 persons or 68 percent became ill, and among the 55 persons exposed to potato salad, 49 individuals or 89 percent became ill.

TABLE 4

ATTACK RATE AMONG EMPLOYEES OF PLANT

	Total	Became ill	Were not ill	Percent ill	Percent not ill
Persons ate at 10 A.M.	70	47	23	67+%	33—%
Persons ate at 12 noon	63	50	13	79+%	21—%
Persons ate at 3 P.M.	57	36	21	63+%	37—%
Persons who had drinks containing raw milk	73	50	23	68.4+%	31.6—%
Persons who ate hamburg	56	45	11	81.4+%	18.6—%
Persons who ate potato salad Note: (Lettuce and tomato part of salad)	55	49	6	89%	11%
Persons who *did not* eat potato salad	9	2	7	23—%	77%
Persons who *did not* have drinks containing raw milk	4	4	0	100%	0%
Persons who *did not* eat 12 o'clock meal	10	0	10	0%	100%

THE SOURCE OF THE INFECTING ORGANISMS

The epidemiological and clinical data support the theory that the illness probably was caused by an enterotoxin of *Staphylococcus* origin in the incriminating foods. These were milk drinks containing raw milk and/or potato salad.

Examination of the hands of the three food handlers revealed no evidence of skin infection or other localized infection. Inspection of the cafeteria disclosed that the kitchen was in good sanitary condition, that the foods used were fresh and obtained from reliable sources, except the raw milk supply which was being dispensed at the cafeteria in violation of a local pasteurization regulation, and that the refrigeration and storage of the foods were adequate. The raw milk supply was obtained from two farms located in another town. Both of these farms were found to be in an insanitary condition. The refrigeration and care of the milk at both farms were inadequate. These farms were never recorded with the local Health Department and therefore were never inspected until the time of the outbreak.

Throat cultures were obtained, during the investigation, from the three food handlers and the four persons handling the raw milk supply. *Staphylococci* were found to be present in the throats of one of the milkers at each farm. There were no apparent suspicious illnesses among the persons at either farm or among the food handlers.

The seven cows which were supplying the plant cafeteria with milk were examined by a state veterinarian, and milk samples were obtained from each.

Bacteriological and chemical examination of the foods involved in the outbreak were made. *Staphylococci* were not found in the cultures from the hamburg steak, mayonnaise, butter, and cake. The organisms were found in the cultures from the drinks containing raw milk and the potato salad. The milk from four quarters of six cows showed the presence of *Staphylococci,* and the milk from the seventh cow tested showed *Staphylococci* present in one quarter.

The chemical analysis of the milk showed no arsenic, antimony, mercury, or fluorides present in the food.

Two water samples taken in the factory proved to be free from bacteria characteristic of pollution.

Although it was impossible to determine the exact food causing the outbreak, it became apparent that there was probably a definite link between the heavily contaminated raw milk and the potato salad which also carried the causative organisms. Consequently, this point was investigated. It was disclosed that there were at least two common vehicles by which this particular milk could have contaminated the potato salad. It was found that, during the morning of the outbreak, a long-handled spoon was used to stir the raw milk and was subsequently used, without washing, to mix the salad. Another significant fact was that a strainer was used to strain clumps from the raw milk, and this utensil was used later, without washing, to strain parsley which was used as an ingredient in the potato salad. The data were definitely substantiated by the chef himself. However, because of the lack of significant laboratory findings for *Staphylococci* in the specimens of the milk and potato salad, it is impossible to reach a definite, satisfactory conclusion in regard to naming either the potato salad or the milk as the exact food responsible for the outbreak, nor can it be definitely ascer-

TABLE 5

RESUME OF THE LABORATORY RESULTS OF THE SPECIMENS OF FOOD INVOLVED IN THE OUTBREAK

Raw milk sample	2 strains of *Staphylococcus aureus,* one which fermented lactose and mannite and produced coagulase. The other fermented lactose but did not produce coagulase. Negative for paratyphoid group.
Standard Plate Count of Raw Milk per ml.	Count over one million.
Potato Salad	A *Staphylococcus aureus* which fermented lactose but not mannite and did not produce coagulase.
Coffee Milk	A *Staphylococcus aureus* which fermented lactose and mannite but did not produce coagulase.
Milk (direct from cows) 333377 (4 quarters) 521 (4 quarters) 649928 (LR, RR and LF) D-45387 (RF and RR) 129038-B (RR) C-22269 (RR, LR, RF and LF) 655366 (RF, LF, LR, RR)	*Staphylococcus aureus* of five cultural varieties.
Milk (direct from cows) D-45387 (LF and LR) 129038-B (RR) 649928 (RF)	*Staphylococcus albus.*
Hamburg Apple Turnover Blueberry Muffin Cookies Brownie	No *Staphylococci* or paratyphoid group.
Milk 129038-B (4 quarters) Cream (Holstein) Butter (Jar) Butter, Pat	No *Staphylococci.*
Mayonnaise	No *Staphylococci* or paratyphoid group.
Water	Two samples—no bacteria characteristic of pollution.
Food.	Chemical analysis showed no arsenic, antimony, mercury or fluorides present.
Throat Cultures	*Staphylococci* were found in the cultures from the throats of a milker at each farm.

tained that the milk was the contaminating agent.

CONCLUSION

Although evidence is not conclusive, the probability that the raw milk was the incriminating food in this particular outbreak cannot be ignored. With this idea in mind, it is needless to say that the finger of suspicion points to the possibility that once again raw milk was the primary factor in another outbreak of illness which might have been prevented if properly pasteurized milk had been used in accordance with the requirements of the local milk pasteurization regulation.

The assistance of Dr. Roy F. Feemster, Dr. Harold W. Stevens and Dr. Kingston of the Massachusetts State Department of Health, of the members of the State Health Department Laboratory, and of Dr. Walker of the State Department of Public Safety is gratefully acknowledged.

Applying the Direct Microscopic and Swab Tests in a Milk Control Program

N. O. Gunderson
Commissioner of Health

AND

C. W. Anderson
Laboratory Director
Rockford, Illinois

Prior to 1943, use was made of the sediment, methylene blue reductase, phosphatase, standard plate count, and coliform tests in appraising the sanitary quality of milk in the Rockford, Illinois, milk shed, consisting of 405 milk producers and eight pasteurization plants, supplying milk and milk products to a population of 110,000 people.

As of October 1st, 1943, a study was made of certain results obtained with a plan in which the Direct Microscopic Test and Swab Test played an important role as shown in these two outlines:

Tests Used Prior to January 1st, 1943

1. The Sediment Test
2. The Methylene Blue Reductase of raw milk (a useful test with no laboratory available)
3. The Phosphatase Test
4. The Standard Plate Count Test of pasteurized milk
5. The Coliform Test of pasteurized milk

Tests Used Since January 1st, 1943

1. The Sediment Test
2. The Direct Microscopic Test of the incoming raw and pasteurized milk
3. The Phosphatase Test
4. Standard plate counts—comparison only
5. The Swab Test of cleaned equipment

Whether this changed procedure should be extended into the year 1944 forms the basis of this report, as revealed in Table 1.

TABLE 1

A. Standards

Sediment Test to Note Cleanliness of Milk	*Direct Microscopic Test of the Raw and Pasteurized Milk*	*Phosphatase Test*	*Swab Test of Cleaned Equipment*
A. Criteria 1. Clean .... 0 mgm. 2. Acceptably clean.. 25 mgm. 3. Dirty ....100 mgm. 4. Very dirty........125 mgm.	*A. Criteria* Raw milk........200,000 Pasteurized milk..100,000 Cream ....500,000 *B. Raw—Differential Microscopic* 1. Evidence of mastitis 2. Ineffective Cooling 3. Contaminated utensils *C. Pasteurized—Differential Microscopic* 1. Thermophilic bacilli (usually due to seeding of equipment) 2. Mastitis streptococci (from raw milk) 3. Other heat resistant types	Of pasteurized milk to note faulty pasteurization and possible mixing of some raw milk with pasteurized milk.	Swabs are cultured on tryptose agar plates *A. Criteria* 1. No growth 2. Slight growth 3. Excessive growth This test was helpful in locating equipment trouble as described later on in this report.

B. PREVAILING CAUSES OF HIGH MICROSCOPIC COUNTS OF THE INCOMING RAW MILK

A. Mastitis		*B. Contaminated Utensils*		*C. Ineffective Cooling*	
Mastitis and utensils	177	Utensils and mastitis	177	Cooling and utensils	98
Mastitis only	127	Utensils only	170	Cooling and mastitis	85
Mastitis and cooling	85	Utensils and cooling	98	Cooling only	47
All three	53	All three	53	All three	53

C. MONTHLY LOGARITHMIC AVERAGES OF THE INCOMING RAW MILK AND PASTEURIZED MILK

(Standard Plate Count will be discontinued January 1, 1944.)

Month	*Microscopic Tests of Incoming Raw Milk*	*Microscopic Tests of Pasteurized Milk*	*Standard Plate Count of Pasteurized Milk*
January	55,000	320,000	40,000
February	35,000	220,000	41,000
March	38,000	50,000	14,000
April	24,000	32,000	8,000
May	44,000	16,000	5,000
June	150,000	30,000	8,000
July	100,000	36,000	5,000
August	100,000	83,000	8,000
September	41,000	20,000	5,000

D. MONTHLY LOGARITHMIC AVERAGES OF MICROSCOPIC TESTS OF PASTEURIZED MILK BY DISTRIBUTORS

Month	*Dairy 1*	*Dairy 2*	*Dairy 3*	*Dairy 4*	*Dairy 5*	*Dairy 6*	*Dairy 7*	*Dairy 8*
Jan.	220,000	31,000	5,000,000	120,000	700,000	None	500,000	280,000
Feb.	110,000	170,000	400,000	53,000	74,000	65,000	5,400,000	410,000
March	12,000	28,000	47,000	170,000	33,000	310,000	82,000	26,000
April	63,000	14,000	10,000	15,000	49,000	29,000	51,000	22,000
May	24,000	10,000	10,000	10,000	26,000	13,000	16,000	14,000
June	45,000	40,000	56,000	16,000	47,000	10,000	30,000	39,000
July	50,000	36,000	100,000	17,000	63,000	13,000	87,000	23,000
Aug.	47,000	43,000	49,000	32,000	600,000	83,000	110,000	64,000
Sept.	16,000	20,000	10,000	23,000	48,000	14,000	24,000	13,000

COMMENTS

1. The increased average counts for the raw incoming milk for June, July, and August is apparently a normal seasonal increase due to higher temperatures of the summer months. The increased count for these months is not reflected in the direct microscopic examination of pasteurized milk except during the hot month of August.

2. The average counts of the raw incoming milk during the coldest winter months of January and February are quite low, indicating again the effect of temperature upon bacterial growth. It is very interesting to note that the average microscopic counts of the pasteurized milk during these two months are very high, considerably higher in fact than the raw milk averages.

This anomalous and apparently incredible condition is due to the extremely large numbers of thermophilic bacilli which were present on the equipment of these plants during this period. It is believed that, except for the seeding of the equipment, the effect of thermophilic bacilli which were present in the raw milk as delivered to the plants, was a negligible factor in enhancing the counts of the pasteurized milk at this time. There are two factors which may explain the high microscopic counts of pasteurized milk during the months of January and February and the subsequent sharp reduction in such counts during the months of March, April, May, and June.

The first and most important was the fact that swab tests were made of pasteurization equipment on all plants during February and March. These tests indicated that thermophiles were present in many cases on the hoppers, screens, receiving vats, pasteurizer vats, agitator paddles, and cooling coils. The equipment was dismounted and cleaned in the afternoon. Because of conditions related to humidity, lack of air circulation and favorable temperature, in some cases, a tremendous increase in growth of thermophiles on the equipment took place overnight. These favorable conditions were at a maximum during January and February and became less favorable during the following months.

The second factor was the fact that in the latter part of February and March as the situation with reference to thermophiles was understood more completely, chlorine concentrations for disinfecting the equipment were increased to the point where efficient destruction of thermophiles took place. In some instances 300 ppm. of chlorine were necessary for a period of several days with a subsequent reduction to a normal average of 150 ppm. It is hoped that greater care in cleaning equipment and higher concentrations of chlorine will prevent a repetition of this condition during the coming winter months.

3. The ratio of average plate counts to average microscopic counts fluctuates over a considerable range. It is believed that such fluctuations are primarily due to the fact that thermophiles grow with difficulty in the milk media used and also because temperature of incubation may not be the most favorable. Fluctuations in the ratio due to the counting of dead organisms in the microscopic test has in our experience been a negligible factor. The wide fluctuations encountered illustrates the inadequacy of the plate count method as a means of estimating the bacterial population of milk.

4. Only through the use of the direct microscopic test on pasteurized milk and the swab test on pasteurization equipment was it possible to gain information concerning the presence, source, and eventual elimination of thermophiles from the pasteurized milk. The plate count gave no useful information in this respect.

5. The coliform test indicates only the presence or absence of colon organisms in pasteurization equipment following pasteurization. Since the coliform test gives no information concerning the presence of thermophiles on equipment either prior or subsequent to pasteurization, it also gave no useful information in this respect. If the absence of coliform bacteria is interpreted as indicating that pasteurization equipment is clean and sterile and hence by inference free from thermophiles or heat-resistant bacteria, then the coliform test is very misleading. This interpretation is not suggested in standard methods but is nevertheless very prevalent. If the interpretation of a positive coliform test is strictly limited to possible recontamination of pasteurized milk by small traces of raw milk or dust in the atmosphere, then it supplies information which may be useful to the health officer and milk inspector but not to the *general public*. A negative coliform test should not be interpreted as having any bearing upon the cleanliness or sterility of pasteurization equipment.

Due to the confusion surrounding the interpretation of the coliform test and the fact that the test is rarely made within the time limits specified in the standard methods, its practical usefulness as a standard method is very debatable and open to serious objections.

6. If the average counts of the raw incoming milk are considered to be unusually low in relation to such counts obtained in other areas, it should be borne in mind that the producers supplying milk in the Rockford area have been under continuous and very close supervision for the past fourteen years. Such supervision included weekly testing of each producer's milk with the reductase and sediment tests as well as adequate farm inspection. Information concerning these tests have been reported annually in the Dairy Research Bulletin, Detroit, Michigan, since 1929.

MANNER OF APPLYING TESTS

Through a cooperative agreement, the milk producers, pasteurization milk plant owners, and the city health department acquiesced in carrying out the following milk control procedures:

A. Incoming Raw Milk

1. *To assure palatable milk,* the weighman in each of the 8 pasteurization plants conducted daily odor, appearance, and temperature (by feeling of the cans) observations of the milk before dumping. Cans that were objectionable were set aside for later testing.

2. *To assure clean, high quality milk,* the weighmen also conducted weekly sediment tests, and collected milk samples from the weigh can monthly in test tubes, which were iced and delivered to the city laboratory by the city milk sanitarian, for conducting direct microscopic tests on the milk.

3. *To minimize customer complaints,* the direct microscopic test was applied to the pre-pasteurized milk for the purpose of noting: (a) excessive bacteria counts, (b) evidence of mastitis as revealed by the presence of pus cells, and long chain streptococci, (c) signs of improper care of utensils as shown by clumps of bacteria, and (d) ineffective cooling of the milk as evidenced by an excessive number of lactic acid bacteria. Even though milk is pasteurized, the possible presence of gastroentero-toxins, not destroyed by the heat of pasteurization is an important factor in causing digestive disturbances, especially in bottle fed infants.

4. *To assure capacity milk production,* notices of abnormal milk, especially as related to mastitis, and contagious abortion (test requests from veterinarians), were followed up with dispatch by a farm milk advisor paid by the producers and milk distributors, who maintains an office in the City Health Department, because rejection of milk and low production cows are a direct financial loss to producers and distributors. Field follow-ups for minor infractions, consisted essentially of can tags, letters, phone calls, and temporary shut-offs, while submitting test samples to the laboratory. Milk was rejected as a last resort only.

5. *To foster milk producer cooperation,* routine farm inspection findings were recorded on the regular scoring sheets recommended in the Standard Milk Ordinance, but also supplemented by detailed written comments, which were mailed to each producer. This was very helpful.

6. *To satisfy local milk code requirements,* the city health department milk sanitarian was delegated to supervise all testing procedures, milk rejections, and permanent shut-offs, but subject, however, to a cooperative review by the milk producers and pasteurization plant owners when desired.

7. *To command program respect,* it was deemed essential to adhere to two axioms, one of which was "Educate Do Not Boss" and the other "Remember That Persuasion Is Always Better Than Force." This procedure proved very helpful to the field men.

B. Pasteurized Milk

1. *To assure clean pasteurizing equipment,* periodic sterile cotton stick swabbings (similar to throat cultures) of equipment surfaces after cleaning, were streaked on agar plates divided into 4 areas with a red glass pencil, to detect possible seeding of the equipment with lacto-bacilli and other mesophilic and thermophilic organisms, which often affect the taste, odor, and consistency of milk, resulting in customer dissatisfaction.

