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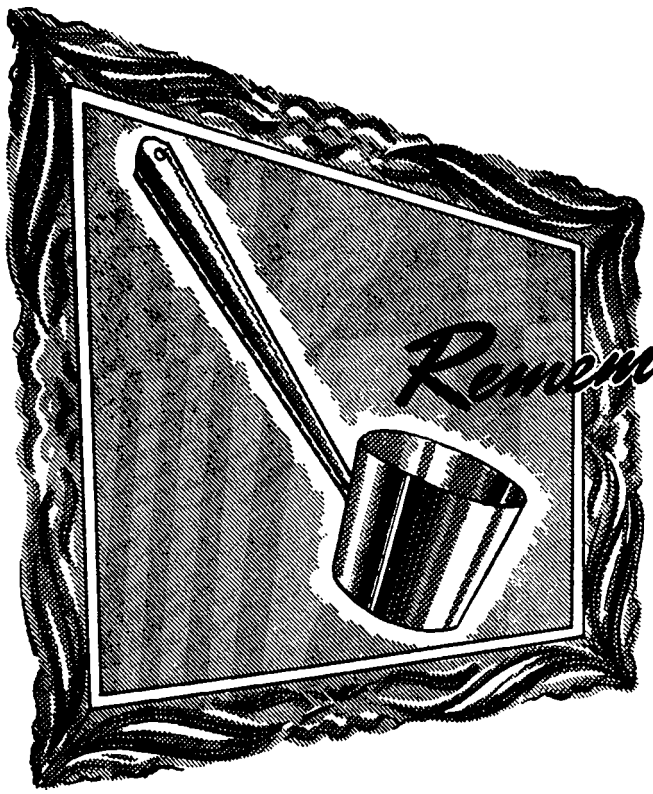

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1. Tanner, F. W., *Journal of Milk Technology*, January, 1939.

THE CANCO PAPER MILK CONTAINER

JOURNAL OF MILK TECHNOLOGY

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JOURNAL of MILK TECHNOLOGY

Volume 4 September-October, 1941 Number 5

As this issue of The Journal goes to press we learn of the death on September 4, 1941, of

Leslie C. Frank

President, International Association of Milk Sanitarians

The Association extends deep sympathy to his bereaved family and realizes the great loss to this organization.

Editorials

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

New Emphasis on Dairy Education

Food engineering is the new profession whose sun is peeping over the horizon. Developments in food industries—including dairying—are directing attention to involved technology associated with production and handling of foods.

In the dairy industry, the legal requirements and health department regulations have long educated the industry to the need of laboratory control. Almost every plant has some degree of such service, either intra- or extra-mural. The application of mechanical engineering to milk pasteurizing plants has shown that more advanced training is necessary for personnel than that accorded by education as a plant bacteriologist or chemist. Even formal courses in dairying given in most colleges specializing in dairy industry are failing to meet the need. Common experience of milk sanitarians is that many a college creamery or dairy department cannot pass sanitary inspection. Students are turned out as fairly acceptable workers in dairy plants when they unlearn some of the things they were taught by precept and example. They have been signally failing to contribute much to dairy development.

There may be, and probably are, several reasons for this shortcoming. One of the most important is failure to recognize that the food industry is outgrowing its swaddling clothes, so to speak, and is taking its place among the great industries. This growth involves more than manipulating finances, setting up a selling organization, and complying with health regulations. It necessitates technological development that places the dairy industry in the class of big business. It emphasizes the need for a personnel who are trained to think in terms of operating economies, plant efficiency, product quality, and new markets. Such a staff would not be tied down to adherence to the sacred past. It would be progressive, adaptive, inventive.

The shortcomings of our present system are seen in the type of developments in the industry. Most, if not all, of the innovations are brought into it from sources outside of itself. As pointed out before, the dairy industry seems to be set in the mold of the past, and does not seem to possess the creativeness and developmental

vision to enable it to keep abreast of its sister branches of the food industry. If anyone wants proof, let him look at the kind of inventiveness in the dairy industry as compared with that in other branches of the food industry. Let him look at the types of laboratory organization and development, and note the relative emphasis placed on technology versus appearance and show. For example, the improvement in quality of milk consists in splitting hairs over the sanitary significance of a few hundred bacteria per milliliter, fancying up the bottle, providing a lip-cover, and fortifying the milk with a vitamin—at a profit of 20 to 1, oh yes, and building glittering plants that look like hospitals—or morgues. In these days of national emergency when conservation of quality is as important as quantity of production, the dairy industry lags behind the other branches.

Suppose the chemical industry were as backward in its development as the dairy industry. Where would we be now? No short-cut hocus-pocus was responsible for its achievements. The chemical industry plowed large earnings back into research and development. It engaged men of broad training. It geared business to research, and did not treat the latter as a necessary evil, a dead cost, a financial drag. The highest positions in the companies were open to men from the research department as well as to the salesmen and accountants and capitalists.

It is noteworthy that these great developments in the chemical industry came a generation following the inauguration of courses of chemical engineering in the great universities. Chemical engineering is a department of engineering that deals with the basic principles involved in the properties of chemicals. Its work is predicated on such fundamental lines of training as advanced mathematics, chemistry, thermodynamics, mechanics, and statics, first in the abstract and then applied to the properties of materials. Such knowledge is fundamental to the developments in this epoch of the reign of the chemical engineer. He has won his spurs, so to speak, alongside of the civil engineer, the mechanical engineer, the mining engineer. Now the aeronautical engineer is developing.

The operations and processes that are concerned in chemical engineering are so similar to those used in the food industries that authorities like Burton and his associates in *Food Industries* place food engineering as a special branch of this broader profession. Some progressive food companies now recruit their ranks with graduate chemical engineers. Therefore, the food industries are happily situated in that they can see at once what the food engineer ought to do for them whereas the chemical industries waited long to see what the chemical engineer could do for them. Engineering got into its stride in the chemical industries, and now it is only a step over to the kindred food industries.

Food engineering ought to do for the food industry what chemical engineering did for the chemical industry. Food engineering should feed men into food manufacturing with knowledge of how to bring all the wealth of approved engineering practice to apply to food production. Such men, when they arrive at positions of responsibility, would integrate research with operations because they would have been grounded in appreciation of the inter-dependence of the two. They would be sympathetic with the aims and technique of research, and at the same time appreciative of its limitations. A food engineer would have perspective over the whole field of industrial operations, and would be capable of, as well as interested in, applying to food operations the best of modern engineering practice.

It is men that make industry. No person can reap a crop that he does not sow, nor can he get out of a tank that which he did not prepare for. So in a business of the type of the food industry. It can rise no higher than the quality of its personnel. When they have vision, when they know what they are doing and why, and when they know the developments in allied fields, and last but not least, when they

have the encouragement and understanding of the management, they will carry the food industry to new industrial heights.

What is possible for the food industry is possible for any of its parts. If the dairy industry would wake up and produce dairy or food engineers, if it would change its dairy courses from vocational training into study of the fundamental sciences on which the dairy industry rests, if it would demand a quality of personnel that are the professional equivalents of the technical staffs of the chemical industries, and finally, if the dairy industry paid for the quality of service it needs, then the dairy industry would have reached adolescence among the industrial giants with which it is kindred.

J. H. S.

Another Look at Milkborne Outbreaks

A study of Public Health Service reports of milkborne outbreaks for the five-year period 1935-1939, the computations from which are only guaranteed to be approximately correct, shows 175 outbreaks as having been reported by 42 states. Six states reported none. Over a third of these outbreaks were reported by 2 states, New York and California. Typhoid fever predominated, with 62 outbreaks or 35 percent of the total. Hemolytic streptococcus infection (scarlet fever and septic sore throat) occurred in 39 percent, and acute digestive disorder, reported under various names in 20 percent. Of the typhoid outbreaks, in only one was there 50 cases or more, while in 43 percent of the outbreaks of streptococcus infection there were from 50 to several hundred cases.

The figures for septic sore throat were compared with those covering a twenty-five year period ending with 1932 ("Missed" Epidemics of Septic Sore Throat, A. P. H. A. Journal, November 1933). The 30 outbreaks reported in the recent five-year period were nearly half the number for the earlier 25 years. Two states that reported no outbreaks as occurring during the earlier period, reported two or more each for the recent period. Massachusetts, which headed the list in the early period with 27 outbreaks, reported none for the later. New York was credited with 18 outbreaks in the earlier period, 12 in the later.

From this little study two long-standing needs again become apparent: one for a definition of an outbreak, the other for uniformity of nomenclature. "Outbreaks" of one case each, reported by several states, were disregarded in this study. It is respectfully contended that they should not be included in the Public Health Service reports. Until something better is proposed it is suggested that two or more cases distributed in more than one household be considered as constituting an outbreak.