2. *To assure maximum pasteurization plant efficiency,* a minimum of 12 swab tests of the equipment were used in each of the pasteurization plants, which required only three agar plates. Results of this test were reported as (a) no growth, (b) slight growth, and (c) excessive growth. The mere showing of these results to plant operators was very helpful. No counts were made of the plates.

3. *To assure good keeping quality milk,* routine periodic checks of pasteurization vat thermometers and recording thermometer charts by the city milk sanitarian were most helpful to the plant owners in assuring customers that the milk was of good keeping quality.

4. *To assure customers safe milk,* a phosphatase test was conducted on the pasteurized milk to assure plant owners that the plant operators were actually operating the pasteurizers at the right temperature for the required time, and that no raw milk was being mixed with the pasteurized milk.

5. *To keep farm utensils and pasteurization plant equipment from seeding the milk with lacto-bacilli and other thermophilic organisms,* direct microscopic tests were applied to the finished pasteurized milk, to note the number and types of bacteria present. This test replaces the standard plate count, which is quantitative and not qualitative in character. All samples were collected from the refrigerator storage room, within two hours after pasteurization, so that observations would be uniform for all plants. No delivery wagon samples taken. (Low count milk keeps sweet longer.)

6. *To note other plant care,* periodic checks were made of the cleaning, washing, and equipment storage operations, cleaning solutions were chemically tested for proper strength, and refrigerator storage room temperatures were checked, in cooperation with the plant foreman.

7. *To assure rich creamy milk.* Babcock tests of the milk were conducted periodically to assure a uniform butter fat content.

Recapitulation of Procedures

A. Incoming Raw Milk

Odor, temperature and appearance—Daily
Sediment tests—Weekly
Direct microscopic tests—Monthly

Routine farm inspections—Semiannually
Follow-ups—As indicated
Standard plate counts—None
Notices—as indicated
Narrative reports—Monthly to distributors and producers associations

B. Pasteurized Milk

Swab tests of equipment—Monthly
Direct microscopic—Weekly
Phosphatase tests—Each batch
Temperature chart checks—Each batch
Staff thermometers—Each batch
Cleaning solution tests—Weekly
Butter fat tests—Weekly
Standard plate counts—see above
Coliform test—None

SOME ADVANTAGES OF THE PLAN

1. **The plan meets four cardinal consumer milk requirements,** because especial stress is placed on those control procedures, directly related to milk quality, such as (1) Cleanliness, (2) Safety, (3) Keeping Quality, and (4) Richness.

2. **The plan obviates non-essentials,** by minimizing milk control procedures which do not directly affect the quality of milk.

3. **Eliminates time-consuming standard plate count tests.** The plan substitutes the quickly conducted Direct Microscopic Test for the time-consuming Plate Count Test, because the Microscopic Test is qualitative in character and aids in directing attention to possible sources of contamination which affect the taste, odor, and consistency of milk with possible formation of gastroenterotoxins which may cause digestive disturbances.

4. **The plan tends to reduce milk rejection,** by government officials passing on milk and milk products for the armed forces, lend-lease shipment, and civilian use.

5. **Simplicity of plan has appeal,** Milk producers, pasteurization plant operators, and milk sanitarians have voiced a keen desire to continue to cooperate in the plan because of its simplicity.

6. **Encourages consumer satisfaction** because each test procedure defines and apparently locates sources of potential contamination affecting the taste, odor, appearance, and safety of the milk.

7. **Assures uniform baby feeding formulas.** The plan gives assurance that gastroenterotoxins in milk are kept at a minimum, so essential to hospitals and mothers preparing feeding formulas for infants.

8. **Is a safeguard against milk-borne epidemics.** The plan apparently aids in keeping milk-borne epidemics at a low figure, as evidenced from city health department morbidity records.

9. **Plan is in keeping with the war effort** because it is economical to operate, practical, and eliminates, non-essentials, so vital in our war effort.

POSSIBLE OBJECTIONS TO THE PLAN

1. **Difficult to adopt in some localities.** The plan perhaps does not lend itself naturally to the rigid scoring requirements of the Standard Federal Milk Ordinance as related to raw and pasteurized milk. It does however include the basic fundamentals of environmental sanitation in the Federal Ordinance plus additional platform tests for actual milk quality.

2. **Minimizes environmental factors.** It has been suggested that the plan places too much emphasis on milk quality and not enough emphasis on environmental conditions surrounding the production and processing of milk.

CONCLUSIONS

1. From data presented, it apparently can be said that the inaccurately quantitative Standard Plate Count Test has outgrown its usefulness as a milk control procedure for pasteurized milk as well as for raw milk for pasteurization.

2. The Direct Microscopic Test of both raw and pasteurized milk and the Swab Test for determining equipment cleanliness apparently offer certain

(Continued on page 110)

The Effects of Farm Cooling Methods and Transportation on the Temperature of Night's Milk

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The importance of keeping milk adequately cooled at every stage of its handling—from production to eventual consumption—is clearly recognized. If the three prime essential factors in the production of raw milk of good sanitary quality were listed, proper cooling would take its place alongside of healthy cows and clean utensils. In fact, even if utensils are not as clean as desired, it is still possible to keep the bacteria count of milk down by maintaining milk at a low temperature during the usual handling period.

Platform examination of in-coming milk for temperature does not necessarily give the inspector the actual temperature of night's milk at which it was kept on the farm, since in some instances milk is iced in transit to the plant and its temperature reduced, or, the temperature may increase on long hauls if refrigeration or proper insulation is not maintained on delivery vehicles. This is particularly true where proper segregation is not maintained between the warm morning's milk and the cooled night's milk on vehicles and no ice is used during transportation.

In this respect the platform test for temperature is similar to the sediment test which does not necessarily reveal whether clean methods were employed at the farm.

In 1942, the New York City Department of Health undertook a program of checking temperatures of milk on farms prior to its being loaded on delivery trucks, to ascertain (a) the actual temperatures under which night's milk is kept on farms; (b) the types of cooling methods employed; (c) the relative efficiency of various cooling methods; and (d) the effect of various transportation practices on temperature of the milk before its receipt at the plants.

Temperature of Night's Milk on Farms

The temperature range of cooled night's milk as found at the time the haulers picked up the milk at the farms is summarized in Table 1. It will be noted that 36.7 percent of the producers cooled milk to below 46 degrees F.; 53.6 percent of the producers to below 51 degrees F.; 42.7 percent cooled between 51 and 60 degrees F.,

TABLE 1

Temperature of Nights' Milk on New York City Approved Dairy Farms, Immediately Prior to Delivery during June, July, August and September, 1943, Covering Various Parts of the New York City Milk Shed

	45° F. or lower	*46° to 50° F.*	*51° to 55° F.*	*56° to 60° F.*	*61° to 65° F.*	*66° F. and higher*	*Total*
Number of Dairies	820	377	511	443	67	15	2,233
Percent	36.7%	16.9%	22.9%	19.8%	3%	.7%	
	53.6%		42.7%		3.7%		

and only 3.7 percent of the producers' milk exceeded 60 degrees F. Since the Sanitary Code permits cooling on farms to a maximum of 60 degrees F., this is a remarkably good record of performance and is an adequate reward for many years of effort.

This effort consisted chiefly of close deck inspection for quality, follow-up inspection on farms delivering milk of poor quality, general emphasis on cooling and advocating mechanical refrigeration and insulated and covered cooling vats. At every opportunity we have advised producers that much of the milk rejected because of poor quality would have been accepted if proper cooling facilities had been provided on the farm. We recommended the use of mechanical refrigerators wherever spring water at around 50 degrees F., was not available during the warmest weather. We also discouraged the use of well water without ice unless the pump was activated by a thermostatic control to start the pumping of fresh cold water whenever the temperature of the water in the cooling vat became warm.

THE EFFECT OF TYPE OF COOLING FACILITY ON THE TEMPERATURE OF NIGHT'S MILK

The types of cooling facilities found on farms included in the survey which represents a fairly good cross section of the New York City Milk Shed, are shown in Table 2. It will be noted that of the 2,233 dairy farms, 45.6 percent had mechanical coolers—19.3 percent cooled in springs—16.5 percent used ice, and 18.6 percent depended on pumped well water for cooling without the use of ice. Table 3 shows the average summer milk temperature on farms using various types of cooling to have been as follows:

Mechanical coolers...	42.7° F.	1,018 farms
Ice water	50° F.	368 "
Spring water	53° F.	432 "
Pumped well water without ice	56.5° F.	415 "

As may be expected, mechanical coolers gave the most efficient cooling. Ice water was next in performance, though the average temperature with this type of cooling was six (6) degrees higher than that obtained with mechanical coolers. Spring water cooling gave an average temperature which was roughly ten (10) degrees higher than that obtained with mechanical refrigeration, and three (3) degrees higher than with ice water. Pumped well water without ice gave fourteen (14) degrees higher average temperature than mechanical cooling; 6.5 degrees higher than ice water, and 3.5 degrees higher than spring water.

As shown in Tables 3 and 4, there is a definite relationship between type of cooling facility and the degree of cooling which is obtained. The conclusions drawn from the results indicated in Table 4 regarding the various types of cooling facilities, are as follows:

Mechanical coolers: Seventy percent of the producers equipped with mechanical refrigeration were able to cool to below 46 degrees F., and 89.8 percent to below 51 degrees F. It is interesting to note that of the 1,018 producers equipped with mechanical coolers only 2.9 percent had milk at above 55 degrees F., and five (5) producers, or 0.49 percent at above 60 degrees F. Failure in these instances

TABLE 2

TYPE OF COOLING FACILITIES FOUND ON DAIRY FARMS REFERRED TO IN TABLE NO. 1

	Mechanical refrigerators	*Spring water*	*Ice water*	*Pumped well water (no ice)*	*Total*
Number of Dairies	101	432	368	415	2,233
Percent	45.6%	19.3%	16.5%	18.6%	

TABLE 3

AVERAGE TEMPERATURE OF NIGHT'S MILK ON DAIRY FARMS COOLED WITH VARIOUS TYPES OF FACILITIES

	Type of Cooling Facility: *Mechanical*	*Ice water*	*Spring water*	*Pumped well water (no ice)*
Average Temperatures	42.7° F.	50° F.	53° F.	56.5° F.
Number of Dairies	1,018	368	432	415

TABLE 4

RELATIONSHIP BETWEEN TYPE OF COOLING FACILITY USED AND TEMPERATURE OF NIGHT'S MILK ON DAIRY FARMS

TEMPERATURE OF NIGHT'S MILK

Type of Cooling

	Mechanical 1,018 dairies—45.6%						*Ice Water 368 dairies—16.5%*					
	45° F. or less	*46° to 50° F.*	*51° to 55° F.*	*56° to 60° F.*	*61° to 65° F.*	*66° F. or higher*	*45° F. or less*	*46° to 50° F.*	*51° to 55° F.*	*56° to 60° F.*	*61° to 65° F.*	*66° F. or higher*
Dairies	713	202	73	25	5	0	95	76	117	69	10	1
Percent	70%	19.8%	7.1%	2.4%	0.49%	—	25.8%	20.6%	31.8%	18.7%	2.7%	0.3%
	89.8%		9.5%		0.5%		46.4%		50.5%		3.—%	

Type of Cooling

	Spring Water 432 dairies—19.3%						*Pumped Well Water (No Ice) 415 dairies—18.6%*					
	45° F. or less	*46° to 50° F.*	*51° to 55° F.*	*56° to 60° F.*	*61° to 65° F.*	*66° F. or higher*	*45° F. or less*	*46° to 50° F.*	*51° to 55° F.*	*56° to 60° F.*	*61° to 65° F.*	*66° F. or higher*
Dairies	9	86	186	133	14	4	3	13	135	216	38	10
Percent	2%	19.9%	43%	30.7%	3.2%	0.9%	0.7%	3.1%	32.5%	52%	9.1%	2.4%
	21.9%		73.7%		4.1%		3.8%		84.5%		11.5%	

is undoubtedly due to unfamiliarity with the equipment, improper adjustment of the thermostat or to other mechanical difficulties.

Ice water: This is a very satisfactory medium for cooling, provided enough ice is used. Of the 368 dairies using this method, 25.8 percent cooled to below 46 degrees F., and 46.4 percent to below 51 degrees F. However, 21.7 percent cooled their milk at above 55 degrees F., and 3 percent exceeded the maximum permitted temperature of 60 degrees F.

Spring water: Satisfactory results were obtained where milk was cooled directly in spring water having a low temperature, since, of the 432 dairies using springs, 21.9 percent were able to cool their milk to below 51 degrees

F. However, only 2 percent of these producers cooled to below 46 degrees F., 34.8 percent had milk at above 55 degrees F., and 4.1 percent at above 60 degrees F. This can be attributed to a number of springs not being sufficiently low in temperature, piping of spring water from long distances without proper insulation of the piping, or, to slow flowing springs.

Pumped well water, without ice: This appears to be a poor method of cooling. It is necessary for the producer to change the water in the cooling tank at frequent intervals and to pump a large quantity of water. Obviously, a great deal of time, effort, and attention on the part of the producer is required.

It is unlikely that producers depending on hand pumping of well water will give the necessary time and attention to insure proper cooling, even if the temperature of the well water is adequate and the cooling tank is insulated and covered. This is also true, but perhaps to a lesser degree, where dependence is placed on gasoline engines for the pumping operation. This method of cooling is satisfactory only if there is an ample supply of cold water. preferably below 50 degrees F., and the producer is equipped with a thermostatically controlled electric pump to start the flow of fresh cold water into the cooling vat whenever the temperature of the water in the vat is warm. Of the 301 farms using pumped well water without ice, only 3.8 percent had milk below 51 degrees F., and the milk on 63.5 percent of these farms was about 55 degrees F.—11.5 percent of the farms exceeded the 60 degree F. limit, set by regulations.

If a producer is not equipped with a thermostatically controlled electric pump, the following conditions are deemed necessary to satisfactorily reduce the temperature of the milk:

1. A cooling tank of sufficient size to hold at least three times as much water as the volume of milk to be cooled.
2. The cooling tank and its cover should be well insulated and equipped with an overflow pipe to bring the water to the necks of cans. The pipe should be large enough to take care of the overflow if the water is pumped over a longer period of time.
3. Water should be kept in the tank during the day to keep it cool.
4. Immediately before milking, this water should be replaced with freshly drawn cold water (50 degrees F. or below).
5. Each can should be placed in the tank as soon as filled with milk.
6. If a power driven pump is available and the water supply is plentiful, the pumping of water into the tank should be continued until the milk is around 50 degrees F. The cover should then be closed, and if the tank is properly insulated the milk will keep cool until morning. The water in the tank should be replaced again the first thing in the morning and where possible the pump kept going until the milk is down to around 50 degrees F.
7. Where the supply of water is not too plentiful or a power driven pump is not available, and the water cannot be pumped continually until the milk is cooled, the water in the tank should be changed at least twice during the cooling process, and again just before retiring, especially on very hot nights. It should be changed again the first thing in the morning.

IN-THE-WELL COOLING

There is another method of cooling which may be touched upon briefly, namely, "in-the-well" cooling. This method which consists of lowering of cans into dug wells, is not approved by our department, though used in the New York City Milk Shed a number of years ago. "In-the-well" cooling has the following disadvantages:

a. Water in the well which is frequently used for household purposes, is contaminated by spilled milk and soiled exterior of cans.

b. Water frequently gets into the milk when cans are completely submerged because of inability of producers to properly judge when sufficient lowering of the cans has been accomplished. This is also responsible for insufficient cooling when filled cans are not lowered to the required depth so that the water will reach the neck of the can.

c. Partly filled cans will tip over or float, resulting in spillage, and improper cooling, unless the cans are weighted down.

THE EFFECT OF TRANSPORTATION ON TEMPERATURE OF NIGHT'S MILK

In addition to data indicated above we also determined the average mileage traveled by each vehicle, average number of cans per vehicle, average temperature of night's milk at farms and of the same milk upon arrival at the country milk plant. This information is given separately in Table 5, both for vehicles using ice and those not using ice in transit.

Of the 154 vehicles for which this data are given, only 18, or 11.6 percent carried ice for refrigerating the milk during transportation, using an average of 316.9 lbs. of ice per vehicle.

The average number of producers per iced vehicle was 14.8 as compared to 13.2 for un-iced vehicles. The iced vehicles covered an average of 62.7 miles to collect an average of 82.3 cans per vehicle, while the average mileage per un-iced vehicle was 26 and the average load 65.2 cans. The average temperatures respectively of night's milk at the farm and at the plant were 52.7 degrees F., and 52.8 degrees F. on the refrigerated trucks as compared with 47.8° F. and 52.2° F. respectively on the unrefrigerated trucks. It will be noted that without the use of ice the average temperature of night's milk per truck has increased from 1 to 15 degrees F. during transportation, while the temperature change on the iced trucks ranged from minus 4 degrees F. to plus 7 degrees F. The average milk temperature at farms which hauled their milk in refrigerated trucks was 5 degrees higher than on those which had their milk on un-iced trucks. This is explained by the fact that the former used wells and springs to a large extent.

The fact that night's milk may either increase or decrease appreciably in temperature during transportation from farm to plant at times results in plant rejections of milk which has been cooled at a farm within legal limits or in the acceptance of milk which has not been properly cooled.

CONCLUSIONS

Mechanical refrigerators are the most effective means of cooling milk on farms and probably the most economical in the long run, except when an adequate supply of cold spring water at 50° F. or less is readily available. Their use therefore should be encouraged in preference to cooling with ice or well water.

Ice cooling gives good results if a sufficient quantity of ice is used. The human element, however, is an important factor where this method is employed, and carelessness in the use of ice is frequently the cause of poor cooling even where sufficient ice has been harvested and a properly constructed cooling tank is available.

Farms having spring water at 50 degrees F. or below throughout the summer can cool their milk satisfactorily. However, about 34 percent of the springs used are not cold enough to provide good cooling.

Unless a producer is equipped with a thermostatically controlled electric pump and has an ample supply of well water at 50 degrees F. or lower, the use of well water alone is not dependable in most cases. It is not likely that many producers can afford the time, attention and effort which is required for proper cooling with this method.

The use of insulated truck bodies,

TABLE 5

AVERAGE TEMPERATURE OF NIGHT'S MILK ON FARMS, AND OF SAME MILK UPON ARRIVAL AT THE MILK PLANTS, PLUS OTHER DATA ON HAULING MILK, SUMMER OF 1943

New York City Milk Shed

	Number of vehicles checked	Total number producers	Average number of producers per vehicle	Number of vehicles insulated	Average route mileage per vehicle	Average load per vehicle (cans)	*Average temperature of night's milk at the		Average increase or decrease in temperature per vehicle (deg. F.)	Average quantity of ice used per vehicle (lbs.)
							Farm (degree F.)	Plant (degree F.)		
No ice used on vehicles	135	1,782	13.2	1	26.02	65.2	47.8	52.2	plus 4.4	—
Range			5 to 27		8 to 65	13 to 122	38 to 60	44 to 63	plus 1 to 15	—
Ice used on vehicles	18 (11.6%)	267 (13%)	14.8	2	62.7	82.3	52.7	52.8	plus 0.1	316.9
Range			6 to 27		16 to 120	30 to 285	48 to 58	47 to 56	minus 4 to plus 7	40 to 700

* This temperature was obtained by determining the average of the average temperature per vehicle.

separation of warm morning's milk from cooled night's milk, and the use of sufficient ice to maintain the original farm temperature of the milk, would make deck testing for temperature more useful as a guide to cooling methods on farms and would prevent unfair rejections. The use of approximately 317 pounds of ice per truck, carrying 82 cans of milk on a 62-mile run, would serve this purpose, even if the truck body was not insulated.

It must be admitted, however, that such icing involves an estimated expenditure of approximately two dollars per day, per truck, or $320 for the four warm weather months of the year. This does not take into consideration the extra labor involved in handling the ice.

Relieving Labor Problems in Creameries*

C. R. ROBERTS
Sheffield Farms Co., New York, N. Y.

IN war there are always two very important factors confronting any producing industry such as the milk industry, namely, a shortage of materials and a shortage of manpower. The manpower shortage is more serious to us in the milk industry than the shortage of materials, as difficult as the latter may be.

In analyzing this problem, we might consider two methods of approach, namely:

1. The best possible or most efficient use of our present available personnel, and
2. Additions to our present personnel.

AUTOMATIC MACHINERY

To make the most efficient use of our present manpower, the first thing to consider is the full use of all automatic machinery possible as well as other labor-saving devices. In spite of the difficulty in obtaining new equipment today, I do not believe that we have taken all of the advantage that we can of saving labor through this means.

It is important that we consider under this heading such things as the full use of conveyors to save the necessity of rolling cans or handling cases from one point to another within the plant. Or again it might be the elimination of a man at the end of a can washer through an automatic tailing device. It even could be very minor clever contraptions to save footsteps in the canning and weighing of cream, or it might be the entire elimination of cans through the use of tank equipment. It might also be the use of glass piping to save many man hours in the cleaning and assembly of pipe lines. In fact, I know of one instance where an installation of this nature saved 8 man hours per day. All of you are familiar with the possibilities along this line and I do not believe that there are many milk plants along the Atlantic seaboard but what some improvements of this nature could result in the saving of manpower.

INCENTIVE PLAN

Another method of obtaining the greatest efficiency from our present labor is the use of the incentive plan for payment. There is an old adage that "You can catch more flies with molasses than you can with vinegar." I believe that in our industry we have a very fertile field to develop this incentive plan.

In one of our butter operations recently using female labor in packaging, we instituted a piece work system based upon the production of the entire group as a unit. Immediately upon application of this incentive plan, our output of packaged material greatly increased. We only applied what we know will bring results, that is, compensation for increased effort. We have applied this same principle since that time to other types of conditions such as the strapping of evaporated milk as well as the turning of evaporated milk cases after several months of storage, and have found that in most instances it has a remarkable effect upon production. It is not possible to apply such a principle throughout all of our operations but it does seem as

* Read at the 22nd Short Course Conference and Annual Meeting of the Vermont Dairy Plant Operators and Managers, Burlington, November 3–4, 1943.

if we should take a leaf from the book of other industries using this idea and apply it to our industry wherever possible. At present we are attempting in three locations to extend this practice to include management, and we now have it in three receiving plants. While it is too early to be able to judge the results that will be obtained, I am confident that from this experience we shall be able to develop a practical procedure that will be of benefit to both the employee and employer. There are future possibilities that should and can be developed. For example, butter and cheese production might well be considered on an incentive plan based upon yields and cost of operation. In fact, in the large butter territories of the west, some methods of a similar nature are now being used. There are further possibilities such as in the manufacture of skim milk powder, casein, etc.

EMPLOYEE TRAINING

As a further means of making the best use of our present manpower we must also consider the training that we need to give to our present personnel in order to equip them to do the best possible job. After all, the personnel within an organization determines to a large degree whether or not that organization is successful. To be sure, we cannot operate without raw material or the machines to handle that material. On the other hand, having raw material and machines is of no value to us unless we have manpower to handle and process it properly. It becomes our responsibility to spend sufficient time with our employees to see that they properly understand what is expected of them and to make sure that they learn the right way and not the wrong way.

Some of you may know of the present program that is carried on by the Training Division of the War Manpower Commission called "Training Within Industry". While we have not had any direct experience with their program, all reports indicate that it produces very effective results, and it is our hope that we may be able to take advantage of this free service within the very near future. While the plan was originally started by a few large and aggressive organizations, it has now been adopted by the Manpower Commission although still supervised and actually operated by men from private industry. Briefly, the plan calls for the training primarily of supervisory personnel such as foremen or supervisors in the handling of workers. It consists of three courses of 10 hours each, given in 2-hour periods. The first course appertains to job instruction, the second to job planning, and the third course to the methods to be used in handling people. It is important to see that proper training is given to employees for the particular jobs that they may be given if we are to obtain the best efficiency from our present personnel. Therefore, we should add "job training" to the list that we have already discussed for making the best use of our present personnel.

INTEREST IN EMPLOYEES

Several months ago, I read an article in one of the popular magazines about an experiment that was carried on in an electrical supply manufacturing plant to increase the efficiency of the workers. First of all, a trial was made in a portion of one department to increase the production by better lighting. The group receiving better light immediately increased their production over their previous output and also beyond the output of the control group that did not receive improved lighting. The investigator felt that he had found the answer to his problem, but in order to be sure of his grounds, he carried the experiment further. This time, instead of increasing the lighting facilities, he decreased them below what they had been previously. Very much to his surprise, he found that instead of the output going down it went up still higher than it had gone even under the improved lighting. This immediately threw all of his theories into the scrap basket but he stuck with the problem and tried other experiments to see if he could find the answer. In every case that he tried, regardless of what he did, whether it was to improve or even reduce the working conditions, the results always turned out in higher production output. It finally dawned upon him that the answer was exceedingly simple: *All that the employees wanted and all the incentive that was needed to increase production was "Attention"*. It did not matter particularly whether they had more or less light, or more or less ventilation, but what did matter was the amount of *"Attention"* that they received. So let us add to our list of necessities for obtaining the most efficiency from our present personnel the very big factor of *"Attention"* to them—praise if they deserve it and a closer working relationship with all of those over whom we supervise.

SUGGESTION BOX

While there are unquestionably many items that we might discuss for obtaining the greatest efficiency from our present manpower such as ways and means of overcoming absenteeism, etc., time will not permit going into all of them in detail. I would like to add however to our list the important one of using "suggestions" from our employees for improvement in the operation. After all, who should know better how to make the job more easily accomplished, or how to do it better, than the employee who is doing it every day. Good business judgment indicates that he should be encouraged to offer suggestions that may be adopted to improve the operation both from the standpoint of efficiency as well as improved working conditions. None of us have a monopoly on ideas, and the more ideas that can be encouraged the more possible answers we may have for a satisfactory solution. Some companies have seen fit to develop the "suggestion idea" to a very high degree because it pays dividends. We might again adopt some of their methods and put into use "the suggestion box" through which ideas are gathered from the employees. The use of this system creates an incentive for the employee as he is reimbursed for any ideas that are found practical and put into use by the company.

ADDITIONAL PERSONNEL

After exerting every effort and using every idea to obtain the greatest efficiency from our present manpower, we can now turn to our second possible solution which is "additional personnel".

Immediately the question arises as to where we can obtain the necessary manpower to fill our depleted ranks. If we want to add to the word "manpower", the words "or woman power", the prospect is still not too bright. However, if it had not been for woman power in our Company, we would not have been able to have operated some of our plants to capacity during the past year. Our records tell us that in our 78 country operations today, we are employing 147 female workers or 17 percent of our total country payroll including supervisory personnel. Some large plants have a personnel running as high as 33 percent women. They do laboratory work, but they also do other types of work, such as running cream separators, canning and weighing cream, washing milk equipment, operating fillers and cappers, casing-in milk, operating vacuum pans, milling casein, churning butter, unloading evaporated milk cans, operating evaporated casing-in machines, judging milk from farmers on the weigh stand, and even in one case managing completely a receiving plant. If we are to continue to operate we must expect to fill our ranks to a fairly large extent from female workers.

The question of what jobs they can do has been answered by our finding out that they are now doing nearly every job that we have in a milk plant. To be sure, we cannot expect to take the high school girl weighing 100 pounds and ask her to handle 85 or 100-pound containers. We must look in such instances to a more robust individual. As to their general efficiency, they are equally as efficient as the average male worker today for certain jobs. It is true that they are less flexible in most any plant operation because it is impossible to move them from one job to another to meet emergency conditions. On the other hand, their reliability in most instances is superior. We had one rather interesting case last winter that brings out this point rather clearly. In one of our country bottling plants staffed to about 30 percent with female workers, the temperature one morning was 24 degrees below zero and a good majority of the men did not report for work. Most of the reasons advanced consisted of inability to get their cars started because of the severe weather. On this same morning all of the women were at their work at the usual time and if it had not been for their reliability we would have been unable to have completed our full bottle order. In the employment of female labor, it is extremely important that we use care in the type of individual that we select for the job. Married women are more dependable and conscientious as a general rule.

The next question that might be raised when we consider adding to our present personnel is the one as to what to do if we must have male workers and are unable to use women. Here, I am afraid you will have to trust to fate. Sometimes, however, surprising things happen that make us feel rather ridiculous. In one plant a few months ago our output was being curtailed because of a labor shortage. All reports from the local management indicated that it was impossible to obtain additional manpower in that area. Further investigation, however, resulted in several more men being located and three of them were discovered by simply asking other employees in the plant if they knew of persons that might be obtained.

SUMMARY

To reduce our labor problems we should first make use of our present personnel through automatic machines, incentive plans, job training, attention to our workers, as well as receiving their cooperation in suggestions. If we feel that we have exhausted those possibilities, let us then add to our personnel. In making these additions do not overlook the possibilities that female labor holds.

Mastitis—Laboratory Tests and Their Interpretation*

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The American consuming public is losing huge amounts of milk and the American dairy farmer is losing an astronomical number of dollars every year through the inroads of mastitis. Today, when it is so vitally important to keep every milk-producing cow in good health so that she can make the maximum amount of milk on the allotted hard-to-get feed, the subject of its control becomes urgently important.

Recognizing the timeliness of this problem, the Extension Department of the College of Agriculture here at the University of Vermont has recently inaugurated a program. Under it, sound preventive herd management practices, as well as the economic importance of mastitis to the herd owner himself, will be emphasized. Any success that may be had will make the job of everyone interested in milk quality control that much easier.

Before such a program can get very far, sound laboratory methods will have to be used to locate for sure the offenders, and determine the status of infection and probably the type of organism causing the trouble, in order to intelligently segregate, treat, or dispose of such animals.

Selection of diagnostic methods is extremely important. They must be adequate, relatively simple, and capable of as widespread application as facilities and personnel will permit.

No known single test can do this job.

The attempted determination of the comparative accuracy of various tests commonly used to aid the diagnosis of mastitis has been a popular pastime for a number of years. The results in some cases have been rather disappointing, largely because different yardsticks were used, and different skills, in both manipulation and interpretation, were brought into play.

Although we are probably primarily interested in *Streptococcus agalactiae* as the predominant cause of infectious chronic mastitis, we cannot ignore the possibility of the organism which we find being any one of several others.

Mastitis is not a "one bug" disease like typhoid, diphtheria, etc. Organisms, other than *Streptococcus agalactiae,* which are not at all uncommon are: *S. dysgalactiae, S. uberis, S. faecalis,* certain staphylococci and members of the coliform group. There are others which have been mentioned in the literature from time to time, but these are probably the most important.

It is quite generally agreed that early diagnosis increases the efficiency of herd disease control. (Segregation, disposal or treatment.) This depends to some extent upon the type of organism causing the trouble as well as the degree of infection.

Before some of the more common and most useful tests are described and discussed, a word should be said about sampling as it is vital to the success of any laboratory test.

1. Samples should preferably be taken just before milking but never within at least two hours after milking.
2. The sample taker should wash and disinfect his hands between cows.
3. The udder and teats should be washed

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with a chlorine solution of about 200–400 p.p.m.—or other acceptable germicide—*immediately* prior to drawing the sample, giving particular attention to the end of the teat.

4. The first two streams from each quarter should be milked into a strip cup—this helps to avoid contaminating bacteria which may have gained entrance into the teat in the interval since last milked. At this time it can also be observed whether the milk from any quarter is flaky, stringy, or otherwise abnormal.
5. Each sample bottle or container should be carefully identified. Carelessness about this detail has been known to cause confusion and embarrassment.

PHYSICAL EXAMINATION

The physical examination of the udder is not, of course, a laboratory method and therefore does not properly belong to the topic assigned to me for discussion. However, it cannot be passed over without mention. It is a diagnostic aid of potentially great importance whose value varies in direct proportion to the skill and judgment of its user.

After enumerating eight important steps in the proper observation and palpation of the udder, Dr. Udall (14) in his book, "The Practice of Veterinary Medicine," says, "While the technic may appear to be simple, skill in the classification of udders is acquired only after long practice. It includes not merely the *art* of detecting indurations, but experience and judgment in reaching a decision upon all the evidence available." He further says, "Conclusions based on a milker's statement that an udder is normal, or on a superficial examination of the udder or on an examination by one who lacks training in palpation of the udder is unreliable."

Many people believe that udder palpation is one of the most reliable methods for determining whether a cow actually has mastitis or not. They hold that the seat of this disease is in the udder and not in the milk; that significant alterations in the udder tissue can be disclosed by competent manual examination and therefore that the mere finding of unidentified streptococci in the milk unaccompanied by evidence of tissue involvement does not constitute positive diagnosis of disease. It is difficult to quarrel with this view. On the other hand, affected cows do sometimes recover, either through treatment or even automatically. Under these circumstances there will be a varying amount of scarred tissue, etc., of a permanent nature. How then can a cow that has mastitis be differentiated from a cow that *has had* mastitis? This is mentioned only to emphasize the point that physical examination alone, even though expertly done, may not be enough to establish beyond doubt, an infected udder in the absence of adequate confirmatory laboratory tests.

It should be said that the thorough veterinarian often uses the strip cup, brom thymol blue test, and laboratory examination of the milk to increase the efficiency of his diagnosis.

STRIP CUP TEST

The strip cup test is designed to detect abnormal milk in the barn during milking rather than after the milk has been taken to the laboratory.

There are several types of strip cups that may be used. One of the most popular consists of a heavy tin cup holding a pint or more which is fitted with a removable top about 1¼ inches deep. One-half the bottom of this section is made of fine wire mesh (100–120 squares to the inch), the other half made of tin. A piece of fine black cloth stretched over the top of a tin can may be used for the same purpose. This test is best made when the udder is filled with milk *just* before regular milking time. The procedure is to draw the first two or three streams from each teat directly on the sieve or black cloth and carefully examine for flakes or clots. The top should be removed and rinsed in water after each test. Many believe that the routine use of the strip cup can be of great value in revealing early an acute inflammation or a flare-up of a chronic case. Obviously a single survey of a herd is of little value as many chronically infected cows do not at all times give the type of milk detected by this method. However, it should be noted that flakes may be present in milk of abnormal color as a transient condition after injury. Thin, watery milk of abnormal color (brownish, etc.) may be given in which no flakes can be found. This type of milk can be easily spotted if set up in test tubes and compared with normal milk.