Acute digestive disorders were variously reported as food poisoning, milk poisoning, gastroenteritis, and diarrhea. The states in which outbreaks of this condition are recognized should be able to get together. Since erysipelas and so-called scarlet fever and septic sore throat occur in the same epidemics, why not report them as hemolytic streptococcus infection?

Two factors, both operating principally on the farm, are of major importance in the causation of these outbreaks: the undiscovered typhoid carrier and, with streptococcus infection, the combination of the milker with infected throat or wound and the cow whose udder he infects. This brings us back to the undeniable fact that no degree of inspection and supervision, practicable for general application will control these factors. This leaves pasteurization as the only dependable safeguard.

The probability that numerous outbreaks are occurring and running their courses without discovery or adequate investigation continues evident. But there are encouraging signs of improvement.

P. B. B.

Ice Cream Epidemics — A Correction

In the May-June issue of this Journal, we published editorially a tabulation of outbreaks of disease attributed to the consumption of infected dairy products as published in the annual compilation by the U. S. Public Health Service. Ice cream was listed as being involved in eight outbreaks.

The International Association of Ice Cream Manufacturers informs us that upon investigation in the Washington office of the Service, only two of the eight outbreaks were traced to ice cream with any definiteness. One vector was a Mexican push-cart vendor, and the other was a one gallon mix containing milk, eggs, sugar, and a gelatin ice cream mixture that was not refrigerated before freezing. In the other six cases where ice cream was suspected, either alone or with some other dairy product, the information was too meager to indicate any other than hasty and incomplete investigation. Therefore, ice cream should be charged with only two.

The Public Health Service compiles these lists on the basis of reports as submitted. They cannot investigate any of them. In the future, any publicity we give them will distinguish between clearly traced outbreaks versus suspicious ones.

We commend the alertness of the above Association in so promptly bringing this situation to our attention. We are reminded of the effectiveness of the action of Mr. Frank Gorrell, Secretary of the National Canners' Association, in so vigorously inquiring into the why-and-wherefore of newspaper reports of illness as caused by ptomaines in canned food that now this misrepresentation is rarely seen. Bob Hibben, your friendly letter was good medicine, and we thank you for it.

J. H. S.

Amendment to Specifications for Single-Service Containers and Caps, Item 10p, Public Health Bulletin No. 220

(Adopted by Public Health Service Sanitation Advisory Board July, 1941)

The following changes have been adopted under Satisfactory Compliance of item 10p, page 91, of the printed 1939 edition of the Milk Ordinance and Code recommended by the U. S. Public Health Service:

In (5), last sentence, insert "and tests" after "inspections."

In (b), insert after the first sentence: "The disintegration test technic described in the latest (eighth) edition of Standard Methods for the Examination of Dairy Products should be followed. Samples of paperboard or cut blanks for this test should be taken before paraffining, at the milk plant, if possible, otherwise at the fabricating plant."

Change paragraph (f) to read as follows: "(f) All single-service containers and container caps and covers shall prior to use be so processed as to produce containers having a residual bacterial plate count of not more than one per cc. of capacity and caps or covers with not more than 10 colonies each, as determined by the rinse technic described in the latest Standard Methods."

Mastitis and the Plate Count of Milk

I. A Quantitative Study of the Growth of *Streptococcus agalactiae* in Various Plating Media.

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Interest in the relation of bovine mastitis to the total bacterial content of herd milk has been stimulated by the rapid increase in the number of herds which have beeen subjected to laboratory tests for evidence of mastitis. In 100 herds which have been tested periodically, *Streptococcus agalactiae* has been found to be the principal cause of mastitis. The question is often asked as to whether animals infected with this organism cause high bacterial counts in herd milk. Up to the present time a satisfactory answer to this question has not been forthcoming. Until recently there were no reliable practical methods of differentiating *Str. agalactiae* from other milk streptococci.

The discovery that some streptococci produce zones of hemolysis on blood agar has been a great aid in the detection of streptococci which are more or less pathogenic for man and animals. However, such hemolytic properties do not permit actual differentiation between *Str. agalactiae* and other hemolytic streptococci which may occur in milk.

Whenever bacteriologists have become interested in any particular organism they have often been able to prepare a selective medium to facilitate recognition of the organism. This has been accomplished for *Str. agalactiae*. By taking advantage of the fact that streptococci are more resistant to the bacteriostatic action of crystal violet than are staphylococci, and that *Str. agalactiae* fails to split aesculin while the majority of other milk streptococci have this property, Edwards (1) devised a selective medium that yields satisfactory results in the routine cultural diagnosis of *Str. agalactiae* mastitis. The composition of the medium recommended by Edwards is as follows:

Meat extract (Lemco)	
agar pH 7.4	1,000 ml.
Crystal violet (B. D. H.)	
0.1 percent	2 ml.
Defibrinated ox-blood	50 ml.
Aesculin	1 gm.

In this medium staphylococci and most Gram-positive organisms are inhibited by the crystal violet, while streptococci are usually dye-resistant. Saprophytic streptococci and *Streptococcus uberis* are distinguished from others by their dark appearance and browning of the colonies on the medium, due to splitting of the aesculin. *Str. agalactiae* colonies can be recognized as a rule by the absence of brown pigmentation and the presence of a narrow zone of hemolysis. Nonhemolytic types of this organism appear as uniformly small colonies which produce no visible change in the surrounding medium.

Plastridge, Anderson, and Seremet (2) used Edwards' medium in the examination of incubated milk samples which were shown by direct microscopic examination to contain streptococci. Identification of isolations obtained from Edwards' medium showed that 95.7 percent of gray-blue hemolytic colonies and 94.9 percent of gray-blue nonhemolytic colonies were *Str. agalactiae,* while only 4.1 percent of the colonies classed as brown were identified as *Str. agalactiae.* These investigators concluded that Edwards' medium is about 95 percent effective in separating *Str. agalactiae* from other types of streptococci found in freshly drawn milk.

Slanetz and Naghski (3) found that 98.7 percent of 573 cultures of weakly hemolytic streptococci identified as *Str. agalactiae* produced gray-blue colonies on Edwards' medium.

Previous to 1939 there had been much agitation for a standard plating medium for the bacteriological analysis of milk which would support more of the bacteria present in milk than the standard nutrient agar in use at that time. The work of Bowers and Hucker (4) in the development of their tryptone-glucose-skim-milk agar finally precipitated some action in this respect by the American Public Health Association. In 1939 this body recommended the use of a modification of the Bowers and Hucker medium for making plate counts of milk. The changes from the standard medium, particularly the addition of glucose and skim milk, and the replacement of plain peptone with tryptone, should make this medium more nearly ideal for the growth of *Str. agalactiae*. Bowers and Hucker (4) reported that the new standard medium had a decided effect upon the count secured from milk containing a large number of mastitis streptococci.

Foltz and Bushnell (5) made comparative determinations of the growth in the new standard medium and the old standard medium of a series of pathogenic and non-pathogenic organisms which may be found in milk. They found that all of 53 Lancefield group B cultures (*Str. agalactiae*) developed easily recognizable colonies on the new medium. In the old medium five cultures developed colonies which could be detected with the aid of a Quebec colony counter, and 30 cultures gave colonies that required greater magnification than that afforded by this counter. Eighteen cultures did not develop visible colonies in the old standard medium. The pure cultures employed in this study were isolated from 20 cases of chronic mastitis in one herd, and had been carried on artificial medium from one to nine months.

The principal object of the present study was to determine whether any difference existed between the number of *Str. agalactiae* colonies supported by Edwards', plain ox blood, and the new and old standard media when inoculated in parallel. Edwards' medium was used for the purpose of determining whether this medium could be used in a future experiment, to estimate the contribution of *Str. agalactiae* to the total plate count of raw milk samples. The new and old standard media were compared for the purpose of determining whether adoption of the new medium might be expected to affect the plate count of milk from *Str. agalactiae* infected herds.

METHODS EMPLOYED

Source of cultures. Ten ml. samples of milk were drawn aseptically from 20 quarters known to be infected with *Str. agalactiae*. The samples were taken from 20 different animals located in 14 different herds. Upon reaching the laboratory the milk samples were incubated from 16 to 18 hours at 35-37° C. A four mm. loopful of each incubated sample was streaked over the surface of a blood agar plate. After 24 hours incubation, typical *Str. agalactiae* colonies were picked from each streak plate and transferred to tubes of litmus milk. The inoculated tubes were then incubated at 35-37° C. for a period sufficiently long to permit considerable growth of the organisms, but not long enough for coagulation to occur. The incubation period varied from 18 to 24 hours.

Media employed. The new and old standard media used in this experiment were obtained in the dehydrated form from the Difco Laboratories. One percent of good quality skim milk was added to the new standard medium just prior to sterilization. Extreme care to keep any perceptible precipitate at a minimum was exercised in the preparation of this medium. Edwards' aesculin crystal violet ox blood agar was prepared according to the formula and directions given by Plastridge, Anderson, and Seremet (2). The five percent ox blood agar contained the same basic ingredients as the Edwards' medium (the aesculin and crystal violet being omitted).

Inoculation of test media. Dilutions of 1 : 10,000, 1 : 100,000 and 1 : 1,000,000 of the litmus milk cultures were prepared. One ml. of each dilution was plated in triplicate in the new standard medium, the old standard medium, Edwards' medium, and five percent ox-blood agar. The plates were incubated at 35°-37° C. for 48 hours. Counts were made on the dilution plates which contained not fewer than 30 and not more than 300 colonies.

Determination of numbers of colonies. All plates were counted over a home-made counting box in which an optimum of transmitted and reflected light was directed on the colonies. The Edwards and the plain ox-blood agar plates were counted against a white background, and the standard media plates against a black background. All plates were first counted with the unaided eye and each colony indicated with an ink mark on the bottom of the plates. The plates were again eaxmined with a four inch (2.5x) magnifying glass to check the first count.

Determination of size of colonies. After the plates had been counted, ten well-isolated colonies which were located beneath the surface of each medium in the dilution plates that were counted were measured for length and width. The measurements were made by observing the colonies under a microscope equipped with a 10x objective and a 10x ocular containing a calibrated micrometer.

Identification of organisms. A four mm. loopful of the litmus milk cultures used in preparing the dilution plates was streaked on blood agar to check the purity of the first isolations. Transplants were made from colonies in beef infusion ox blood broth appearing on the streaked plates. The reisolated organisms were then identified by biochemical and serological tests.

The following biochemical characteristics were determined: reaction in litmus milk, ability to reduce methylene blue milk containing one part of dye to 15,000 parts of skim milk, and the ability to produce acid from lactose, mannitol, inulin, raffinose, and salicin. Organisms which produced acid and coagulation, with partial dye reduction, in litmus milk, but failed to reduce methylene blue milk and to produce acid from mannitol, inulin, and raffinose, were considered partially identified as *Str. agalactiae.*

Final identity of the cultures was based upon the rapid slide agglutination test as employed by Plastridge, Banfield, and Williams (6). Antigens were prepared by culturing the organisms in buffered beef infusion dextrose broth medium. Cultures which yielded antigens that were agglutinated by a pooled antiserum which contained agglutinins against the 10 serological types of *Str. agalactiae* described by Stableforth (7) and the G 42 strain described by Stewart (8), were considered to be *Str. agalactiae.* As a check, these antigens were also tested with an antiserum that contained agglutinins against *Str. dysgalactiae,* which Plastridge, Banfield, and Williams (6) reported as being serologically identical with Lancefield's group C, and against a pooled antiserum containing agglutinins against the 11 serological types of *Str. uberis* described by Plastridge and Williams (9).

RESULTS

The average numbers of colonies that developed in the four media, following parallel inoculation with 20 pure cultures of *Str. agalactiae,* are presented in table 1. The counts are expressed in millions per ml. of culture.

The biochemical and serological properties of cultures regarded as typical strains of *Str. agalactiae* are given in table 2.

Numbers of colonies on the different media. All of the 20 cultures grew well on five percent ox blood agar and on Edwards' medium. One culture failed to yield visible colonies on the old standard medium, and one revealed no visible growth on the new standard medium.

In comparing the mean counts for the four media by assuming a value of *one* for the average count on ox blood agar, the mean ratios seem to indicate that there was very little difference between ox blood agar and Edwards' medium in

TABLE 1.

Numbers of Colonies Resulting from Plating of Pure Cultures of Str. agalactiae

Culture number	Bacterial Count per ml. in Millions			
	Blood medium	Edwards' medium	New st'd medium	Old st'd medium
1	304.0	296.0	155.6	180.6
2	367.0	345.0	282.5	315.6
3	1,023.3	893.3	390.0	820.0
4	806.6	803.3	840.0	803.3
5	953.3	1,043.3	996.6	1,153.3
6	1,486.6	1,353.3	1,163.3	600.0
7	746.6	760.0	443.3	570.0
8	510.0	600.0	496.6	523.3
9	79.3	81.0	77.3	88.6
10	120.6	110.3	63.3	114.0
11	76.3	84.3	48.6	69.3
12	184.0	185.3	186.6	193.0
13	235.3	239.3	216.6	260.0
14	147.6	140.6	128.3	139.3
15	120.3	139.3	82.6	120.3
16	60.5	104.6	84.5	23.5
17	177.6	128.6	40.0	no growth
18	35.0	36.3	30.0	34.3
19	420.0	590.0	no growth	423.3
20	543.3	563.3	520.0	533.3
Average	419.9	424.8	312.2	348.2
Mean ratio	1 : 1	1 : 1.012	1 : 0.744	1 : 0.829

TABLE 2.

Biochemical and Serological Identity of Cultures Used as Inoculum in Plating Experiment

Culture number	Biochemical reactions							Serological group*
	L.M.	M.B.	L	M	I	R	S	
1	ACpR	0	A	0	0	0	A	B
2	ACpR	0	A	0	0	0	0	B
3	ACpR	0	A	0	0	0	A	B
4	ACpR	0	A	0	0	0	A	B
5	ACpR	0	A	0	0	0	A	B
6	ACpR	0	A	0	0	0	A	B
7	ACpR	0	A	0	0	0	A	B
8	ACpR	0	A	0	0	0	A	B
9	ACpR	0	A	0	0	0	0	B
10	ACpR	0	A	0	0	0	A	B
11	ACpR	0	A	0	0	0	0	B
12	ACpR	0	A	0	0	0	A	B
13	ACpR	0	A	0	0	0	A	B
14	ACpR	0	A	0	0	0	A	B
15	ACpR	0	A	0	0	0	A	B
16	ACpR	0	A	0	0	0	A	B
17	ACpR	0	A	0	0	0	A	B
18	ACpR	0	A	0	0	0	A	B
19	ACpR	0	A	0	0	0	a	B
20	ACpR	0	A	0	0	0	A	B

Abbreviations: L.M.=litmus milk; M.B.=methylene blue milk; L=lactose; M=manitol; I= inulin; R= raffinose; S=salicin; ACpR=acid, coagulation, and partial reduction; A=acid production; a=weak acid production.

* After Lancefield.

their ability to support the growth of *Str. agalactiae*. The old standard medium appeared to be slightly better than the new standard medium in respect to numbers of *Str. agalactiae* colonies produced.

Results obtained by this method of analyzing the data have but very limited value, since there is no indication as to whether the ratios would remain the same if an indefinite number of cultures were plated in the same manner. An analysis of variance was made in order to determine whether there was any significant difference between the numbers of colonies supported by the different media.

To obtain a maximum amount of information on the variations between media from an analysis of variance, the abridged counts in table 1 were converted into their logarithms. This operation decreases the variation between cultures and tends to reduce the experimental error. The characteristic of each logarithm was reduced by unity to simplify the calculations.

Since no growth was observed in two instances in this experiment, it would be impossible to make an accurate analysis of variance without supplying theoretical values in these two cases. By employing the Yates missing value technique (10) it was possible to supply these values.

Table 3 contains the log transformations of the data in table 1 with the missing items supplied. The analysis of variance was computed according to the machine method as outlined by Snedecor (10), and the results are tabulated in table 4.

After removing the variation which may be assigned to differences between cultures from the total or overall variations, the total variation between media and its error term were isolated. The variation between media was then broken down into the variation between blood agar and Edwards' medium, the new standard and old standard media, and the effect of added blood.

After testing these variations for significance by computing the variance ratio (F value), it was found that *under the conditions of the present experiment there was no significant difference between the number of Str. agalactiae colonies supported by blood agar and Edwards' medium. No significant difference existed between the number of colonies supported by the new and old standard media. However, there was a very significant difference between the number of colonies that developed in the media containing blood as compared to the number that developed in the media containing no blood.* It was

TABLE 3.

Log Transformation of Data in Table 1 with Missing Values Supplied

Culture number	Logarithm of ($\frac{\text{Count per ml.}^*}{10}$) Blood medium	Edwards' medium	New St'd medium	Old St'd medium
1	1.483	1.471	1.192	1.257
2	1.565	1.538	1.451	1.499
3	2.010	1.951	1.591	1.914
4	1.907	1.905	1.924	1.905
5	1.979	2.018	1.999	2.062
6	2.172	2.131	2.066	1.778
7	1.873	1.881	1.647	1.756
8	1.708	1.771	1.696	1.719
9	0.899	0.908	0.888	0.947
10	1.081	1.043	0.801	1.057
11	0.883	0.926	0.687	0.841
12	1.265	1.268	1.271	1.286
13	1.372	1.379	1.336	1.415
14	1.169	1.148	1.108	1.144
15	1.080	1.144	0.917	1.080
16	0.782	1.020	0.927	0.371
17	1.249	1.109	0.602	(0.948)
18	0.544	0.560	0.477	0.535
19	1.623	1.771	(1.568)	1.627
20	1.735	1.751	1.716	1.727

* In millions.