Use of the strip cup should be made a part of every milking routine, especially if a milking machine is used, without after stripping. This affords the dairyman daily contact with the udder and makes it possible for him to pick up many incipient cases which might otherwise be passed over for a long time. However, hurriedly milking into the strip cup without careful examination of results is a waste of time and energy.

Care should be taken in the disposal of the contents of the strip cup—never pour it into the gutter.

Finding of clots or flakes are usually confirmed as indicating mastitis but their absence does not necessarily indicate freedom from trouble.

BROM-THYMOL-BLUE TEST

The brom-thymol-blue test is a semi-laboratory test which can be and often is performed in the stable, either by a veterinarian as a confirmatory test in connection with physical examination of the udder or by the dairyman himself.

When it was first introduced it was widely heralded as the answer to the prayer for a simple, accurate test whose results were nearly infallible. It received world wide study and was found to have certain limitations and pitfalls. There is supporting evidence for the theory that active infection induces an infiltration of the blood serum (and perhaps other fluids) into the udder which carry leucocytes whose function, as scavengers of the blood stream, is to halt or control further invasion of the infecting organism and to aid in the repair of damaged tissue. At any rate, blood serum is known to be on the alkaline side while normal milk is slightly acid. This test is a measure of acidity or alkalinity (hydrogen ion concentration or pH as it is commonly spoken of).

One way of performing the test is draw 5 ml. of the milk from four separate quarters into four separate tubes. This test is useless when applied to pooled milk samples. Next add 1 ml. of the brom-thymol-blue solution of the proper strength and which has been adjusted to near neutrality. (Made by dissolving 1 gram of the powder in 125 ml. of alcohol—either methyl or ethyl but not denatured—this is then made up to 500 ml. with distilled water. It is then adjusted to near neutrality by the addition of small amounts of normal sodium hydroxide.)

Each tube is carefully inverted and examined for color changes.

1. *A greenish-yellow* denotes a milk more acid than normal.
2. *Yellowish-green* usually denotes a normal milk.
3. *Light green* denotes a slightly more alkaline than normal milk and therefore suspicious.
4. *Dark green to greenish blue* denotes a distinctly alkaline milk which is usually indicative of mastitis.

Occasionally a bright yellow or orange reaction will be encountered which usually is found to come from a cow suffering from an acute case of mastitis.

I have found it desirable to examine and compare samples from the four quarters at the same time—differences are more easily noted. Rarely are all four samples of exactly the same shade due to varying amounts of pigment carrying fat. I have also found color standards to be of but little value except to give a rough idea of what to look for.

In the course of testing several thousand samples of milk it has been noted that when a suspicious reaction is found repeatedly in the same quarter or quarters that later if that cow definitely develops mastitis it will almost invariably be in those quarters.

Care should be taken when using a single set of four tubes for herd testing to avoid using tap or well water to rinse them between tests. This type of water is almost always distinctly alkaline and might lead to erroneous conclusions in borderline cases. Either use distilled water, rain water, or normal milk for this purpose.

Milk from cows early or late in lactation may give misleading results and cannot be depended upon.

Positive results with this test are said to be indicative of mastitis in as many as 90 percent of cases while negative results do not necessarily mean that the cow is mastitis-free.

This test is much more valuable as a routine test, frequently performed, than as a survey test.

Other dyes which are sensitive to reaction changes are sometimes used for this test such as brom-cresol purple. However, the dye of choice now seems to be brom-thymol-blue, sometimes called thybromol.

MODIFIED WHITESIDE TEST

The modified Whiteside test is one of the newer tests. A modification proposed by Murphy and Hanson (9) is very practical and can be run in the stable with a minimum of equipment. All that is needed is a glass plate or plates ruled into two-inch squares; a dark background; a glass stirring rod; two droppers and some normal sodium hydroxide solution. To perform the test one drop of the normal NaOH is added to 5 drops of the fore milk of each quarter and stirred for 20 seconds. Normal milk remains unaffected. Mastitic milk becomes coagulated in rough proportion to the degree of infection. A viscid mass is quickly formed which, except in the worst cases, quickly breaks up into a slightly opaque fluid and a precipitate composed of many rather large particles.

It has been reported that increased accuracy can be obtained by refrigerating samples over night, also that where fresh samples are used increasing the NaOH used to two drops increases the accuracy of this version.

In explanation of what happens in this test, Dunn, Murphy, and Garrett (3) have recently postulated the theory that the protein material of leucocytes in mastitic milk reacts with the sodium hydroxide to form a gelatinous mass similar to that which is formed by the action of sodium hydroxide on the nucleic acid obtained from animal cells.

We have used this test on several hundred samples and have found that the results roughly reflect the leucocyte count.

CATALASE TEST

The catalase test is also based on the presence of leucocytes which secrete varying quantities of the enzyme catalase which in turn is able to release hydrogen gas from hydrogen peroxide when added to the sample being studied. This becomes immediately evident by the evolution of minute gas bubbles. There are many ways of performing this test all the way down from a more or less exact measurement of the amount of gas to rougher qualitative determinations. We have found the simplest method is to place a drop or two of the quarter sample on a glass plate with a dark background and mix with a drop of 6–9 percent hydrogen peroxide. Mastitic milk supposedly produces bubbles which are not evident in normal milk. A small hand lens greatly aids in this examination.

Rosell (11) suggested adding 1 ml. of 6 percent peroxide of hydrogen to the brom-thymol-blue test after color comparisons have been made. The tube is then mixed by careful inversion and closely observed for the presence of the gas bubbles which quickly form in the presence of leucocytes. He says that the results closely conform to the brom-thymol-blue color changes. This would appear to be a laboratory procedure.

CHLORINE TEST

The chlorine test is regarded by many workers as a very delicate and valuable test and an accurate indicator of the presence of fibrosis in the udder. It has been found that although the chloride content of normal milk is somewhat variable, it usually runs between 0.09 and 0.14 percent chlorine. Mastitic milk usually runs significantly over the top figure. There are many ways of obtaining this information running all the way from methods which give the exact percentage of chloride down to the so-called field tests which merely determine whether there is more than the normal amount present. We have used Hayden's field test with success. The reagents consist of an accurately made silver nitrate solution (1.3415 grams of the chemically pure product in 1,000 ml. of distilled water) and a 10 percent solution of potassium chromate. The test is performed by measuring an accurate 5 ml. of the silver nitrate solution into a small test tube. Add 2 drops of the chromate solution. A red color develops at once. Then add an accurate 1 ml. of the quarter sample of milk. Carefully invert to mix. A yellow color develops in one minute or less if the chlorine is 0.14 percent or over. Normal milk remains red. Even this field test has been found to be a laboratory procedure and is not recommended for rapid field work. Much depends on the care with which the silver nitrate solution is made up.

Both the catalase and the chloride tests are open to the criticism of being over sensitive. That is, they produce too many false positives.

MICROSCOPIC EXAMINATION

It is hardly necessary to describe the details of this method for it has been an important and serviceable tool of the dairy industry for more than 30 years. It early became an important aid in mastitis diagnosis. I used it for that purpose twenty-five years ago. However, there are a few things about its application that will be briefly discussed.

The source of any given sample determines, to an important degree, the dependability of ensuing results.

The important point is, however, to obtain a sample and so handle it that the maximum of desirable information may be had from it. In the search for mastitis, samples are often taken from the weigh can, individual cans, pooled quarter samples and from the individual quarter. They are examined before and after incubation.

Microscopic examination of unincubated samples from any source are almost a waste of time, except where cell counts alone are desired. Too many significant cases will be overlooked.

It is realized that weigh can samples are widely used for rapid survey purposes—largely as a matter of expediency and not because the user actually believes that the results are too revealing. The presence of long chain streptococci with or without many leucocytes is commonly accepted as proof of mastitis in the herd from which the sample comes. It should be remembered that such samples are nearly always contaminated, that contaminants are the first to multiply under incubation, and that they often appear as long chain streptococci indistinguishable in smears from mastitis streptococci. It is probably true that from grossly diseased herds the milk may be sufficiently infected to show mastitis streptococci in the smear from weigh can samples. However, the fact that as a result of such an examination, infected cows are later found in the indicated herds proves nothing because it would be difficult indeed to find a herd in this State or any other state in which one or more mastitic cows could not be located.

Examination of any of these samples is made in the search for two things:

1. Long chain streptococci or possibly staphylococci or the coliform types.
2. Leucocytes.

Assuming that samples of individual quarters have been aseptically drawn into sterile bottles and incubated for 12 to 16 hours at about 37° C. and that the smears have been properly prepared—then what?

The first problem that arises is—what are long chain streptococci? In other words, when do short chain streps become long chain streps? Investigators do not all agree on this. Figures from 4 to 10 units per chain are found in the literature as the dividing line. I am not prepared to say what the correct figure should be nor how important it is. However, I do feel that where there is any question there should be verification.

There may be and usually are other cells of less significance than leucocytes found in milk. I am inclined to think that cell counts are more often made than leucocyte counts.

In speaking of cells, those originating in body fluids and tissue are meant and not the invading bacterial cells.

In regard to leucocyte numbers—what is normal? Figures are found all the way from 50,000 to 1,000,000 and over. According to Seelman (13) the normal fluctuation in numbers of leukocytes are so great and the sensitiveness of the mammary glands so variable that the establishment of a fixed normal would only lead to error. Nevertheless, informed opinion in this country, resulting from the study of thousands of samples, most often places the figure at 500,000 per ml. as indicating an udder abnormality and possibly mastitis—certainly suspicious as possibly indicating incipient infection.

Transient cell counts of several millions have been observed with no other evidence to be found. The cell count is normally high in late lactation. Occasionally it may be high as a result of disease other than mastitis—such as winter dysentery.

There is little doubt about a microscopic picture of millions of leucocytes per ml. and extremely long chains. It is the borderline cases that are the headache.

If the herd owner is to be helped in his effort to control this disease, correct interpretation of these borderline cases is of importance. They may be the ones which can be greatly helped by treatment if discovered early. If they persist with or without treatment it may be that they are carriers and thus a menace to their mates—even though they themselves are able to hold the disease in check.

Carefully taken and incubated quarter samples are to be preferred for microscopic examination. Some laboratories that are doing a large volume of routine work have been forced to use incubated pooled udder samples. Undoubtedly an occasional lightly infected cow will be passed over if this type of sample is resorted to.

HOTIS TEST

The Hotis test is partly chemical and partly bacteriological in its disclosures. This test was first introduced in 1936 by Hotis and Miller (5) of the U.S.D.A. It involves the addition of 0.5 ml. of a sterile 0.5 percent aqueous solution of brom-cresol-purple to 9.5

ml. of an aseptically drawn quarter sample of milk. It is sometimes used on a composite udder sample; under these circumstanceces it is customary to double the quantities of both dye and milk sample. It cannot be successfully used on weigh can samples due to the inevitable contamination by organisms which obscure the results obtained. According to Miller (7), when the dye and milk are first mixed, a purple color results. The reason for this color is that normal milk is very slightly acid and this pH is in the upper range of the dye which runs from pH 5.2 which is yellow to pH 6.8 which is distinctly purple. Since the pH of normal milk is slightly acid such samples will be a sort of a pale grayish-purple or dove color. Samples from an infected quarter are *more* alkaline and have a distinct to deep purple shade. By noting the color at this time, as suggested by Cone and Grant (2), considerable information can be obtained about the physical condition of the quarter or udder. The samples are then incubated at 37° C. for 20–24 hours. At this time the color of the column of milk varies from dove gray and olive drab to canary yellow. In general, samples containing *Streptococcus agalactiae,* flakes, or clumps of a whitish material will be noted clinging rather tenaciously to the sides of the tube as well as a coarse flocculent sediment in the bottom of the tube. The color of the flakes varies somewhat according to the type of *streptococci.* Dr. Little (6) has noted that in mild infection the yellow deposits may appear only in the cream line or at the bottom of the tube. In addition, it has been found that some, though not all, types of staphylococci form rust colored colonies on the sides of the tubes. Because these usually are slow acid formers there is less change in the color of the milk.

To counteract the unfavorable action of contaminating bacteria in obscuring positive changes in the test, certain agents have been added whose function it is to inhibit the growth of these contaminants without interfering with the growth of the streptococci. One such agent that has been suggested for this purpose is sodium azide. Several workers have found it very useful for this purpose. However, Miller (7) reports that the changes are not entirely typical in all cases and that 48 hours may be required for positive results to occur. Also that staphylococci do not grow well in the presence of sodium azide. Consequently some information that might be obtained from the test are thereby lost. It might be added at this point that some workers now feel that staphylococcic mastitis is somewhat less than uncommon and must be reckoned with more in the future. According to Schalm (12), "The staphylococci are usually involved in severe forms of acute mastitis and gangrene of the udder, but may also be the cause of a mild chronic mastitis. Knowledge is limited concerning the origin, mode of spread, and methods of control of this type."

Miller (7) also reports that since the test has been in use at the U.S.D.A. Animal Disease Laboratory, between 10,000 and 15,000 samples have been examined in comparison with blood agar plate cultures, and has maintained an average agreement of from 80–90 percent.

Murphy (8) has reported that, "application of the test to 753 samples of milk in conjunction with cultural examination in blood agar showed them to be in perfect agreement for 95 percent of the samples." Others have reported a much lower correlation—sometimes as low as 30 to 50 percent. However, it seems to be highly regarded in some quarters—especially by those who have used it most and understand it best. It is used in some places as a screen test from which samples from suspicious or positive tubes can be smeared and examined microscopically.

If more information is needed as to

whether or not the causative organism is *Streptococcus agalactiae* it can be plated in plain blood agar or streaked on the aesculin-gentian-violet blood agar described by Edwards.(4) The system suggested by Plastridge (10) for more definite identification uses loop transfers from samples showing either streptococci or more than 500,000 leucocytes per ml. to ox blood agar or Edwards medium which he considers adequate for the detection of *Str. agalactiae.* He adds that in ordinary routine work growth observed on Edwards medium alone is considered adequate except under special conditions. Many workers believe that Edwards solid medium is more useful than the plain blood agar because, in addition to indicating whether or not the organisms are hemolytic it yields other desirable information.

Dr. Little (6) has reported that where it is advisable to use more critical tests, Edwards liquid medium has certain advantages over plating in blood agar. It is simple to prepare—containing meat extract, glucose, crystal violet and sodium azide. The function of the crystal violet is to inhibit the growth of the staphylococci while sodium azide prevents the development of coliform organisms. He suggests using it in conjunction with the Hotis test, modified by the addition of sodium azide. After incubation for 16 to 18 hours, a loopful (0.01 ml.) of gravity cream is transferred to the selective medium and the samples incubated for the completion of the Hotis reaction. The development of *Str. agalactiae* in the liquid medium as a flocculent growth with the clearing of the supernatant fluid is of diagnostic significance, for usually other types of streptococci cause turbidity of the broth.

Dr. Little (6) also reports that extracts from bovine streptococci can be prepared from the sediment of Edwards' liquid medium for serological identification.

For exact typing it is necessary to either use a serological classification or an even more complicated and time consuming biochemical study either one of which is out of the question for large scale work.

Up until recently, wherever efforts have been made to control mastitis, work has been concentrated on the latent (or sub-acute or chronic) type caused primarily by *Str. agalactiae*—this for two reasons:

1. It is by far the most prevalent.
2. It is probably the most infectious.

It has been reported that in herds where they have had considerable success in eliminating *Str. agalactiae,* other types such as staphylococcic and coliform mastitis have made their appearance. Provision for their recognition should be considered. With this in mind the desirability of including growth inhibitants in some of the suggested media and tests should be reviewed.

VERMONT PROGRAM

Now as to the Vermont program. Obviously unrestricted laboratory service is out of the question. However, it is hoped to eventually set up several demonstration herds. The idea is to keep the number down to a point where adequate laboratory supervision can be maintained. It is hoped thus to be able to indicate by precept what can be done with sound herd management plus a certain amount of laboratory assistance, materially to lower the incidence of mastitis in Vermont dairy herds.

The tentative diagnostic procedure will be as follows: In addition to the routine use of the strip cup, physical examination of the udder and the brom-thymol-blue test, all of which will be performed in the stable, aseptically drawn quarter samples (or perhaps pooled udder samples) will be taken for the laboratory. In cases where they cannot be promptly transported, Bryan's (1) suggestion as to the use of inhibitory agents, such as brilliant green, and sodium azide, will be tried.

The Hotis test will be run on all samples. Those which are either positive or suspicious will be examined microscopically and transferred to either Edwards' blood agar medium or the plain blood agar, as an additional check.

On the basis of this information it is hoped to recognize incipient mastitis early and thus facilitate more intelligent and fruitful segregation, treatment or disposal.