TABLE 4.

Analysis of Variance of the Number of Colonies which Developed in the Various Media

Source of variation	Degrees of freedom	Sum of squares	Mean square	Variance ratio (F)
Between cultures	19	15.775134	.830270	67.093*
Blood vs. Edwards'	1	.002576	.002576	0.208
New vs. old st'd	1	.025200	.025200	2.036
With vs. without blood	1	.236205	.236205	19.087**
Total between media	3	.263981	.087994	7.110
Error	55	.680633	.012375	1.000
Total		16,719748		
Correction		150.730697		
Error of blood factor	18	.262121	.014562	
Error of Edwards' vs. new st'd	18	.181141	.010063	

Mean effect of blood vs. without blood as log of ratio=0.10867 $\pm$ 0.0382

Mean effect of Edwards' vs. new st'd as log of ratio=0.13858 $\pm$ 0.0325

Mean ratio of blood vs. without blood=1.284 $\times/+$ 1.092 : 1

Mean Ratio of Edwards' vs. new st'd=1.376 $\times/+$ 1.078 : 1

* Surpasses the 1 percent point, 2.23, for 19 and 55 degrees of freedom.

** Surpasses the 1 percent point, 7.12, for 1 and 55 degrees of freedom.

TABLE 5.
Average Exposed Areas of Str. agalactiae Colonies

Culture number	Area of Colonies in Square mm.			
	Blood medium	Edwards' medium	New st'd medium	Old st'd medium
1	.672	.458	.358	.113
2	.587	.367	.349	.072
3	.405	.355	.339	.088
4	.597	.455	.320	.122
5	.263	.279	.490	.028
6	.405	.333	.314	.053
7	.402	.267	.487	.135
8	.408	.333	.311	.088
9	.625	.575	.270	.141
10	.703	.559	.471	.097
11	.612	.499	.512	.289
12	.619	.477	.389	.047
13	.386	.345	.371	.166
14	.301	.204	.210	.041
15	.383	.336	.349	.075
16	.499	.393	.452	.257
17	.449	.239	.628	no growth
18	.581	.392	.964	.044
19	.176	.160	no growth	.053
20	.418	.311	.264	.091
Average	.475	.366	.392	.100
Mean ratio	1 : 1	1 : 0.772	1 : 0.827	1 : 0.211

found that the media containing blood supported more colonies than the media without blood, in the ratio of 1.284 $\times \div$ 1.092 : 1. The blood media, therefore, supported 28.4 percent more colonies than the media which did not contain blood. Where growth occurred on both Edwards' and the new standard media, it was found that the Edwards' medium supported more colonies than did the new standard medium in the ratio of 1.376 $\times \div$ 1.078 : 1. Edwards' medium was, therefore, 37.6 percent more efficient in supporting the growth of *Str. agalactiae* than the new standard medium.

Size of the colonies. A *Str. agalactiae* colony located just below the surface of a solid medium presents an outline which is elliptical in shape. The product of the mean length and width measurements of the colonies of each culture which grew in the four media multiplied by 3.14 is taken to represent the mean exposed areas. These areas are presented in table 5. Assuming a value of *one* for the mean exposed areas of the colonies in plain blood agar, the mean exposed area of the colonies in Edwards' medium was somewhat smaller. As compared to the mean area of the colonies on the plain blood agar, the mean area of those in the old standard medium was very much smaller than the mean area of those in the new standard medium.

An analysis of variance again seemed to be in order. To simplify the computations the areas in table 5 were multiplied by 100. The log transformation was again necessary on the basis of the previous explanation. The two missing values were determined and an analysis of variance was made on the data in table 6.

In testing the variance ratios in table 7 for significance, it was found that there was a very significant difference between the areas of the colonies which developed in the new standard medium and those in the old standard medium. The logarithmic mean of the exposed areas of the colonies grown in the new standard medium was 420.3 percent larger than the mean of the exposed areas of the colonies grown in the old standard medium. A very significant difference was found to exist between the exposed areas of the colonies grown in the two

TABLE 6.

Log Transformation of Data in Table 5 with Missing Values Supplied

Culture number	Logarithm of (100 x area) Blood medium	Edwards' medium	New St'd medium	Old St'd medium
1	1.827	1.661	1.554	1.053
2	1.769	1.565	1.543	0.857
3	1.607	1.538	1.530	0.944
4	1.776	1.658	1.505	1.086
5	1.420	1.446	1.690	0.447
6	1.607	1.522	1.497	0.724
7	1.604	1.427	1.688	1.130
8	1.611	1.522	1.493	0.944
9	1.796	1.760	1.431	1.149
10	1.847	1.747	1.673	0.987
11	1.787	1.698	1.709	1.461
12	1.792	1.679	1.590	0.672
13	1.587	1.538	1.569	1.220
14	1.479	1.310	1.322	0.613
15	1.583	1.526	1.543	0.875
16	1.698	1.594	1.655	1.410
17	1.625	1.378	1.798	(0.963)
18	1.764	1.593	1.984	0.643
19	1.246	1.204	(1.250)	0.724
20	1.621	1.493	1.422	0.959

media containing blood and those containing no blood. The logarithmic mean of the exposed areas of the colonies grown in the media containing blood was 219.1 percent larger than the mean exposed area of the colonies grown in the media containing no blood. Since supplying missing plots in an analysis of this sort exaggerates the variance ratios slightly, it is doubtful whether there is a significant difference in the size of the colonies which grow in the plain blood agar and those in Edwards' medium. The F value of this comparison falls short of the value required for significance at the one percent point.*

SUMMARY AND CONCLUSIONS

A series of 20 freshly isolated cultures of *Str. agalactiae* grown in milk were plated in five percent ox blood agar, Edwards' crystal violet aesculin ox blood agar, the new standard medium, and the old standard medium.

Under the conditions of our experiments there was no significant difference in the growth promoting ability of plain ox blood medium and Edwards' medium.

No significant difference was found in the number of colonies supported by the new and old standard media. However, the mean exposed area of the colonies grown in the new standard medium was found to be 420.3 percent larger than the mean exposed area of the colonies grown in the old standard medium.

From these experiments it would seem that *Str. agalactiae* colonies when present in the new standard medium are large enough to be included no longer in the class of so-called "pinpoint" colonies.

When Edwards' medium is employed

* Statisticians, as a rule, prefer to use the values at the one percent mark as a test of significance when missing plots have been supplied.

TABLE 7.

Analysis of Variance of Exposed Areas of Colonies which Developed in the Various Media

Source of variation	Degrees of freedom	Sum of squares	Mean square	Variance ratio (F)
Between cultures	19	1.385784	.072936	3.200*
Blood vs. Edwards '	1	.122544	.122544	5.375
New vs. old st'd	1	3.959556	3.959556	173.702**
With vs. without blood	1	2.320508	2.320508	101.799**
Total between media	3	6.402608	2.134203	93.626
Error	55	1.253719	.022795	1.000
Total	77	9.042111		
Correction		163.131864		
Error of blood factor	18	.384813	.021379	
Error of new vs. old st'd	17	.825197	.048541	

Mean effect of blood vs. without blood as log of ratio=0.34062 $\pm$ 0.04624

Mean effect of new vs. old st'd as log of ratio=0.62355 $\pm$ 0.07344

Mean ratio of blood vs. without blood=2.191 $\times \div$ 1.112 : 1

Mean ratio of new vs. old st'd=4.203 $\times \div$ 1.184 : 1

* Surpasses the 1 percent point, 2.23 for 19 and 55 degrees of freedom.

** Surpasses the 1 percent point, 7.12, for 1 and 55 degrees of freedom.

in parallel with the new standard medium to estimate the effect of *Str. agalactiae* mastitis upon the total plate count of raw milk, Edwards' medium may be expected to yield considerably more *Str. agalactiae* colonies than will the new standard medium.

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Dairy Industries Exposition

This year the Dairy Industries Exposition will be held in Toronto, Canada, together with the annual conventions of the International Association of Milk Dealers and the International Association of Ice Cream Manufacturers, during the week of October 20 to 25.

There are no red tape difficulties in crossing the border. A somewhat stricter examination is made of the tourist than heretofore but this is reduced to the vanishing point if he brings some identifying paper such as a birth certificate, a voter's license card, or other similar document. Purchases, not in excess of one hundred dollars per person, may be made without payment of duty, provided that the tourist remains in Canada more than 48 hours, and also that he makes this order of purchase not more frequently than once in thirty days. For every dollar of United States currency that is spent there, the purchaser receives $1.10 in Canadian money in exchange.

Toronto is known as a golfer's paradise. There are thirty-two 18-hole courses of 6,000 yards or over. There is plenty of hunting and fishing. As to open seasons, write to the Department of Game and Fisheries, Province of Ontario, Toronto, Canada.