It should be remembered that men of wide experience in this field do not agree on the details of proper procedure. Therefore, about all that can be done is to adopt a routine with which, it is believed, dependable results can be obtained. Experience here and elsewhere will inevitably lead to changes. An effort will be made to keep an open mind and adopt only those methods which, in our opinion, are most applicable to this particular problem and are best substantiated by sound research.

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Scientific Advances in the Dairy Industry

A Review of Much Current Literature *

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As might be expected, a global war of the intensity of the present one is exerting an adverse effect upon progress in research and development in the dairy industry. Research has been curtailed, fewer papers are being published, health departments are under-manned, and standards of quality of dairy products are being lowered, especially in fat content of cream and ice cream. We see no signs of any increased illness from the consumption of dairy products as now produced and distributed. The demand for this food is greater than ever. Unfortunately, now that our nutritive need is greatest and public acceptance at an all-time peak, our limited supplies restricts our consumption.

The exigencies of the times are responsible for two beneficial movements, namely, better care of equipment and a movement toward simplification of our regulatory procedure. The first means that greater skill and personnel training are necessary to handle properly a plant that is difficultly replaceable. The second reveals a trend toward placing more emphasis on the quality of the milk itself and less on its environmental setting.

In the field of education, there seems to be a growing dissatisfaction with dairy courses as they are now constituted. Curricula are being studied to turn out a type of graduate who more adequately meets current requirements and who can secure a position which is now going increasingly to the sanitary engineer and the veterinarian. In this connection the requirement by the military establishment that milk inspection be under veterinary officers has focused attention on the anomalous professional standing of the milk sanitarian. (He seems to be a maverick among the physicians, veterinarians, engineers, bacteriologists, and chemists.) So the question has been raised: what is a milk sanitarian? His duties, qualifications, and educational requirements are now being studied.

A striking development is the discovery of the avidity of employees in food establishments to seek information about food handling. Numerous in-service courses have been instituted, particularly by health departments, as prophylactic measures. The industry has responded with requests for a more productive emphasis.

Laboratory

The large amount of attention now given to the detection of mastitis has continued to stimulate laboratory studies of appropriate tests. Miller (1) has published a revision of the Hotis test, now emphasizing more the detection of *Streptococcus agalactia.* He claims about 90 percent agreement with blood-agar plates.

In a study of the relative value of the cell count and electrical conductivity method for diagnosing bovine mastitis, Malcolm, King, and Campbell (2) used the value of 500,000 cells to differentiate infected from non-infected specimens. The cell count gave the same result as the culture test in 86 percent and over 90 percent of two series of composite samples, and with 85 percent of the individual quarter

* Read at Annual Meeting of Massachusetts Milk Inspectors' Association, Worcester, January, 1944.

samples. They report that the pH value was not a reliable indication of mastitis. The conductivity method gave a count diagnosis in 72 percent of bulk samples from individual cows, and in 78 percent by the cell count technique.

A Beckman direct-reading pH meter, equipped with a remote electrode assembly, was applied by Johnson and Doan (3) to measure the hydrogen ion concentration of incoming milk in the dairy plant receiving room without appreciably interfering with the operations. Observations on 702 samples of herd milk at different seasons of the year indicated a normal range of from pH 6.40 to 6.80. Only 14 of the samples fell outside this range, and 11 of these showed evidence of bacterial action or the presence of mastitis infections in the herds.

Martin reported (4) that treatment of 37 quarters of 18 cows with a 50 percent mineral oil emulsion of tyrothricin freed 24 udders of the organism.

A combination of the resazurin and rennet tests has been applied by Davis (5). Usually a quarter sample reducing resazurin to pink within 1 hour will clot slowly with rennet, give a high catalase value, give purple mastitis organisms, usually streptococci or staphylococci, in some numbers. Mastitic milk clots slowly with rennet on account of high pH. Quick resazurin reduction means a milk high in cells; slow rennet clotting means an abnormal milk, high in pH and globulin. If the sample reduces resazurin quickly but clots normally, it may mean that the quarter is in the latent condition of the disease and so will be suitable for treatment. If the sample clots slowly but does not reduce resazurin, it may mean that the quarter has suffered an attack of mastitis in the past.

Three forms of the test are in vogue in England: (a) The rapid resazurin test, originally 5 minutes at 45° C. and modified in 1941 to 10 minutes at 37.5° C. This is a sorting out test for the creamery platform. (b) The above resazurin-rennet test for single-cow or quarter samples, unsuitable for bulk milk. (c) The resazurin test at 18° C. for keeping quality (6).

Milk sampling in England has been standardized under the National Milk Testing and Advisory Scheme (7). Every churn of milk which possesses any abnormal smell or taste is examined by the 10-minute test. When the resazurin disc reading is 4 or higher, the milk is accepted; when 3½ to 1 inclusive, it is salvaged if possible; and when ½ to 0, it is rejected. The test was compared with the Methylene Blue-Reduction Test, colony counts, bacterial clump counts, acidity, clot-on-boiling, alcohol clot smell and taste tests. The resazurin was found to be satisfactory.

In order to differentiate between the reduction of methylene blue by lactic acid bacteria and "harmful" bacteria, an antiseptic such as 0.25 percent sodium fluoride was proposed by Zarins and Blumbergs (8). They give a series of grades of milk based on the new fading time of methylene blue. The "harmful' bacteria on which this procedure was fixed were *Streptococcus lactic, Bacterium coli communis, Bacterium fluorescens liquefaciens,* and a special culture.

The Whiteside test provides for the addition of 2 ml. of N NaDH to 10 ml. of milk. Mastitic milk produces a viscid mass. Dunn, Murphy, and Garrett (9) have studied this reaction. Their findings point to the postulation that the protein material of leucocytes in mastitic milk reacts with NaOH to form a gelatinous mass similar to that which is formed by the action of NaOH on nucleic acid from animal cells.

The development of a positive phophatase test in refrigerated, pasteurized cream has been studied by Barber and Frazier (10). They found that positively reacting pasteurized cream samples, after storage at 10° C. or 4° C. always contained strains of *Bacillus* *cereus* and *Bacillus mesentericus*. In cream, bacterial phosphatase withstood heat treatments as high as 76.7° C. for 30 minutes whereas milk phoshatase is inactivated at 62.8° C. in 30 minutes. Bacterial phosphatase can be distinguished from milk phosphatase by reheating a sample of cream for 30 minutes at temperatures above those normally used for pasteurization but below 76.7° C. and then testing for phosphatase activity by means of the regular milk test. Barber gives a good review of the pertinent literature (11).

Minut points out (12) that the standard phosphatase reaction is not of certain value for cream because of incomplete destruction of phosphatase.

Buck isolated from the milk of four dairies the organism *Lactobacillus enzymo-thermophilus* which produces a bacterial phosphatase responsible for false positive phosphatase tests in properly pasteurized milk (13). He criticizes the use of route-returns for standardizing butter fat content because it entails a continuous reinoculation process.

Kaplan points out (14) that false positive reactions may be ascertained by checking the reagents for deterioration and by laboratory pasteurization. A second phosphatase test will again be positive if the first one was caused by the thermophilic lactobacillus.

Milk with high cell content from inflamed udders has been shown by Schönberg and Milbradt (15) to protect peroxidase from heat destruction. The engyme, stored in the cells, can be liberated slowly, giving a late positive test.

In the study of samples of milk from cows with chronic bovine mastitis, Murphy shows (16) that the biochemical alteration decreases from the first to the fourth 10-ml. foremilk fraction, and even greater for bacterial content. He urges the use of strict foremilk and not that which follows the discarding of unknown quantities. He determined the (17) leucocyte and chloride content and the pH value of 4049 samples from 120 cows of different ages, and of 770 samples from 64 uninfected first lactation quarters. Samples classed as "uninfected" were biochemically normal only when they contained fewer than 200 staphylococci per ml. or in combination with nonhemolytic udder diphtheroid bacilli. Samples classed as "staphylococcus-infected" often exceeded biochemical end points in a manner similar to the "streptococcus-infected" samples.

The relation between the harmful effects of mold on butter score and the mold content was shown in a report on 280 samples of Montana commercial butter by Boyd and Nelson (18). Butter scoring above 90, graded "satisfactory" to the mold mycelia grade, whereas the lower the score, the higher the mold content.

In order to ascertain the mold mycelia content of the finished butter that would be made from a given sample of raw cream, Wilkowske and Renner (19) devised a rapid method of making butter quickly in the laboratory by using a malt mixer. Good checks were obtained with such butter as compared with commercial churnings from the same cream.

A quick method was devised by Brereton and Sharp (20) for determing the casein in samples of skim milk. The procedure consists in precipitating the casein with dilute acetic acid, dissolving in dilute sodium hydroxide, and measuring the refractive index with a dipping refractometer.

Jamieson describes a new procedure (21) for studying the effect of bacteria on butter flavor. He prepares a "butter medium" in the laboratory, and shakes it aseptically with known cultures.

Gray has devised a double-staining procedure (22) for differentiating capsules on bacteria in milk films. Bacteria and other cells are stained blue whereas serum solids and casein are pink.

Ball shows mathematically (23) that the discrepancies between bacterial destruction by the long versus the short-hold pasteurization processes depends upon the particular kind of bacteria involved, and also on the time required to heat and cool the milk before and after the pasteurization treatment respectively. Heating at 71.7° C. (161° F.) for 19.2 seconds has destructive power equivalent to 61.7° C. (143° F.) for 30 minutes to kill *Br. suis*, but for *S. aertrycke*, a process of 3 minutes, 20.4 seconds at 71.7° C. (161° F.) is equal to 30 minutes at 61.7° C. (143° F.). For phosphatase inactivation, assuming a simple chemical reaction, one requires a process of 3 minutes at 71.6° C. (161° F.) to produce the equivalent of 30 minutes at 61.7° C. (143° F.).

A fixed relation is claimed by Montefredine (24) to exist between the electrical conductivity and the specific gravity of milk. The amount of water added to milk can be determined by the electrical conductivity.

The relation of heat-volatile sulfides of milk and sulfhydryl groups to several off-flavors of milk led Townley and Gould (25) to devise a method for measuring these sulfides quantitatively. They aspirated the milk with nitrogen during heating for 30 minutes, collected the liberated sulfides in zinc acetate, added reagents to form a blue dye, and measured the intensity photometrically.

The composition of the dietary fat in the feed of cows was found by Hilditch and Jasperson (26) to impart similar composition to the milk fat.

In this connection it is interesting to read the work of Corbett and Tracy (27) who showed that the tendency of milk to develop an oxidized flavor was not related to the iodine number of the fat in the range of 24 to 40, but that above 40, there was a slightly greater tendency to this development than in milk having a lower iodine number. However, the differences were too slight to be considered significant. Six cows were given the same diet but their milk exhibited marked variation in susceptibility to off-flavor.

Hawley (28) points out that published Reichert values of milk of single animals should be accepted with reserve in the absence of any statement of the stage of lactation or the yield of milk at the time of sampling.

Brown and Thurston (29) report on a modified Babcock method for the determination of fat in concentrated milk, chocolate milk, and ice cream. They use the Minnesota reagent.

The Committee on Frozen Desserts Sanitation reported (30) through its chairman, F. W. Fabian, four new methods for the chemical examination of frozen desserts: Accurate Sampling for the Determination of Milk Fat of Ice Creams Containing Insoluble Particles Such as Fruits, Nuts, and Crumbs of Pastry, by P. H. Tracy; Determination of Milk Fat in Ice Cream by a Modified Babcock Technique, by W. H. Martin; Determination of Stabilizers in Frozen Desserts, by F. L. Hart; and Determination of Percent Overrun in Ice Cream by P. S. Lucas (30-a). These will be published in an early new edition of *Standard Methods for the Examination of Dairy Products.*

Kelly, Reid, Arbuckle, and Decker (31) describe a technique for the examination and photomicrography of ice cream in which the identity, quantity, and grain size of the crystalline substances can be determined, and the textural relationship of non-crystalline materials and air cells observed. These several properties can be studied without melting, adding chemical reagents, or otherwise changing the ingredients.

The reduced and total ascorbic acid can be determined, as shown by Hochberg, Melnick, and Oser (32), by a modification of the current photoelectric colorimetric methods. A nomogram enables the analyst to estimate the ascorbic acid concentration from the residual densities of the dye at the end of 5 and 10 seconds of reaction. The reduction of the dye by the vitamin is a reaction of the second order. The photometric procedure has a much greater degree of specificity than the visual titration, even when only relatively small amounts are present.

Krehl, Strong, and Elvehjem (33) modified the basal medium of Smell and Wright for the microbiological determination of nicotonic acid. The new procedure nearly doubles the response of the bacteria, and have produced a linear, standard curve, with greater reliability and reproducibility of the essay results.

Leviton reported (34) that the absorption of riboflavin selectively on lactose crystals is a linear function. Lactose can be prepared containing as high as 300 micrograms of riboflavin per gram. Higher concentrations retard lactose crystallization, and change the shape of the lactose crystals.

By using roentgenographic examinations of the course of bariumized milks through the intestinal tract, Hadary, Sommer, and Gonce (35) concluded that no correlation exists between the curd tension of the milk and stomach or colonic emptying time of children. Soft curd milks were not found to leave the digestive tract any more rapidly than the hard curd milk. Chocolate milk behaved in this respect as did all other soft curd milks.

Foam is measured by static and dynamic methods. Ross (36) reports on the factors involved. Static methods depend on observing the rate of liquid drainage out of the foam, whereas dynamic methods involve measurement of the rate of bubble collapse. Apparatus of different types and full discussion are presented.

Doan discusses at length (37) laboratory methods for the control of homogenized milk. He states that rancidity can be detected 30 to 45 minutes after homogenization if the milk is not pasteurized. Raw milk and homogenized pasteurized milk, when mixed, will develop rancidity when neither alone will show this defect. Homogenized milk is protected from copper-induced oxidized flavor but is very susceptible to "sunlight" flavor, oxidized, or burnt flavors. Accurate determinations of milk fat can be made by using minor alterations in the standard method, such as having acid and milk at room temperature, using 17 ml. of acid, and mixing after the first centrifuging. The best method to prevent sedimentation is clarification. Greater curd reduction is made by higher testing milk. Bottles should be filled a little lower than in regular fills to minimize seepage. The protein, made less stable by homogenization, is more easily coagulated by acids or heating. The syphon method of removal of the upper 100-ml. for fat analysis will give results a little lower but more uniform than with the pipette. The Farrell Index of Homogenization Efficiency is considered a satisfactory method for measuring the effectiveness of homogenization. This index is the number of globules, 2 microns in diameter, which could be obtained from all the globules larger than 2 microns which are observed in five 25-micron-square fields covered with a 70-micron-thick layer of 1 to 25 dilution of milk in a 40 percent glycerine solution. Details are given for determining these values.

Health

The outbreaks of disease traced to water supplies, milk, foods other than milk, and undetermined vehicles, reported by the U. S. Public Health Service, are tabulated in the *Journal of Milk Technology* for the years 1938, 1939, and 1941 (38). In each year, the number is close to those attributable to polluted water, but run far below those traced to foods other than milk. Brooks (39) discusses outbreaks particularly in New York State. He recommends that the Public Health Service revise its reporting procedure so as to list those outbreaks in which milk is suspected but not reasonably proven to be responsible under a separate heading: "Outbreaks Possibly Milk-borne." This report also points out the desirability of reviewing our laws and regulations governing milk control in order to weed out those that are relatively irrelevant.

Leete reports (40) a milk-borne outbreak of streptococcal fever, involving 23 cases. The cause was traced to a cow's injured teat which had been treated just prior to the outbreak by a person infected with the same organism.

Human tuberculosis of bovine origin is reported (41) to be present in Wales to the extent of 1 percent, in England 1.6 percent, and in Scotland 7 percent of pulmonary tuberculosis. The bovine type is responsible for about 50 percent of lupus and cervical gland tuberculosis in England, 25 percent of the meningeal, and 15 percent of the bone, joint, and genitourinary tuberculosis. Corresponding figures for Scotland are higher.

Caudill reports (42) an epidemic traced to pasteurized milk. The evidence pointed to the production of large amounts of toxin from staphylococci which found their way from the udders of several cows. It is believed that the toxin was not all destroyed during pasteurization, although the producing organisms were killed.

Staphylococcus aureus was found (43) in one third of the samples from 445 cows in 6 dairy herds. Artificial inoculation of 26 teat canals with *S. aureus* (6 bovine, 1 human strain) caused infection in 22. Staphylococcal antitoxin appeared in the blood following the udder infection but none was found in the milk from the undamaged quarters. Antitoxin was present in the colostrum but disappeared as soon as the secretion assumed the appearance of normal milk.

An article on bacterial food poisoning (44) reviews much of the recent literature and presents many of the author's findings on staphylococcus food poisoning and the interotoxins produced by these organisms.

Stone lists 82 outbreaks of staphylococcus poisoning from 1907 through 1939 (45). In 63 of these, 4123 individuals were involved. Of these outbreaks, 14 were traced to dariy products. with 14.3 percent of the cases.