Last but not least, all purchases in Canada contribute to maintaining a sound state of trade balance. It all helps.

Preliminary Bacteriological Study of Market Creams *

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Although the bacteriological examination of market cream has long been a laboratory procedure, there is little information in the literature concerning the results of bacteria counts. When, in looking over the annual figures for 1939 and 1940, we found in our laboratory that almost 50 percent of the market creams examined by the direct microscopic method failed to meet the tentative standards of 500,000 clumps per ml., it was then decided to utilize as many bacteriological counting techniques as was practicable in order to secure more information. So, in addition to our microscopic clump count, all samples received for routine examination were plated in triplicate, using the standard tryptone-glucose-skim-milk agar. One set of plates was incubated at 37° C. for 48 hours, one set was incubated at 55° C. for 48 hours, and one set was incubated at 8° C. for 4 days.

A few words will explain our choice of these three temperatures. The standard routine temperature of 37° C. for 48 hours allows for the optimum growth of the mesophilic bacteria, those organisms which grow well at body temperature, and which would include the disease-producing bacteria if they were present, and the coliform group of bacteria. Incubation at this temperature of 37° C. for 48 hours is the commonly accepted "Standard Methods" technique heretofore used so generally that it is spoken of as the "standard plate count". We have included in our studies an incubation temperature of 55° C. in an effort to find to what extent "heat-loving" (thermophilic) organisms might be responsible for high counts. Although we hear much less about a third group of organisms, the psychrophilic types, those bacteria which grow at low temperatures, this is a most important group when dealing with a product, such as cream, subjected to long periods of storage at ice-box temperatures. This treatment gives these cold-loving bacterial types a chance to develop. Bacteria grow much more slowly at low temperatures, and so a four-day incubation period was necessary before counting.

For the purpose of this discussion we have divided our cream samples into three groups:

1. *Raw retail samples*: Creams produced in Connecticut not subjected to any heat treatment; creams which were received by us in the bottle as ready for sale at retail to the consumer.
2. *Import cream samples*: Creams imported from outside of the state. Most of these samples had been either pasteurized or heat-treated at their source and were received at the laboratory in sterile pint bottles, having been "dipped" or "poured" from the original container by an inspector.
3. *Pasteurized retail samples*: Creams produced either within or outside of Connecticut and pasteurized within the state. Samples were received at the laboratory in the bottle as ready for sale at retail to the consumer.

With reference to our findings on raw retail creams, Table 1 shows the figures on a total of 130 raw retail creams. Of these, 38 (29.2 percent) failed to meet the legal standards of 500,000 colonies per ml., when plated and incubated at

* Presented at the 44th Annual Meeting, Connecticut Association of Dairy and Milk Inspectors, Bridgeport, Connecticut, May 13, 1941.

37° C. for 48 hours; 40 (30.7 percent) failed to meet this standard when incubated at 8° C. for 4 days; only 2 (1.5 percent) failed when incubated at 55° C., while by the direct microscopic clump count 62 (47.7 percent) failed to meet the tentative standard of 500,000 clumps per ml. It is interesting, although not shown in the table, that 106 samples showed no growth whatsoever at 55° C., thus indicating that the majority of raw creams tested did not contain organisms which could be termed true thermophiles.

Incubation at 8° C. gave us little more information than did incubation at 37° C. Although we have no data concerning the age of these raw creams it seems likely that they had not been stored for long periods and hence the low-temperature organisms present had been allowed no opportunity to develop.

The direct clump count failed 62 creams which is 18.5 percent more failures than by the plate method at 37° C. Since the predominating organisms in the microscopic counts morphologically resembled spore-producing types, it is reasonable to believe that we did not use a plating medium or temperature suitable for development of colonies from these forms and so failed to obtain more failing counts by the plate method. In other words, apparently plate counts whether made at 37° C., at 55° C., or at 8° C., do not grow all the bacteria that are present in the raw creams and that can be seen under the microscope. No attempts have been made to isolate and classify organisms growing at any of the plating temperatures.

A total of 201 samples of import cream has been included in this study. An examination of Table 2 shows that only 13 (6.4 percent) of these import creams failed when plated at 37° C., only 26 (12.9 percent) failed at 8° C., and only 2 (0.9 percent) failed at 55° C. Yet by the direct clump count 75 (32.3 percent) of these samples failed. It is well to remember that practically all of these samples had been pasteurized

TABLE 1

Raw Retail Cream Samples

Method	Less than 500,000 count	Greater than 500,000 count	Total samples	Percentage failing
37° C.—48 hrs.	92	38	130	29.2
55° C.—48 hrs.	128	2	130	1.5
8° C.—4 days	90	40	130	30.7
Direct clump count	68	62	130	47.7

or had received heat treatment at their source and that the length of time from the date of the heat treatment to the date of laboratory testing varied from as little as 24 hours for some samples to as much as 10 days for others.

With import creams we have a product which has been heated. Presumably all bacteria susceptible to pasteurization temperatures have been destroyed and the cream has been cooled and stored at ice-box temperatures. During shipment and at all subsequent times it is assumed that this temperature has been maintained. Cream of initially low bacteria count so handled will maintain a low bacterial population for an indefinite period. We have examined import cream samples seven days after pasteurization, showing very low plate counts and very low microscopic counts. However, when low count cream is not held at ice-box temperatures but is exposed to higher temperatures even for periods as short as two hours, bacterial growth takes place and high counts are soon obtained. When the cream is again placed at low temperatures these bacteria may revert to resistant types and well withstand these adverse conditions. When creams that have been so handled reach the laboratory, the plating medium, time, and tem-

TABLE 2.

Import Cream Samples

Method	Less than 500,000 count	Greater than 500,000 count	Total samples	Percentage failing
37° C.—48 hrs.	188	13	201	6.4
55° C.—48 hrs.	199	2	201	0.9
8° C.—4 days	175	26	201	12.9
Direct clump count	126	75	201	32.3

perature used may not be adequate to permit these spore-producing organisms to grow and hence we have low plate counts but high microscopic counts.

In the group of import creams we find that twice as many samples showed failing counts at 8° C. as at 37° C. This is quite a different picture from that obtained in the raw cream group where only 1 percent more of the samples failed at the 8° C. incubation than failed at 37° C. Microscopically the flora of these two kinds of cream was similar, as were the colonial types. No cultural studies were made on either group. Only 2 of the import samples failed at 55° C., indicating that very few samples contain thermophilic organisms in excessive numbers.

The retail pasteurized cream samples present an unknown factor with regard to age. The capping regulations of Connecticut require only the day of bottling to appear on the cap and not the day of pasteurization. There is a dairy law which requires that when any milk or cream sample has been pasteurized longer than a week that information shall be stated on the cap. Of the 192 samples submitted in this series none was so marked. In the laboratory we have no way of knowing whether or not any of these creams had been pasteurized seven days or more prior to testing. Referring to Table 3, of the 192 samples examined, 45 (23.4 percent) failed at 37° C.; 62 (32.2 percent) failed at 8° C.; and 6 (3.1 percent) failed at 55° C. Once again the direct clump count failed many more, 102 (53.1 percent) of the samples.

TABLE 3.
Pasteurized Retail Samples

Method	Less than 500,000 count	Greater than 500,000 count	Total samples	Percentage failing
37° C.—48 hrs.	147	45	192	23.4
55° C.—48 hrs.	186	6	192	3.1
8° C.—4 days	130	62	192	32.2
Direct clump count	90	102	192	53.1

COMPARISON OF PASTEURIZED LOCAL WITH IMPORT CREAM

We know that some of these retail creams are the same creams repasteurized that were included in the import group. When true thermophiles are present in creams they increase at pasteurization temperatures. However, with these creams regardless of the fact that they were pasteurized outside of the state and again within the state before retail bottling, we find only 3 percent (6 samples) failing because of true thermophiles. Thus we feel justified in stating that true thermophiles, those organisms which grow readily at 55° C., were unimportant in contributing to high counts in these market creams. It is noteworthy that the samples in this study were taken as furnished to this laboratory by representatives of the Dairy and Food Commissioner in a routine sampling program and do not represent any particular cross-section or group of samples. Thus our results have been based on this routine group of unselected cream samples covering a period of 12 months.

Of the import group, 50 percent more of the samples failed at 8° C. than at 37° C., while in the retail pasteurized group only 8 percent more failed at 8° C. than at 37° C. All retail creams were either pasteurized originally or re-pasteurized within the state. This may afford an explanation for the difference in percentage of failures since thermophilic organisms appear to be an insignificant factor in high counts and since the types described in this paper as spore-producers are seldom found in the heat-resistant stage in market creams. Hence, pasteurization would destroy the majority of the bacteria in the cream including the psychrophilic types. When psychrophiles were found in retail creams we can conclude they were introduced subsequent to pasteurization.

COMPARISON OF PLATE WITH DIRECT COUNTS

A question may justly be raised whether comparing a plate count using a standard of 500,000 colonies per ml., with a direct clump count using a standard of 500,000 clumps per ml., is a fair com-

TABLE 4.
Import Cream Source "A"

Sample Number	Standard plate count			Direct clump count	Coliform	Phosphatase test
	37°C.—48 hrs.	55°C.—48 hrs.	8°C.—4 days			
1	1,500	0	0	180,000	1.0	PT
2	4,400	0	25,700	20,000	0.01	PT
3	5,500	0	23,200	340,000	0.01	PT
4	2,100	100	20,800	80,000	0	PT
5	800	200	0	60,000	0	PT
6	4,000	0	0	80,000	0	PT
7	1,800	0	1,900	120,000	0	PT

parison. It is interesting to report the distribution of the direct microscopic clump counts. Of the 62 failing raw creams, 13 samples had counts from 500,000 to 1 million, 31 had counts from 1 million to 10 million, and 18 had counts from 10 million to 100 million. Of the 75 failing import creams, 12 had counts from 500,000 to 1 million, 43 had counts from 1 million to 10 million, and 20 had counts from 10 million to 100 million. Of the 102 failing pasteurized retail creams, 17 had counts from 500,000 to 1 million, 40 had counts from 1 million to 10 million, and 45 had counts from 10 million to 100 million.

If we doubled our failing count figure and took a count of 1,000,000 clumps per ml. as our standard, only 17.5 percent more of all the creams examined in this study would have been acceptable. In other words, the majority of the failing cream samples by the microscopic clump count have extremely high counts and are not "border-line" failures. It is our feeling that the standards for practical work in Connecticut can be met by the industry without hardship since creams well within the limits are obtained consistently from many sources. The failing creams are consistently obtained from some sources where the effects of a follow-up sanitation program must be evaluated before a final conclusion is drawn.

POSSIBILITY FOR LOW DIRECT COUNTS

All of these extremely high figures may give us cause to ask if it is possible to produce and obtain from a given source cream which will yield low counts by the direct microscopic method over a stated period of time. And the answer is definitely yes. It has been done as Table 4 well illustrates. This records the results obtained on a series of creams from a source outside of this state. Although for purposes of presentation we have chosen a short series of samples, we have figures on other outside-of-the-state sources covering more samples and giving the same picture as is here presented. Unfortunately, we do not have the age of all of these samples, but they were examined about three days after pasteurization. All the counts at each of the plating temperatures and all the microscopic counts were low. Having shown that thermophiles rarely contribute to the flora of these samples, it seems reasonable to us to assume that these creams, re-pasteurized within the state and given proper handling and storage, will yield a retail product with a satisfactory bacteria count. We have evidence that age does not materially affect the bacteria count of pasteurized creams provided that the initial count was low and that handling and storage treatment have been properly carried out and maintained until the sample is purchased by the consumer.

In Table 5 are the results on creams from a source outside of the state. All of these creams met the 37° C. plate count standards. But the microscopic counts present quite a different picture. This well illustrates what would happen should only plate counts be considered in grading these creams bacteriologically. Certainly these creams cannot be considered as quality samples. The 8° C. incubation period showed three samples with high counts, indicating the presence

TABLE 5.
Import Cream Source "B"

Sample Number	Standard plate count			Direct clump count	Coliform	Phosphatase test
	37°C.—48 hrs.	55°C.—48 hrs.	8°C.—4 days			
1	51,000	0	*1,000,000	*10,200,000	0.001	PT
2	340,000	0	*1,000,000	*30,600,000	0.001	PT
3	16,500	0	300	* 1,040,000	0.1	PT
4	2,800	100	13,800	* 4,140,000	0	PT
5	32,000	0	200,000	* 2,020,000	0.01	PT
6	40,000	0	0	* 1,640,000	0	PT
7	5,300	0	0	*19,800,000	0	PT
8	11,700	0	320,000	* 1,160,000	0.1	PT
9	21,500	0	700	* 9,240,000	0.1	PT
10	22,800	0	* 610,000	*10,440,000	0.1	PT

* Failing Counts.
PT = Pasteurized sample.

of a true psychrophilic flora. One outstanding fact is gathered from these tables, namely that the extremely high microscopic counts should be a factor in considering the acceptability of cream for retail purposes.

We believe our evidence makes clear that it is possible to produce, bottle, store at low temperatures, and sell cream which will meet microscopic clump count standards such as have been established in this state. We do not feel that a cream meeting the standard legal limits we have set for the plate count necessarily is a low count cream. In certain samples there are many organisms present which do not grow under the usual laboratory techniques. The most useful incubation temperature and time for counting pasteurized cream flora appears to be 8° C. for 4 days.

CONCLUSIONS

In a survey made upon 523 market creams (raw and pasteurized) we found that 45.6 percent of the samples failed to meet tentative standards by the direct microscopic clump count, 18.3 percent failed to meet the legal standards when plated at 37° C. for 48 hours, 24.4 percent failed to meet these standards when plated at 8° C. for 4 days, and 1.9 percent failed when plated at 55° C. for 48 hours.

Bacteriological quality of cream should not be determined only at an incubation of 37° C. for 48 hours, but that procedure should be supplemented by an 8° C. incubation for 4 days. True thermophiles in this series of creams examined were of little importance in contributing to high counts and it is questioned whether their significance in cream may not have been over-emphasized.

More attention should be paid to the direct microscopic clump count in an effort to determine as accurately as possible the bacterial population of cream samples. Further studies are in progress to determine the types of organisms that can be observed in microscopic smears but which do not develop under the plating methods reported.

Detergents in the Dairy Industry *

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Tradition requires that any discussion of detergents be initiated by a consideration, from the theoretical point of view, of the factors involved in detergency. These factors have been variously listed as wetting, emulsification, adsorption, desorption, dissolving power, rinsing, lubrication, buffer action, and a host of others. That such discussions of theory are imposed by tradition is in a sense unfortunate since the passage from theory to practice in this field, at least, is not logically defined and has led in the minds of many to a state of confusion in which detergency is believed to be synonymous with one or the other of the factors enumerated above. Since this confusion does exist, and since we can not hope to dispel it with information available at present, it is perhaps best to consider a practical approach to the subject assisted only by so much theory as is directly applicable.

1. THE PROBLEM

The problem of dairy cleaning resolves itself into the removal, at the end of each period of use, of every trace of soil from dairy equipment.

The soil on dairy equipment arises from contact with milk or other dairy products, water, and, at times, detergent. This latter may be surprising since the detergent is supposed to remove soil, not to put it on. However, we shall see later that by a peculiar chain of events, the detergent at times is responsible for the most difficultly removable soil. It is obviously paradoxical to attempt to use a detergent to remove soil when the detergent itself may be responsible in part for soil formation. Paradoxical or not, that is exactly what has been done for many years, and is a situation which any adequate solution to our problem must avoid.

The most obvious soiling agent is milk either as such or in the form of various products derived from it. Milk is a complex mixture of fats, proteins, inorganic salts, and milk sugar, together with lesser amounts of minor constituents. Each of these is at some time or another a serious source of soil that must be removed from plant equipment, and is perhaps deserving of a little more interest than mere mention might imply.

The fatty substances in milk are essentially glycerides of various aliphatic acids together with some cholesterol and a small amount of carotene. The glycerides with which we are mainly concerned are composed of the trihydroxy alcohol, glycerine, combined with various fatty acids.

It so happens that a fat may be resolved into its components—glycerine and fatty acids—by the action on it of water at high temperatures. This reaction does not go to completion ordinarily, and is facilitated by the presence of inorganic acids or alkalies. This decomposition of fats, known as "hydrolysis," occurs almost simultaneously with saponification, since when alkali is present during this reaction the fatty acids formed react simultaneously with it to form salts (or soaps) of the alkalies used. The soaps often formed on dairy equipment are insoluble calcium or magnesium soaps, since these alkaline earth metal ions are present both in the milk and in the water used for cleaning.

Proteins are complex products, composed of carbon, hydrogen, oxygen, nitro-

* Read at the Joint meeting of the International Association of Milk Sanitarians, and the New York State Association of Dairy and Milk Inspectors, New York City, October 17-19, 1940.

gen, sulphur, phosphorus, etc., and are built up from simpler products called amino acids. The proteins in milk with which we are primarily concerned are casein and albumin. Both substances are ordinarily soluble in strong alkalies without much difficulty. On repeated heating the proteins become denatured and there is a marked decrease of solubility. The exact reactions are not known because of the complexity of the materials involved. Strong acids can dissolve proteins also.

The inorganic materials encountered in dairy soil are largely salts of calcium in combination with carbon dioxide or phosphate as the case may be. These salts are generally not soluble in water, nor are they soluble in alkalies. Moderately strong acids, however, do dissolve them.

Before discussing in detail the manner in which it is believed soiling takes place by milk products, it is desirable to describe the role of water in the cleaning process since it leads at times to the most serious difficulties.