An epidemic of brucellosis (46) caused illness of 77 persons. The organism involved was *Brucella suis* in the raw milk of a common dairy. One patient with one healthy child aborted twin embryos; there was no other discernible cause for the abortion. Another outbreak (47) from the same organism involved 57 persons who used the contaminated milk supply.

Weed et al, report a fatal staphylococcus intoxication (48) by drinking milk of a goat suffering from an acute suppurative mastitis due to *Staphylococcus aureus*.

The unidentified streptococcus which was reported some years ago as the cause of human food poisoning from cheese was found to be *Streptococcus fecalis* (49), in Lancefield's serological group D.

Nutrition

Enriched white bread containing 6 percent of dried skim milk is superior in growth-promoting value and hemoglobin production to enriched white bread supplemented to an equivalent extent with dicalcium phosphate and riboflavin, as reported by Mitchell, Hamilton, and Shields (50). They also found it equal to whole wheat bread in growth-promoting value and hemoglobin production, and is distinctly superior to it in the promotion of bone calcification. Skim milk solids is a better supplement to white flour for growth than the residue of the wheat berry that is discarded in its milling.

Irradiation of market milk with ultra-violet light has been shown by Fuhr, Dornbush, and Peterson (51) to exert no reduction in content of vitamin B_1, carotene, vitamin A, or riboflavin.

In spite of some economists to the contrary, Rinear (52) finds that the consumption of fresh milk tends to increase as the family income increases from $500 to $2500. The consumption of fresh and evaporated milk combined in families with low incomes approaches the same level as the combined consumption of families of higher income. Families without children consume more fresh milk than adults in families with children.

Although some nutritionists hold that there is no need to conserve vitamin C in milk because so much citrus fruit is available, Wolman (53) urges that since pasteurization partly destroys ascorbic acid and thiamin, every effort should be made to conserve them.

Immediately after milking, all of the vitamin C is in the form of reduced ascorbic acid. Oxygen slowly changes this to dehydroascorbic acid which in turn slowly disappears because of its own instability. Hand (54) shows that milk contaminated with an appreciable amount of copper may have much of its vitamin C in the form of dehydroascorbic acid as early as the first day after milking. Pasteurization destroys most of the dehydroascorbic acid. Bottling and delivery forms more of the dehydro acid. In pasteurized milk that is deaerated, the vitamin C is entirely in the form of reduced ascorbic acid, and is stable.

The relative nutritional values of butter and margarine were studied by Beth and Hans V. Euler and Säberg (55). On a diet enriched with vitamins, the rats grew well with supplements of either margarine or butter. On diets deficient in vitamin D, butter was superior to margarine. Margarine was superior to other fats.

Regulation

The U. S. Public Health Service issued its recommended ordinance to cover food establishments (56). It includes the regulation of sanitary provisions for handling dairy products.

A series of general papers by Breed, Scharer, Tiedeman, and Fuchs deals with simplified practice in market milk control (57). This includes a discussion of deck inspection whereby (58) milk is examined to a large extent by its odor, especially bacteria from high counts and mastitis. Johns shows (59) that the "triple reading" resazurin test and the oval tube method [see *J. Milk Technol. 4,* 320 (1940) and *4,* 18 (1941) respectively] provide procedures for a quality control program which makes less demand upon skilled help, apparatus, and supplies. The former has advantages for the grading of milk on the basis of both bacterial and leucocyte contents, while the oval tube method is preferred following laboratory pasteurization for the detection of milks containing thermoduric organisms in significant numbers.

Mickle and Borman (60), after several years use, recommend the so called Connecticut Three-Point Laboratory Program for pasteurized milk: 1. the direct microscopic clump count for bacterial quality, 2. test for coliform organisms to furnish evidence of improper handling after pasteurization, and 3. the phosphatase test for effectiveness of pasteurization.

A compilation of the state requirements for milk fat in ice cream shows (61) that numerous states have reduced the minimum standard for the duration.

Bulmer (62) deplores many aspects of our milk control policy which obstruct the availability of nutritious, wholesome milk because of unreasonable regulatory requirements.

The U. S. Public Health Service has issued (63) Emergency Sanitation Standards for Raw Milk for Pasteurization, comprosing modifications of the regular Standards under the Milk Ordinance and Code (Public Health Bulletin No. 220, 1939 edition) during the war emergency.

From the standpoint of the health officer, Gunderson urges (64) that our milk quality control program should be simplified and revised to eliminate what have become with the passage of time. irrelevancies.

Shepard (65) pleads for greater recognition of the dairy college graduate in regulatory and technical positions in the dairy industry.

A comprehensive study was made by Black (66) on laboratory procedures over the country in milk control work. He states that no one laboratory actually met all requirements in equipment and procedure, and no laboratory conformed in all items of even the general group on apparatus or technique. However, "almost universally it was the intention to follow Standard Methods."

Although the determination of "extraneous material" (sediment) in milk has been practiced as a regulatory measure for a long time, it remained for Weckel (67) to show that there is very great lack of uniformity in making and interpreting this test. Many sanitarians feel that "acceptable milk" should be amply and clearly defined. "Certainly the milk described acceptable in one region cannot or may not be classified acceptable in another on the basis of this survey."

Industry

A comprehensive study was reported by Judkins (68) on homogenization efficiency. He reported in detail on the many factors which influence the proper procedure in plant operation and laboratory examination.

Doan and Mykleby (69) state that the U. S. Public Health Service definition for homogenized milk is practically meaningless because it does not specify in detail the procedure to be followed in separating the upper 100 ml. from the remainder of the quart. They give details of a syphon apparatus for satisfactorily removing the upper layer. Details are given for making a modified Farrall index.

Spur reported (70) that homogenization of milk protects it from the cooked flavor that develops when milk is pasteurized at temperatures as high as 150° F.

The absorption of odors by milk was shown by Trout and McMillan (71) to be less in homogenized milk than in regular raw or pasteurized milk. Trout reviews (72) the development of homogenized milk, shows the conditions under which it could be produced and handled, and shows that it may be stored or held longer without oxidative deterioration than regular untreated milk.

The digestibility of lactic acid milk, boiled milk, and homogenized milk was reported by Doan and Dizikes (73) to be much superior to that of regular milk, and that meta-phosphate- treated milk, chocolate milk, and trypsin-treated milk were moderately so.

Practical ideas on piping installations are given by Baker (74). Hucker and Thomas (75) report on the practicability, sanitary excellence, and case of cleaning glass piping. Industrial lighting as applied to the dairy industries was studied by Hill (76).

Larian (77) discusses heat exchanger design, and gives methods for calculating the heat transfer area.

Several good articles have appeared on the literature to help operators check up on the efficiency of their refrigeration machinery (78, 79, 80, 81, 82).

Kullman (83) suggests that equipment and materials can be conserved by installing a system for checking regular periods of lubrication and inspection. Thereby, responsibility is placed for check-up of operations. Burrows (84) likewise gives detailed suggestions to maintain good plant performance. Richardson (85) gives detailed suggestions for conserving dairy rubber equipment, and Doley (86) gives good practical suggestions for the repair of concrete floors in dairy plants. Bendixen (87) publishes the results of his studies on milk house construction, equipment, and maintenance.

Air conditioning is discussed by Slade (88) who urges automatic control, explains the different systems used, and diagrams a control system.

Some of the difficulties encountered in operating a butter manufacturing plant satisfactorily are due to impure water supplies. Cosley, Long, and Hammer (89, 90) show that some supplies meet public health requirements but contain butter spoilage organisms. Some municipal supplies are in this category. Water storage tanks often are the source of contamination.

Hammer and Babel (91) present an extensive review of the bacteriology of butter cultures.

Prouty (92) describes a ropy milk outbreak in the pasteurized market milk of a distributing plant. It was thermophilic and closely related to *Micrococcus freudenreichii*.

Schalm and Mead (93) report some experiments that show that incomplete milking may lead to increased severity of the clinical manifestations of *Str. agalactiae* infections. Conversely, thorough milking of cows affected with chronic mastitis seemed to reduce the severity of the disease.

An excellent discussion of milk filtration with cotton media is presented by Davis (94). He shows the practical necessity for using some kind of straining and/or filtering, and contends that the use of a cotton web is good insurance against re-use of the medium.

The presence of a medicinal flavor in pasteurized milk was traced by Claydon (95) to a variety of the *Aerobacter aerogenes* organism. Examination of line run samples showed that the wash water in the tanks and in bottles where hand methods were used, was infected. Improvement in bottle and can washing effectively remedied the difficulty.

In selecting a rapid platform test for unsatisfactory milk, Barkworth and his associates (96) in England compared the tests of smell, taste, alizarin-alcohol, titratable acid, 10-minute resazurin, and pH, all correlated with the accepted 30-minute methylene blue test and with the clot-on-boiling test. They concluded that the 10-minute resazurin test was most suited for the rapid detection of unsatisfactory milk at the receiving platform.

The checking of commercial high-temperature short-time pasteurization equipment has been described in detail by Holt (97) and by Fay and Fraser (98). The latter article is illustrated. Both are highly practical.

Methyl bromide residues from fumigating dairy products were studied by Roehm, Stenger, and Shrader (99) on dried skim milk, butter, and several kinds of cheese. After allowing a reasonable time for the escape of the fumigant, the residual traces of bromine were in the form of harmless inorganic bromides in insignificant amounts.

Mattick, Hiscox, and Davis (100) review twenty-four articles on dairy detergents from 1939 to 1941. A particularly comprehensive review of detergency was presented by Parker (101) in the scope of a manual describing detergents, wetting agents, and methods of use.

The flavor of frozen cream in storage was shown by Trout and Scheid (102) to be better when the cream was pasteurized at 185° F. for 5 minutes. Copper exerted a deleterious flavor effect which was only very slightly improved by homogenization. The addition of 10 percent sugar (sucrose) exerted no appreciably beneficial effect, except possibly to mask the off-flavor when copper was present. The type of container—whether glass, paper, or tin—had little influence on flavor during storage. In spite of different carotenoid content, cream produced during one season of the year was stored as satisfactorily as that produced from another season. If the cream were susceptible to off-flavor development, this would reveal itself in about three months. The initial titratable acidity exerted but little influence on flavor when the cream was pasteurized at 165° F. for 15 minutes higher, but there was a direct correlation between high acidity and development of off-flavor when the cream was pasteurized at 150° F. for 30 minutes.

The same authors also report (103) that fast-freezing of cream did not prevent "oiling off" of the cream when it was defrosted. Pasteurization at 165° F. for 15 minutes exerted less such tendency than treatment at 150° F. for 30 minutes or 185° F. for 5 minutes. The addition of 10 percent sucrose decreased but did not prevent oiling off. Likewise, homogenization did not prevent this trouble. The maximum destabilizing effect occurred during the first 3 months of storage. Higher testing cream oiled off slightly more than did lower testing cream. Trout and associates (104) showed that carotenoid values of high fat cream ran higher in summer than in winter, but this did not protect cream from the deleterious flavor defects caused by copper. Pasteurization, homogenization, addition of sucrose, 1 ppm. of copper, type of container, freezing and storage for 12 months at 0° to —10° F. exerted no appreciable effect upon the carotenoid content. Trout specifically recommends (105) that cream for storage should contain approximately 50–60 percent fat, should have low titratable acidity, should be high in carotent, and should be pasteurized at 165–185° F.

The short-time high-temperature pasteurization of ice cream was studied by Dowd and Anderson (106). They report that pasteurization at 180° F. for 19 seconds proved as bactericidal as heating at 160° F. for 30 minutes. Homogenization before or after pasteurization did not affect this reduction, nor the phosphatase value.

Dahle (107) recommends that sherbets should contain 40 percent of the sweetening agents in the form of corn syrup solids and 3 to 5 percent milk solids. They should have the same firmness as ice cream. Josephson, Dahle, and Patton (108) report on the relative effectiveness of thirteen different kinds of stabilizers in ice cream. Tracy recommends (109) for ices and sherbets 26–30 percent sugar of which 25–60 percent should be monosaccharides. The proposed Federal standard sets 4 percent milk solids as the minimum for sherbets but the amount varies commercially. Four suggested formulae are given, and faulty body defects are discussed.

Leighton and Williams (110) report that corn sugars are markedly more effective sweeteners of ice cream than has been previously thought. In fact, dextrose hydrate, with a value of 120, is actually sweeter than cane sugar when it replaces one-third of the cane sugar in ice cream. The relative values of corn syrup and corn syrup solids is 75 and 60 respectively.

The U. S. Department of Agriculture announces that milk whey (left after removal of casein from skim milk) can be fermented to lactic acid, and this product can be made to form methyl lactate. This latter is important in the production of plastics and synthetic rubber.

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SEMINAR ON MILK CONTROL

SEMINARS for State and local food and milk sanitarians are being held by the U. S. Public Health Service as a result of a recommendation of the Committee on Milk of the Conference of State and Provincial Health Authorities.

The seminar sessions recently held in the City Hall Auditorium, Cumberland, Maryland, included the following subjects:

How milk supplies are contaminated by various disease organisms.

The history of milk-borne disease outbreaks.

The Public Health Service milk sanitation program.

Definitions used in milk control.

Laboratory control of milk supplies.

Methods of punishing violations—permit revocation, degrading; legal aspects of milk control.

Labeling and placarding.

Inspection and grading procedure.

Detailed discussion of Grade A requirements for dairy farms, including construction and operation of barn and milk house, manure disposal, excreta disposal, water supply, utensil construction, cleaning, bactericidal treatment and handling, milking procedure, cooling, bottling and capping, and health examinations.

Detailed discussion of grade A requirements for pasteurization plants, including plant design, excreta disposal, water supply, construction, cleaning, bactericidal treatment and handling of equipment, the pasteurization process, cooling, bottling, and capping, health examinations, and tests of pasteurization equipment.

Country pasteurization plants.

Milk sanitation bookkeeping.

The rating of community milk sheds to determine the extent of compliance with the grade A requirements.

The cost of milk control.

Maximum attention will be devoted to a discussion of all of the farm and pasteurization plant items of sanitation.

The seminar discussions will be based on the 1939 edition of the Public Health Service Milk Ordinance and Code (Public Health Bulletin No. 220). Before the seminar each enrollee should purchase a copy from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. (price 35 cents, stamps not accepted). Copies will not be distributed at the Cumberland seminar.

APPLYING THE DIRECT MICROSCOPIC AND SWAB TESTS IN A MILK CONTROL PROGRAM

(Continued from page 77)

definite advantages over the Methylene Blue Reductase and Coliform Tests for milk.

3. The Sediment and Phosphatase Tests have a definite place in the sanitary control of milk.

4. A combination of the (1) sediment, (2) direct microscopic, (3) phosphatase, and (4) swab tests for controlling and appraising the sanitary quality of milk are readily and easily applied at the receiving platform and in the pasteurization plants, reduces the number of costly routine, time-consuming farm inspections.

5. This combination of testing milk aids control officials in meeting the public's demand that milk be (a) clean, (b) safe, (c) rich, and (d) of good keeping quality.

Legal Aspects

Filled Milk Law Upheld *

(Kansas Supreme Court; *State ex rel. Mitchell v. Sage Stores Co. et al.*, 141 P.2d 655; decided October 2, 1943). The so-called filled milk statute of Kansas made it unlawful "to manufacture, sell, keep for sale, or have in possession with intent to sell or exchange, any milk, cream, skim milk, buttermilk, condensed or evaporated milk, powdered milk, condensed skim milk, or any of the fluid derivatives of any of them to which has been added any fat or oil other than milk fat, either under the name of said products, or articles or the derivatives thereof, or under any fictitious or trade name whatsoever." This statute was held by the Supreme Court of Kansas to apply to a canned product manufactured by mixing sweet skim milk, refined cottonseed oil, and natural vitamin A and vitamin D concentrates and thereafter evaporating the mixture so as to reduce it to 40 percent of its original volume solely from the loss of water. In sustaining the constitutionality of the law, the following conclusions were among those reached by the court:

(*a*) The purpose of the statute was to preserve the public health and prevent fraud and deception of consumers.

(*b*) If the character or effect of an article, as intended to be used, is debatable, the legislature is entitled to its own judgment which cannot be superseded by the court's views.

(*c*) The fact that a food product is wholesome does not of itself make a prohibitory statute either inapplicable to the product or unconstitutional as applied to it.

(*d*) Whether regulation or absolute prohibition is necessary to attain a statute's purposes is a question for the legislature.

(*e*) The defendant's product was within the statute's purview and it was not material that the product was unknown when the law was enacted.

(*f*) Since the defendant's product was susceptible of being sold as and for evaporated milk, and was so sold, the legislature could prohibit its sale as an instrument of fraud and it was not material that the defendant intended that its product be sold for what it really was and without fraud or deception.

The court said that it had, in *Carolene Products Co.* v. *Mohler*, decided in 1940,[1] held the filled milk statute to be a valid health measure designed to protect the public against deception and fraud and that it adhered to that view now. It appeared that the product in the instant case was the same as the product condemned by the court in the earlier case except that the present product contained cottonseed oil while the former product contained coconut oil.