Water is the vehicle in which detergents are dissolved and which is used to carry them to the surfaces to be cleaned. In its pure state water is seldom found in sufficient amounts to use for cleaning, and it becomes necessary to examine the impurities which occur in it, since they complicate our cleaning problem and are responsible to a large extent for the inorganic substances in our soil. The principal impurities that occur in water naturally the bicarbonates and sulphates of calcium and magnesium. While the composition of water varies considerably with locality and season, the calcium and magnesium salts, because of their properties, are said by some authorities to constitute the main problem in dairy cleaning. These salts constitute what is ordinarily termed water "hardness," and exist in two forms: *temporary hardness* precipitable by heat in accordance with the following reaction

$$Ca(HCO_3)_2 \xrightarrow{\text{heat}} CaCO_3+CO_2+H_2O$$

and *permanent hardness* which is heat stable. Either type of hardness may lead to difficulty unless the water has previously been softened by a base exchange softener, in which case the problems, still existing, of course, are much simplified in character.

The third factor in soil formation is the detergent, and since we have not discussed detergents as yet we shall merely indicate by example what happens when some types of detergents are added to hard water.

If, for example, we add to a hard water an amount of soda ash believed to be sufficient to perform a cleaning operation, either one or both of the following types of reactions may take place:

$$Ca(HCO_3)_2 + 2NaHCO_3 + Na_2CO_3 \rightarrow CaCO_3 + Na_2SO_4$$

$$CaSO_4$$

in which $CaCO_3$ is formed as a precipitate.

With this moderately complete idea as to the composition of the main sources of soil, an attempt might be made to formulate a reasonable hypothesis as to what sort of combinations of these agents occur on dairy equipment and the method by which they are laid down as soil.

First, and most obvious, is a simple (if simple it can be called) film of milk on a non-heated surface such as that of a can, a bottle, or a milking machine. The film of material left on the surface after draining is milk containing the constituents previously mentioned.

It might be thought that since milk is largely aqueous in composition, rinsing in plain water might be sufficient for cleaning equipment contaminated with this milk residue. This has been tried, and while it does under some circumstances give better results than might be expected, it is not a satisfactory method, since the fatty constituents of milk cannot easily be removed in this manner.

The next type of soil is that type deposited from milk on a heat-transfer surface. The exact nature of this soil is not known nor is the exact method by which it is deposited. This soil is believed to result from the heat precipitation of certain of the protein fractions in milk taking place simultaneously with

the destabilization of certain of the mineral salts in the milk. This freshly-deposited "milk film" (1) is gummy in character and acts as a medium for retaining other substances such as the hard-water precipitates mentioned previously.

This leads in turn to a third type of soil which is known as "milk-stone" and which is believed to be the cumulative result of the process indicated above; namely, the formation of a heat precipitated milk film, the incorporation therein of insoluble salts, and subsequent aging of the resulting deposit. Milkstone is built up slowly from films of almost microscopic thickness to layers as much as 1/8-1/4" thick at times. It is difficult to remove and constitutes one of the main problems in dairy sanitation. The composition of milkstone varies over a wide range, but a survey of the literature indicates the following minimal and maximal amounts of the various constituents (1, 2, 3).

	Minimum	*Maximum*
	Percent	
Moisture	2.66	8.75
Fat	3.63	17.66
Protein	4.14	43.83
Ash	42.03	67.33
CO_2 as $CaCO_3$	0.00	42.00
CaO	20.02	34.66
P_2O_5	9.37	26.93
MgO	trace	8.12
Fe_2O_3	0.00	0.29
Na_2O	1.40	7.33

The implied differences existing between the types of soil indicated above are obviously arbitrary, and it is not likely that soiling takes place in the rather orderly manner suggested. It is more likely that all of these various types of soil are formed simultaneously and the cleaning of any dairy equipment resolves itself into a problem of preventing the formation of the most difficultly removable soil, milkstone, with the knowledge gained from experience that if this is accomplished the other forms of milk soil will not cause excessive difficulty.

2. DETERGENTS

The method by which the problem is generally attacked involves the use of an aqueous solution of a detergent. The detergents which are available are almost without number from one point of view but from another quite limited. If one considers trade names, it might take a day or more to read them off. If one considers components, as we shall, we find a rather short list sufficient to embrace at least 99 percent of the available cleaners. We might first divide the available materials into a few groups to simplify consideration of them:

First, and of most importance, are the alkalies and alkaline salts, such as sodium hydroxide, sodium carbonate, trisodium phosphate, and sodium metasilicate.

Second are the acid materials, such as phosphoric acid, tartaric acid, etc.

Third are what might be called neutral materials, since we rely on neither acidic nor alkaline properties in their use,—the soaps and wetting agents.

Fourth, and of recent development, the water-conditioning chemicals, such as tetrasodium pyrophosphate, and glassy sodium metaphosphate, which in general have no marked detergent properties, but which have considerable utility in the washing operations.

As a *fifth* and miscellaneous group, we might mention abrasives, copper cloth, and so on, which are used as mechanical aids with or without detergent solutions when everything else has failed.

Since our approach to a solution of the problem is to be a practical one, we can eliminate from consideration any materials which experience of the past has ruled out completely either by virtue of exceedingly poor results, or lack of sufficient data. This enables us to rule out group three above, the so-called neutral cleaners such as soaps and wetting agents with but a brief mention.

Ordinary soap, which can be exemplified by the formula NaX, where X is a long chain aliphatic acid radical such as oleic or palmitic, is not used generally in dairy cleaning, partly because of prejudice and partly because of difficulty of removal. When soap is added to hard water, lime soaps—insoluble, tenacious, curdy precipitates—are formed, adhere to the equipment being washed and cause "off" flavors to develop (3). The precipitates are formed in accordance with the following reaction:

$$CaSO_4 + 2NaX \longrightarrow CaX_2 + Na_2SO_4$$

The utility of wetting agents, which are in general sodium salts of sulphated fatty alcohols or sodium salts of sulphonated aromatic compounds, cannot at present be discussed because of lack of information about them with respect to dairy cleaning, although a little work has been done in this field (4). These materials have certain desirable properties. They are surface active and might be expected to be of value in the cleaning process. While they do not react with water hardness to form precipitates, neither do they prevent the formation of precipitates from other causes. Unfortunately, most of them have the undesirable property of foaming, which cannot be tolerated in many dairy washing operations.

Since it is not desirable to use abrasives, this group can be eliminated from discussion. There remain three groups of materials from which a solution to the problem must, if possible, be found.

To simplify the discussion further, we can refer but briefly to the acidic materials also, since they have certain undesirable properties which at times overshadow their usefulness. We know from our discussion of the soil with which we must contend that acid materials will be of assistance in some respects. Thus proteins are soluble in strong acids, as are the inorganic salts to be found in milk soil. Unfortunately, milk fat is neither soluble nor emulsifiable in acid as it is generally used. Equipment cleaned with acid has in most cases a greasy deposit left on it. There is a further significant objection to acid, and that is that many types of equipment and most sanitary piping and fittings are made from copper-nickel alloys and tin-coated copper or bronze. These materials are easily corroded by treatment with acid. It is not unusual to find such equipment, after a number of cleanings with acid, deeply pitted and corroded. For this reason, most of our experience has been in the use of materials in the two remaining groups, namely, alkaline materials and water-conditioning substances.

Considering first the group of alkaline cleaners, which are typified by the members sodium hydroxide, sodium metasilicate, trisodium phosphate, and sodium carbonate, we find that they have much in common. They have been listed by various investigators in the order of wetting, deflocculating power, dissolving power, emulsifying power, precipitating properties, and corrosive effect (3, 5, 6). The order is determined to a large extent by the experimental procedure followed. Since they are the most widely used materials in dairy cleaning, it would be wise to survey the results available to us in order to ascertain, if we can, how they might be expected to act under various conditions.

We might feel that the alkali with the greatest dissolving power upon proteins would be most suitable for use. Many theories have stated that dissolving power and alkalinity, as measured both by pH and titration, are directly related so that by measuring the latter, which can be done easily, a measure of the former might be obtained. If we line up the substances in order of alkalinity we get the following relationships on 0.1 percent solutions: (5)

	pH	Relative Titrable Alkalinity (to pH 10.5)
NaOH	12.6	1.00
$Na_2SiO_3.5H_2O$	11.6	.57
$Na_3PO_4.10H_2O$	11.2	.30
Na_2CO_3	10.8	.17

From this we might judge that the order of effectiveness in dissolving proteins would be sodium hydroxide, sodium metasilicate, trisodium phosphate, and sodium carbonate. This has been widely stated to be the case (5, 6). However, in an examination of the data at hand, we find that while sodium hydroxide is the best solvent from the point of view of concentration of material used, and sodium metasilicate is better than trisodium phosphate, so is sodium carbonate; in fact, it seems to be, according to one group of investigators, as good as sodium metasilicate (7). According to another investigator, it is at least as good as trisodium phosphate for this purpose

(3). Thus, on the basis of these data, the three materials, sodium carbonate, trisodium phosphate, and sodium metasilicate fall into one class with reference to milk protein removal, and sodium hydroxide into another class, far superior to the first.