* *Pub. Health Repts.*, Jan. 7, 1944.

[1] For abstract of decision see *Public Health Reports*, Oct. 4, 1940, p. 1834.

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INSERVICE TRAINING COURSE AT MICHIGAN IN MILK SANITATION

The School of Public Health, University of Michigan, conducted a five-day, short course in milk sanitation for milk control officials March 6 through March 10.

This was the fifth in the series of short courses conducted by the School. Previous courses have been conducted for pasteurization plant operators, hotel and rastaurant managers, plumbers, and in industrial hygiene for plant safety personnel.

This is a type of instruction provided in the organization of the School, and the School's new building was designed to accommodate such activity. In addition to the usual facilities there are a number of seminar rooms provided for this purpose. The subject matter in all courses is limited, however, to the health and sanitation aspects, regardless of the group which the course is designed to serve.

While previous courses have served a trade or special pursuit, the course for milk control officials is the first of the refresher type of courses for a professional public health group. It differed from previous courses not only in this respect but also in the method of conduct.

It was conducted in small group instruction units of twenty in each section. All three sections were conducted concurrently and each section was repeated three times during the day, so that each registrant attended each of the three sections during the day. The total registration of sixty was composed of milk control officials designated by the State Health Departments of Michigan, Ohio, and Illinois. The subject matter was designed to provide a course in the advanced level with a view of helping to prepare key milk control officials to aid in the conduct of schools or short courses for local groups.

The following course of study based on the Standard Milk Ordinance as the text was the course of study pursued:

MONDAY, MARCH 6

Sec. 1. Dairy Bacteriology—W. L. Mallman, Ph.D., Professor of Bacteriology, Michigan State College, East Lansing, Michigan.

Sec. 2. Milk Borne Diseases
a. Statistical Studies — Marguerite Hall, Ph.D., Assistant Professor of Public Health Statistics, School of Public Health, University of Michigan.
b. Epidemiology — George Ramsey, Dr.P.H., Resident Lecturer in Epidemiology, School of Public Health, University of Michigan.

Sec. 3. Bovine Diseases — C. S. Bryan, D.V.M., Ph.D., Associate Professor and Research Associate in Bacteriology, Michigan State College.

TUESDAY, MARCH 7

Sec. 1. Milk Examinations Used in Milk Control—Dr. C. S. Bryan.

Sec. 2. a. Cleaning and Bactericidal Treatment—Prof. W. L. Mallmann.
b. Milking Technique — Warren P. S. Hall, D.V.M., M.A., Superintendent, Food Control, Toledo Department of Health, Toledo, Ohio.

Sec. 3. Dairy Barn and Milkhouse Discussion of Construction, Equipment and Maintenance—I. D. Mayer, Associate in Agricultural Engineering, Purdue University, Lafayette, Indiana.

WEDNESDAY, MARCH 8

Sec. 1. Water Supply and Excreta Disposal
a. Discussion of Water Supply and Excreta Disposal Standards — John M. Hepler, C.E., Director, Bureau of Engineering, Michigan Department of Health, Lansing, Michigan.
b. Milk Wastes Disposal — L. F. Warrick, B.S., Ch.E., M.S., State Sanitary Engineer, Wisconsin Department of Health, Madison, Wisconsin.

Sec. 2. Theory and Principles of Teaching — Howard McClusky, Ph.D., LL.D., Professor of Educational Psychology, Mental Measurements and Statistics, School of Education University of Michigan.

Sec. 3. a. Cross-Connections — L. Glen Shields, M.S., Sanitary Engineer, Department of Buildings and Safety Engineering, Detroit, Michigan.
b. Cooling — Russell Palmer, B.S., M.S., Chief Milk Inspector, Detroit Department of Health, Detroit, Michigan.

THURSDAY, March 9

Sec. 1. Pasteurization
Theory and Plant Layout — John Andrews, B.S., P.A., Sanitary Engineer, (R) United States Public Health Service, Washington, D. C.

Sec. 2. Pasteurization
a. Equipment Defects — William J. Guerin, Chief Sanitary Officer, Chicago Board of Health, Chicago, Ill.
b. Design Standards and Practices—George W. Putnam, B.S., Vice-President, The Creamery Package and Manufacturing Co., Chicago, Ill.

Sec. 3. Pasteurization Plant Supervision
a. What the Plant Operator Expects of the Inspector—C. A. Iverson, M.S., Department of Dairy Industry, Iowa State College, Ames, Iowa.

b. What the Inspector Expects of the Plant Operator — W. H. Haskell, D.V.M., Senior Milk Specialist, U. S. Public Health Service, District No. 3, Chicago, Ill.

FRIDAY, MARCH 10

Sec. 1. Testing Milk Plant Equipment — P. Edward Riley, Assistant Milk Sanitarian, Illinois Department of Health, Chicago, Ill.

Sec. 2. Control Program — Dr. W. H. Haskell.

Sec. 3. How to Sell a Milk Control Program — H. L. Thomasson, A.B., Milk Sanitation Consultant, Division of Dairy Products, Indiana State Board of Health, Indianapolis, Indiana.

The fee for registration and enrollment in the course was $5. Persons enrolling and completing the course received an official "Record of Attendance."

SUMMARY OF MEETING OF INTERNATIONAL ASSOCIATION OF MILK SANITARIANS' ADVISORY COMMITTEE TO FOOD DISTRIBUTION ADMINISTRATION, WASHINGTON, D. C., DECEMBER 7, 1943

Government Chairmen

T. G. Stitts, Chief, Dairy and Poultry Branch, FDA.
A. W. Fuchs, U. S. Public Health Service.

Committee Members, I.A.M.S.

A. W. Fuchs, U.S.P.H.S., Washington, D. C., *Chairman.*
Milton R. Fisher, City Health Department, St. Louis, Missouri.
George W. Grim, Milk Control Officer, District No. 1, Ardmore, Pa.
Ralph E. Irwin, State Department of Health, Harrisburg, Pa.
James R. Jennings, State Department of Health, Des Moines, Iowa.
M. M. Miller, U. S. Public Health Service, District 2, Bethesda, Md.
Wm. B. Palmer, Milk Inspection Association, Orange, New Jersey.
Horatio N. Parker, City Health Department, Jacksonville, Fla.
Sol Pincus, Deputy Commissioner of Health, New York, N. Y.
R. G. Ross, City Department of Health, Tulsa, Oklahoma.
W. D. Tiedeman, State Department of Health, Albany, N. Y.

Representing Government

Major C. J. Babcock, SGO.
A. J. Burke, WFA.
Bruce Easton, WFA.
J. R. Hanson, Dairy and Poultry Br., FDA.
W. H. Harper, Dairy Branch, Rationing, OPA.
Capt. L. J. Lindell, OQMG.
J. D. Prior, WFA.
W. J. Parsonson, WFA, Priorities Division.
W. C. Weldon, Dairy and Poultry Br., FDA.

Program

Dairy Situation
FDO 79
Farm Equipment
Prices
Milk Cans
Army Milk Supplies
Plant Equipment
Milk Rationing
Committee Procedure

Dairy Situation

Mr. Stitts said the dairy situation does not look good at the present time. He expressed the hope that a round table discussion would help everyone concerned to have a better understanding of the problems. While a plan for rationing fluid milk is under consideration, it is hoped that rationing will not be necessary because of the danger of black markets and the sale of raw milk on the farms which might result in an outbreak of disease.

The various orders issued for dairy products were reviewed by Mr. Stitts. The first order issued on November, 1942, was a 90 percent set aside order on spray process skim milk. In the same month half of the butter stocks were frozen in warehouses, but there was a leak of the news and handlers moved stocks out. For that reason, shipments to Russia were always behind. This year close to 90 million pounds are being shipped to Russia for the exclusive use of hospitals and soldiers. Another order issued that month, prohibiting the sale of cream of over 18 percent butterfat content, has held back the sale of some butterfat although it may have increased the sale of milk.

On December 1, 1942, the ice cream order was issued which placed a 60 percent limit on milk solids for ice cream. The set aside order on butter was issued on February 1, 1943, and has been the program of buying butter this year. The combined requirements for Army and Lend Lease for butter are roughly 450 million pounds. The set aside order has been operated so as to take the heavy requirements during the flush season and to go out of the market during the short season because the OPA price ceiling gives no appreciation in value for carrying storage stocks. Therefore, the Government agencies are out of the butter market now, except for small quantities the Army and Navy are buying. The acute situation in butter, Mr. Stitts said, is partly a price problem.

On February 1, 1943, a permanent ice cream order was brought out. The industry is being depended upon for compliance, and comments were invited as to its effectiveness.

A marketing economies order was also issued in February looking toward economies in the distribution of fluid milk. The permanent whipping cream order, which replaced the former WPB order was also issued in February, 1943. The cheese set-aside order under which 200 million pounds of cheese was bought for the British, 100 million pounds for Russia, the Caribbean program, Alaska, Puerto Rico, and Hawaii became effective on February 15. Government agencies are now taking 25 percent of American Cheddar cheese. While this order is being avoided widely, it is done on a legal basis by making Italian cheeses which were not important before the war and which have no dollars and cents ceilings.

The rationing of butter, cheese, and cheese spreads started in March, 1943. The set aside was changed so that it applied to spray and roller skim milk on June 1, 1943, taking 75 percent of production for military forces and for shipment to lend lease, principally to England and Russia. The rationing of evaporated milk started in June, 1943, on the basis of one red point for a can. There is moving into civilian trade through rationing 43 million cases of evaporated milk; a year's normal consumption is 52 to 53 million cases. As more soldiers go overseas, the requirements for evaporated milk will increase, but since the production is not increasing, a shortage of evaporated milk is possible. Government requirements for evaporated milk is about 35 million cases, while the anticipated production is 70 million cases. The question of whether the Government can afford a more rigid rationing of evaporated milk has been under consideration. Shipments to Britain have been cut, none of which are being used by civilians but are being used for overseas services and for stockpiling in case of an invasion. There seems to be an increased demand for sweetened condensed milk, particularly by the Russians.

Rationing started in soft cheese in June, 1943. On September 10, the order authorizing sales quotas for milk, cream, and by-products was issued. Requirements from the military side of the Government for dairy products would expand if they could be expanded. In addition, there is the factor not yet set up in Government, and that is the feeding of those in the rehabilitated areas. What the demands will be for dairy products is problematical, but they will be substantial. All dairy products with the exception of fluid milk have been rationed. The requirements for butter for all Government uses will be around 400 million pounds, cheese 400 million pounds. The cheese industry is being completely reorganized and reoriented and is bringing a new food product, dried whey, into the market.

Another unusual requirement at the present time is milk sugar, which seems to be most effective in the making of the new drug penicillin although it is also used in other drugs. The problem is to get enough production.

The production of skim milk powder is about 35 percent under last year.

The committee was asked for comments on the procurement programs and whether they have any effect on work being done by the health departments which the committee represents.

In answer to a question by Mr. Palmer, Mr. Stitts said that out of 400 million pounds of butter purchased by Government agencies, there were only about ten million pounds which were not earmarked to some agency, and arrangements have been made through regional offices to have seven or eight million pounds of that set aside for sale to hospitals.

FDO 79

Mr. Weldon who is directly responsible for the administration of Order 79 described the handling of that order which was made effective on February 10, 1943. The over-all order authorizes FDA to set up sales areas and dealers' quotas. On October 4 implementing local orders were issued marking out sales areas and providing for definite dealers' quotas. In each case so far those quotas have been 100 percent of June sales on fluid milk, 75 percent of June sales on cream, and 75 percent of June sales on fluid milk by-products, such as buttermilk, chocolate drink, skim milk and cottage cheese. Sales to the military services are exempt from quota. By November 1 those local implementing orders were in effect in 81 markets, practically all of them markets of 100,000 population and more, and practically every city of that size above a line running from Texas across the northern line of Tennessee and North Carolina are also under FDO 79. Since that time 15 or 20 other orders have been issued, making somewhat over a hundred orders in effect. The objective was to try to cover all of the 137 cities in the country that are classified by the census as metropolitan population districts. Those 137 cities together now have a population close to 70 million people, which is about 80 percent of the total of 87 million people who might be restricted in the use of milk. There has been some pressure to extend this order to cities of 25,000 or over, but since that would only encompass about three million people and the administrative problem would be doubled, it is not being done as yet. The 100 orders are being administered by 30 market agents, combining close to a million people under each in an effort to keep overhead cost of administering the program at a minimum.

The cost of administering the program is being borne by the industry through an assessment that runs as high as a cent and a half a hundred in some markets and will shortly be reduced to half a cent in quite a number of others. There is little complaint from the industry on this assessment, partly because it is so small and partly because milk dealers are making enough profits that they do not care. Within a pretty rigid framework of national policy the local areas are given a free hand to shape the order.

The order has not been extended to the South as yet because there are very few markets in the South which have had enough milk since October 1 to sell the amount of milk they were selling in June. It is planned to bring the South under FDO 79, however, probably during the month of December as quite a number of requests have been received from southern markets.

The primary reason for issuing FDO 79 was the limited milk supply in this country and the extreme difficulties encountered in having the supply increased. Some of the difficulties were due to price, some to feed supplies, and some to labor. In the face of the limited supply, milk sales were going up, with sales in June 4 to 5 percent above sales in May on a national basis and continuing to increase at the rate of about 1 percent a month or more.

The second major objective of FDO 79 was to try to develop a system which would hold fluid milk sales in check without having to resort to formal consumer rationing of fluid milk. It is feared that the rationing of fluid milk would increase the consumption further and would complicate the administrative and labor problems as well as the over-all complexities involved.

The third major objective of FDO 79 has been to try to stabilize or to prevent a further breakdown in the marketing channels and the methods of marketing fluid milk. Short supplies of fluid milk were causing health regulations to break down in some places. Because of transportation difficulties, milk dealers were trying to take only from the largest producers on the transportation routes going to manufacturing plants, milk was moved uneconomic distances, and there was quite a lot of price competition for the extra supplies among markets that were short. The smaller dealers in a great many markets were urging that the milk supply be taken over and allocated among the dealers. There was considerable hoarding of milk on the part of larger dealers and those who had facilities to do so. Schools and hospitals presented a problem, but market agents have been authorized to give an increase in quotas to schools on the basis of sales in May or in September, and hospitals have been given relief. In some places it has been necessary to exempt schools and hospitals from quotas. Shifts in population have caused difficulty, as well as defense plants which have installed cafeterias since June. However, in the latter case they were held to June quotas.

An amendment to the order liberalizes transfers of quotas from one dealer to another and from cream and by-products to milk. This provides that a handler can sell more milk by selling less by-products and cream, that a quota can change hands in cases where the wholesale contract habitually shifts between dealers, where both dealers agree to it, and where the buyer is not being adequately served by the handler who has the quota supposed to go to him. Rationing may be tried on a few markets on an experimental basis before many months. It is felt that the success of the program depends 40 percent on local administration and 60 percent on the cooperation of milk dealers and consumers.

Mr. Palmer said that a problem had arisen in New Jersey because in fixing the basis on June sales, there were two days in which there were delivery strikes in opposition to the War Labor Board's order for every-other-day delivery, and for that reason 1/15 of the daily sales would be jeopardized by the concerns that were uionized. The contemplated increase of 5 percent to everyone would create an unfair situation in competition because it would give to the other concern 105 percent and would penalize the concerns whose employees struck because they have only 97 percent of deliveries.

Mr. Weldon explained that an effort is being made to obtain the actual daily sales in June. He said, however, that some had found the sales for the 28 days were more than for the 31 days in May or July because the day following the strike their sales were greater.

Farm Equipment

The requirements of farm material and equipment are determined by War Food Administration and presented to the War Production Board where allotments of critical materials for the manufacture of this equipment are made, Mr. Prior said. FPO 14 rations some finished products, but applies only to milking machines and milk coolers in the dairy line.

Mr. Prior reviewed the orders on critical materials and the accomplishments achieved by each.

Mr. Fuchs inquired as to restrictions on covered milk pails, to which Mr. Prior replied that the reason difficulty had been experienced in obtaining milk pails was that the manufacturer had scheduled production over too many months; the type of solder used had also slowed up production. In 1940, he said, there were 1,476,537 milk pails manufactured; in 1941, 1,828,728; under the present program 1,800,000 are being manufactured, and it is hoped to increase that next year.

Prices

Mr. Jennings said that there exists a demoralized condition in the fluid milk situation throughout Iowa resulting from the inequitable price ratio between milk and various other products and the lack of ceilings on others. Milk producers have lost all interest in milk production because corn, hogs, and other products pay much better. When the local health department attempts to maintain sanitary quality, the farmer says if the milk isn't good enough, he will feed it to hogs and chickens or take it to the cheese factory. Because of the demand for fluid milk, distributors in many cases will take milk of any character and the health department is confronted with the dilemma of either shutting off the milk supply or accepting what has been described as "bacterial soup." There are only two alternatives, either a lowering of the ceilings of other products and wages or bringing the price of milk up to a favorable ratio.

Mr. Stitts reviewed the price situation and said that in December, 1942, Justice Burns had approved a series of prices and the Secretary had guaranteed that prices would not be lower than those prices until June 30, 1944. For dairy products there is a floor and a ceiling at exactly the same level. There has been only one change since then; the price of butter was rolled back to 41c at Chicago and a subsidy of 5c is being paid, so that the farmer's price is still 46c on the Chicago base for 92 score butter. It is true, Mr. Stitts said, that at the time these prices were fixed dairy prices were relatively low on an historic basis with hogs. In 1942 there was no surplus of butter, but there was a surplus of milk powder; there was plenty of cheese, and there were 26 million cases of evaporated milk bought by the Government in order to maintain the price in 1941. These prices figured out to net the farmer $2.60 and those were guaranteed prices for twelve months with no seasonal drop in prices. All through the summer of 1942 prices for manufactured milk were at least $1 to $1.10 above the year before, and there were no complaints on prices until the short period was reached because the prices this summer were good prices.

Dr. Parker said that in Jacksonville, Florida, all dairymen are just about 100 percent dissatisfied. Eleven have sold their herds in the past year, resulting in a loss of 2000 gallons daily; 50 percent are now trying to sell their herds. They all think the 4-cent feed subsidy should have been 5 cents. Ninety-five percent of the dairymen are heavily mortgaged and if the subsidy is discontinued and nothing is done to offset it, they will go bankrupt. The Production Credit Association and the banks have gone as far as they will; distributors have taken second mortgages to the point where they can't go any farther. In October 6000 gallons of milk were shipped into Jacksonville daily; in November close to 7000 gallons were shipped in. Due to Selective Service and to the large shipyards which have been opened in Jacksonville, it is impossible for the farmers to keep any help as they cannot compete with the wages being paid by the shipyards. The population in 1940 was 173,065; in 1943, it is estimated to be 225,000; in addition it is estimated that there are 75,000 in nearby military establishments. All of these come under the Jacksonville milk shed and have to be taken care of by Jacksonville milk. Regardless of what happens, unless there is some kind of a ceiling put on feed, nothing will do any good. The only thing that has made it possible for the distributors to exist is the large volume. Some farmers have gone into the black market and more will go unless some solution is found to the problem.

Mr. Burke said all feed prices have been frozen; the question of subsidies is in the hands of the Congress. Conditions in Florida, he said, have been thoroughly gone over and have not been found to be peculiar to themselves.

Mr. Burke also said that an order is being prepared to correct the situation mentioned by Mr. Tiedeman where cities in New York State in the same area had been selling milk at different ceilings.

Mr. Palmer said the grades referred to in MPR 329 were established by the industry in their advertising, and public opinion had been built up to believe there was superior milk under these labels. This has resulted in confusion in the minds of those charged with the administration of the order. He wondered whether some of the milk sold under these labels is not in violation of the order.

The reason for setting these orders up in the regional offices, Mr. Burke said, is so they can be made to fit local conditions. If they fail to do so, attention should be called to specific instances. It is the intention of the regional offices that orders fit into the local board of health regulations.

Milk Cans

Mr. Easton was asked concerning the restrictions on the manufacture of milk cans and said the type of milk can or type of cover is controlled by WPB under Order M-200. This order set up certain specifications for milk cans which could be manufactured, the type and the gauge of steel for the different parts, and specified that the "plug" type cover should be used. The only purpose of this order was to conserve materials and to utilize material available to the greatest extent.

It is estimated by WPB that the largest saving in the conservation order of milk cans is in the type of cover which has been recommended. On the basis of the amount of material a manufacturer would use for the manufacture of the 1,700,000 milk cans asked for by Farm Machinery and Supplies for the 1943–44 program, it is estimated that 178,000 additional milk cans could be produced from the material which would be required to make the umbrella cover. Labor was another factor considered, the umbrella cover requiring more labor to manufacture. Dr. Grim pointed out the undesirability of the "plug" type of cover from a sanitary standpoint in the East where most of the milk is shipped by cars. He suggested that the order limit the weight of the can but leave the type to the judgment of the manufacturer. The complaint was made that health officials were not consulted prior to issuance of the order. It was pointed out that the U. S. Public Health Service had a representative at a recent meeting with WPB (after the order was drafted) and it was his opinion that the victory can with the slightly overhanging lid did not offer any great chances of contamination. Various ways in which this cover contributes to the contamination of milk were cited by Dr. Grim.

Mr. Easton said that the committee might make recommendations, but that the matter had been discussed many times with WPB prior to the issuance of the order. However, he said, if no saving in the amount of metal is effected by the use of this cover, it would be desirable to have at least some of the umbrella type made..

A motion was made, seconded, and carried that a resolution be drafted to be submitted to WPB, asking for a modification of this order, and that a committee from this group be present when the matter is discussed.

Dr. Grim was appointed to act as a committee of one to draw up the resolution for presentation to the Container Section of WPB. (See appendix, Resolution A).

Army Milk Supplies

Captain Lindell explained that a central procurement agency has been established on a regional basis to procure milk for the Army. Supplies of milk were first shipped to areas in Florida where the supply was not sufficient for the camps and for local needs. Although this was a 72-hour trip, the milk arrived in perfect condition and was served from that car for five days. There are now about nine cars a day moving from various ponits in the East to the South.

Lack of inspection of milk and ice cream going to military hospitals in New York City and to camps was discussed, and Captain Lindell stated that every army camp in the country has a laboratory where they are supposed to check on the milk and there are technicians to make tests.

The practice of cafeterias of colleges taken over for military use serving raw milk or milk not under sanitary control was discussed in considerable detail. Major Babcock said the only way to get a veterinary officer at one of these colleges is to have a commanding officer request it. Various ways of bringing this about were considered. Major Babcock said the difficulty is that the Surgeon General's Office does not learn of bad situations until something has happened. It was recommended that such colleges be registered. Mr. Miller said there is no reason in the world why college milk can't be put under sanitary supervision of military authorities. He made a motion that the committee go on record in a resolution to those concerned, the President of the United States if necessary, that these college eating establishments be put under the sanitary supervision of military authorities. Mr. Fuchs suggested that the resolution be presented to the Surgeons General of the Army and Navy. Mr. Miller was appointed as a committee of one to draw up such a resolution. (See appendix, Resolution B).

Plant Equipment

Mr. Parsonson stated that it may be possible to liberalize Order 292 so that some prohibited items may be made. He also said that such items as coolers are not denied, but labor saving equipment, such as bottle washers, are more carefully considered because of the heavy demands.

Milk Rationing

Mr. Harper explained in detail the plan being considered if it becomes necessary to ration milk. The plan has not been approved but is being prepared so that if rationing becomes necessary it will serve as a basis for the drafting of an order.

Dr. Ross said that in Tulsa there are no facilities for condensing milk or making powder, and with sales cut 75 percent there is no outlet for solids. This will mean that thousands of gallons of milk will be dumped in the sewer. Mr. Stitts said the figures in FDO 79 can be changed if conditions make it necessary.

Committee Procedure

The position of this committee as an advisory committee to the different Government agencies was discussed at some length. Mr. Palmer suggested that it should act as advisor to all agencies issuing orders affecting milk sanitation. Mr. Fuchs said that because of the great number of agencies dealing with milk products, it would involve a tremendous expense to members if this committee were to meet with each agency whenever an order was contemplated. Therefore, it seemed advisable to continue working along present lines.

It was decided that just as much could be accomplished by reviewing the orders and sending considered opinions as to desirable changes to the agencies.

Mr. Parker moved that the committee confine itself to milk sanitation and that the chairman be asked to invite those who have milk problems worthy of the consideration of the committee to bring them to the committee for consideration at its annual meeting, as at present. Motion passed.

Resolution B

Whereas, the International Association of Milk Sanitarians' Advisory Committee to the Food Distribution Administration, assembled this seventh day of December, 1943, in Washington, D. C., to advise on matters relating to milk sanitation, has been informed that many of the colleges and universities throughout the country, where Army, Navy, and Air Corps and cadets and other personnel are stationed, are without adequate sanitary supervision of milk, food, and eating establishments for military personnel; and

Whereas, serious consequences have already resulted, including an outbreak of staphylococcus food poisoning traced to milk consumed at William and Mary College, Virginia, in June 1943, involving 150 cases and one death; therefore be it

Resolved, that the Committee respectfully urges the respective military organizations concerned to establish adequate sanitary control and to provide periodic sanitary inspection service, according to established public health standards, over facilities furnished personnel at colleges and universities, with special reference to eating and drinking establishments, milk, meat, and other perishable food products; and be it

Resolved Further, that copies of this resolution be transmitted to the Surgeons General of the United States Army and the United States Navy.

Resolution A

Whereas, the International Association of Milk Sanitarians' Advisory Committee to the Food Distribution Administration, assembled this seventh day of December, 1943, in Washington, D. C., to advise on matters relating to milk sanitation, is of the unanimous opinion that the sunken-cup type covers for milk cans favor contamination of milk, are difficult to clean necessitating employment of additional labor, inhibit satisfactory platform inspection, and occasionally result in serious and wasteful damage to can washing equipment and to covers of the sunken-cup type; and

Whereas, the provisions of Conservation Order M-200, issued October 1, 1942, restrict manufacturers of milk can covers to the manufacture of covers of the sunken-cup type, thereby preventing the user from obtaining can covers of the umbrella type, which have been demonstrated to be free of objections cited above; and

Whereas, cans with covers of the umbrella type might be manufactured without increasing appreciably the total weight of can and cover over the weight of cans and covers now manufactured under the provisions of Conservation Order M-200; therefore

Be It Resolved, that the International Association of Milk Sanitarians' Advisory Committee to Food Distribution direct these facts to the attention of the Container Division of the War Production Board, recent prior consideration notwithstanding, and request that restrictive provisions contained in Conservation Order M-200 be modified so as to permit the manufacture of milk can covers of the umbrella type for use where demanded by the health authorities; and

Be It Further Resolved, that the existing restrictions contained in Conservation Order M-200 limiting weight and gauge of metal for use in constructing milk cans be reconsidered, in view of the improved situation respecting steel plate which has occurred since October 1, 1942, in order that further economic waste of material and labor brought about through the necessity for constructing the light weight cans may be avoided.

New Members

ACTIVE

Beckett, R. C., State Sanitary Engineer, State Board of Health, Dover, Delaware.

McFetridge, Miss Clarissa, Supervisor, State Cooperative Laboratory, 605 S. Adams St., Green Bay, Wis.

Penton, Mr. Herbert, Chief Dairy Inspector, City Health Dept., Ogden, Utah.

Shapiro, Maurice A., District Milk Sanitarian, State Board of Health, P. O. Box 1228, Panama City, Fla.

Turnipseed, Dr. G. T., City Health Department, Columbus, Georgia.

ASSOCIATE

Aulik, Bernard, 113 S. Mills St., Madison, Wis.

Bradstreet, Robert L., Asst. Sanitary Inspector, Monroe County Department of Sanitation, 511 Vosburg Rd., Webster, N. Y.

Brandenburg, W. J., 1320 S. 24th St., Sheboygan, Wis.

Brinkman, Magnus, De Land Cheese Co., Sheboygan, Wis.

Burke, Chas. F., R. 1, Cambridge, Wis.

Carlson, Ed., Medford, Wis.

Cohen, Isaac, Director, Dairytest Service Laboratory, 57-11 Flushing Ave., Maspeth, L. I., N. Y.

Dow, Neal. Production Manager, Southern Dairies, Inc., Washington, D. C.

Farrar, Robert R., 2210-15th St., Monroe, Wis.

Ford, M. H., Whitehall, Wis.

Frazier, Wm. C., College of Agriculture, Madison, Wis.

Goldschmidt, Stanley J., Court House, Janesville, Wis.

Graves, Donald T., Wilson Cabinet Co., 189 Sycamore St., East Aurora, N. Y.

Greze, John P., Oakite Research Laboratory, Oakite Products, Inc.

Hall, Joe, District Sanitarian, State Health Department, Craighead County Health Department, Jonesboro, Ark.

Hansen, Fred, Milk Inspector, City Health Dept., Sioux Falls, S. D.

Herrera, R. Alfonso, Laboratory Technician, Sheffield Farms Co., 225 E. 168th St., Bronx 56, New York.

Hird, E. W., 1709 Hoyt St., Madison, Wis.

Hock, E., 3326 W. Capitol Drive, Milwaukee, Wis.

Hoesly, J. H., 160 E. 5th St., Neillsville, Wis.

Johnson, Lister O., Milk Sanitarian, County Health Unit, 1302 Arnold St., Aberdeen, Wash.

Kavaney, Vincent, Sanitarian, State Health Dept., Public Health Laboratories, Box 1020, Bismarck, N. D.

Kenyon, F. Leonard, Milk, Meat and Food Inspector, City Health Department, 40 Thorpe St., Binghamton, N. Y.

Kline, E. H., Sanitation Supervisor, Calhoun County Health Dept., Calhoun City, Miss.

Luchterhand, C. K., 222 E. Walnut St., Dodgeville, Wis.

Macdonald, T. A., Vice-President, International Milk Co., Inc., 445 Hillside Ave., Hillside, N. J.

Maunz, Walter E., Department of Health, 432 Crescent Ave., Buffalo, N. Y.

Michels, E. P., Greenwood, Wis.

Mickle, P. H., 1326 Mound St., Madison, Wis.

Mohr, Charles A., Bowman Farm Dairy, Madison, Wis.

Netto, Dr. Fidelis Alves, Milk Sanitarian, 873, Turiassu, Sao Paulo, Brazil.

Peterson, Morris, Peterson Laboratories, Califon, N. J.

Petran, F. W., 947 E. Pacific St., Appleton, Wis.

Reeves, Eugene, Sanitarian, State Health Dept., Muskogee, Okla.

Rowe, L. A.. Dairymen's League, 1234 Granite St,. Rochester 4, N. Y.

Russell, James. Kitsap Dairymen's Assn., P. O. Box 314. Bremerton, Washington.

Schreiber, Herman J., 1610 Erie Ave., Sheboygan, Wis.

Spicer, D. W., Kraft Cheese Co., 5816 Haverford Ave., Indianapolis, Ind.

Stezker, Carl, Sullivan County Co-op. Dairy Assn., Jeffersonville, N. Y.

Sticha, A. J., 1010 So. Park St., Madison, Wis.

Tait, H. E., 114 N. Orchard St., Madison, Wis.

Taylor, John J., 758 N. Adams St., Lancaster, Wis.

Tooby, George, Box 54, Prentice, Wis.

Townsend, H. H., Sanitation Supervisor, Lee County Health Dept., Tupelo, Miss.

Van Nortwick, Ivan, 305 Delaware St., Hiawatha, Kansas.

Wohnsiedler, 1st Lt. Herbert G., Kennedy General Hospital, Veterinary Corps., Memphis, Tenn.

Zehren, Francis J., 1121 St. Clair Ave., Sheboygan, Wis.

CHANGES IN ADDRESSES

Now:

Bernstein, Dr., Board of Health, Hilo, Hawaii.
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"Dr. Jones" Says—*

A painting I've got in the other room—one of these winter scenes with ice and snow all over everything—this time of year I prefer looking at pictures of Florida. And I presume, talking now about refrigeration—a lot of folks'd figure that wasn't particularly timely. But these outbreaks of food poisoning—gastroenteritis and so on—while it looks as if there were more of 'em during the warm months, we have 'em right through the year. And it appears a large part of 'em are due to not keeping food cold enough; certain kinds of foods that bacteria grow well in.

This staphylococcus bug—we've talked about that before—that's one of the trouble-makers. In the first place any of us may have 'em on our hands and in our throats and noses. It's the principal cause of boils and other skin infections and when our nose is running with a cold we're liable to have 'em all over the place. So that's one thing: it's awful hard to avoid getting 'em into food—and onto it. And the other thing: there's a lot of different kinds of foods (meats, cooked and otherwise; this so-called "cream" filling stuff, mayonnaise and what not) if they're in it and it's kept at ordinary room temperature or higher for a matter of five hours or more they'll give out this poison they call enterotoxin—certain strains of 'em will. And when you swallow that it's better not to get far from home because you're liable to be sick.

You take milk from a cow that its udder is infected with these staphylococcus germs, of course pasteurization'll kill 'em but if it hasn't been heated and you let it sit at room temperature long enough you'll get this toxin formation. The same way with these other foods: if they're well cooked it kills the bugs. But when this toxin has once been given off, not even boiling half an hour will destroy that.

Just how cool you have to keep these foods: there's been various tests made. At a temperature of 44° no toxin was formed. And of course a refrigerator should be down to that. At 48° it was three days before it showed up. But the temperature on a table in the ordinary kitchen—that's pretty near ideal for this toxin industry.

This old idea we used to have about "ptomaine" poisoning—they say now "There ain't no such animal." And ordinary putrefaction, just from keeping something too long, they say that seldom causes food poisoning. It's this home-grown toxin we ought to look out for principally. Why, yes—look at limburger cheese: if that kind of putrefaction was dangerous I'd have been dead long ago.

Paul B. Brooks, M.D.

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* *Health News*, New York State Department of Health, Albany, N. Y., January 3, 1944.