With reference to butterfat removal, the situation is similar. It is on the one hand reported that sodium metasilicate and trisodium phosphate are almost equivalent as emulsifying agents and the implication is that they remove butterfat equally well, while sodium carbonate and sodium hydroxide are decidedly inferior (5). On the other hand, it is reported in one instance that sodium carbonate, trisodium phosphate, and sodium metasilicate are all fairly effective in removing butterfat from glass, while sodium hydroxide is relatively ineffective although it is improved by the addition of 10 percent of trisodium phosphate or sodium metasilicate (7). In another instance it is reported that trisodium phosphate and sodium carbonate are almost equally effective in butterfat removal with but slight advantage to the former (3). Thus again sodium carbonate, trisodium phosphate, and sodium metasilicate fall into one class with respect to butterfat removal, superior in this case to sodium hydroxide, which falls into a second class.

With reference to another factor, namely, corrosive effect on metals found in dairies, the situation is similar but not quite as confused. It is universally agreed that sodium hydroxide is the most corrosive of all alkalies mentioned. Sodium metasilicate is generally considered to be the least corrosive of the alkalies upon soft metals; and while the data on this point are not entirely free from dissent it can be assumed that in general this is the case (6, 8).

In view of this situation, it is not surprising that standard practice in many cases seems to be to take a shovelful of each of the alkalies, mix them up and hope for the best. While the practice cannot be condoned, it is obvious that the information available is so confusing that this procedure is at least excusable, even if it is not successful. It so happens that this practice of indiscriminate mixing or using any one of the alkalies is not successful for a reason barely indicated above, and one which is not too directly connected with milk at all; that is, the reaction of these materials with the constituents of ordinary water.

When any of the alkalies listed above are added to hard water a precipitate usually forms in accordance with one or more reactions of the following type:

$$3CaSO_4 + 2Na_3PO_4 \rightarrow Ca_3(PO_4)_2 + 3Na_2SO_4$$

$$MgSO_4 + 2NaOH \rightarrow Mg(OH)_2 + Na_2SO_4$$

$$Ca(HCO_3)_2 + 2NaOH \rightarrow CaCO_3 + Na_2CO_3 + 2H_2O$$

$$CaSO_4 + Na_2CO_3 \rightarrow CaCO_3 + Na_2SO_4$$

These precipitates have been recognized as the chief difficulty in dairy cleaning, since they adhere to equipment and in combination with milk solids, dried or precipitated by heat, build up the deposits previously described as "milkstone." In the past most efforts have been directed towards modifying the character of the precipitates formed so as to minimize their adherent properties, since no means was available for preventing them from forming. Thus the precipitate resulting from the use of sodium carbonate has been recognized as the worst offender, and it has been modified by adding to the sodium carbonate appreciable amounts of either trisodium phosphate or sodium metasilicate. In addition to such mixing, it has been common to go entirely to the use of trisodium phosphate or sodium metasilicate, in spite of their higher cost, in the belief that the precipitates formed by them were less troublesome in practice (1, 2, 3). That this has not solved the problem is well known, leading to the application in this field of the other group of substances which we must yet discuss, namely, the water-conditioning materials of which tetrasodium pyrophosphate and sodium

TABLE 1
Minimal Quantities of Sodium Metaphosphate and Sodium Pyrophosphate Necessary to Prevent Precipitation

In 0.25 percent $Na_2PO_4.12H_2O$			In 0.10 percent Na_2CO_3		
Ca P.p.m.	$NaPO_3$ P.p.m.	$Na_4P_2O_7$ (anhydrous) P.p.m.	Ca P.p.m.	$NaPO_3$ P.p.m.	$Na_4P_2O_7$ (anhydrous) P.p.m.
10	50	330	10	10	25
20	125	800	20	50	130
40	250	2120	40	200	400
50	320	2660	80	500	1060
55	350	3200	100	600	1600
80	500	——	120	720	2400
120	820	——	240	1630	——
240	1630	——	——	——	——

metaphosphate are representative members.

The first is a crystalline material generally anhydrous, soluble in water to the extent of about 5 percent (at room temperature). It is mildly alkaline and is not a good detergent of itself but is used in conjunction with other alkalies. The latter material $(NaPO_3)_n$ is an amorphous substance, neutral in character, and apparently soluble without limit in water.

These two materials may be mixed with alkalies and used for cleaning. Their particular function is to diminish or prevent entirely the formation of the precipitates responsible for the difficulties encountered in dairy cleaning and to act as solvents for such calcium salts as are precipitated from milk at heat-transfer surfaces. The manner in which they do this is still open to some question, but it is believed that they form soluble complex ions with the calcium and magnesium in water, from which these materials can no longer be precipitated by the addition of ordinary alkalies. This mechanism may be illustrated by the following reactions:

$$(NaPO_3)_n \rightarrow 2Na^+ + Na_{n-2}(PO)_{3n} - -$$
$$xCa^{++} + Na_{n-2}(PO_3)_n \rightarrow$$
$$2xNa^+ + Na_{n-(2+2x)}Ca_x(PO)_3 - -$$

The question of the relative efficiency in preventing the formation of precipitates of these materials can best be settled by recourse to data in the literature. This problem has been very thoroughly investigated and the results are shown in Table 1 and Figures 1 and 2 (9).

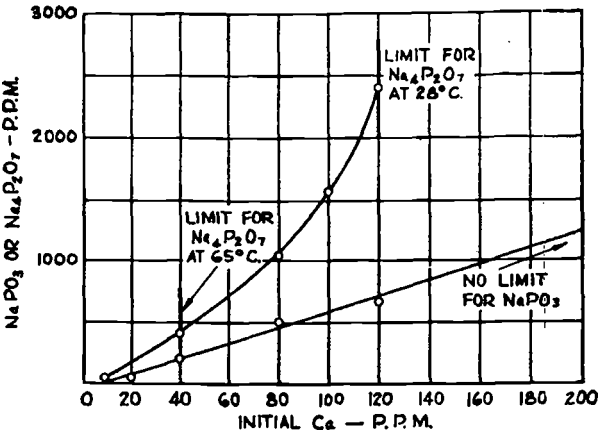
From these data it is obvious that metaphosphate is several times as effective as pyrophosphate in preventing precipitation at both low and high temperatures, and is effective in waters of all degrees of hardness encountered. The pyrophosphate is not only less effective, but does not prevent precipitation in waters of hardness in excess of about six to eight grains at temperatures characteristic of ordinary cleaning operations.

It does not seem too much to say that by combining one of these precipitate-preventing materials with a mixture of properly chosen alkalies, we may expect to get the cleaning results long sought for in the dairy industry. The alkalies actually chosen are largely a matter dependent on the specific use to which the resulting cleaner is to be put. While these types of materials have not for very long been available to the dairy field, many recent publications indicate that their utility has already been widely recognized.

3. THE USE OF DETERGENTS

The correct use of a detergent in a dairy is something which cannot be discussed specifically, since each operation is different, and the method of cleaning depends on the type of equipment to be cleaned, the number of men available, the size, the arrangement, the time, and other factors. It is, however, possible to formulate some general rules which are applicable in practically all dairy cleaning operations.

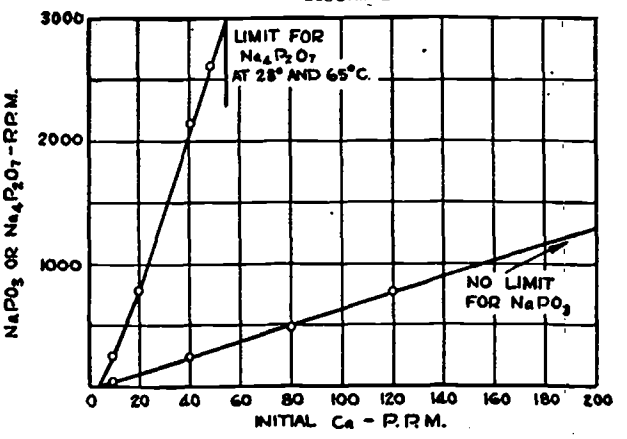
FIGURE 1



RELATIVE MINIMAL QUANTITIES OF SODIUM METAPHOSPHATE AND SODIUM PYROPHOSPHATE NECESSARY TO PREVENT PRECIPITATION IN 0.10 PER CENT SODIUM CARBONATE SOLUTION.

The first one of these, and probably the most important, is that the equipment should be thoroughly rinsed with plain water, cold or moderately warm, until such milk as can be rinsed away has been removed. The water used in rinsing should not be too warm, since if it were it might increase the amount of insoluble deposits present on the equipment. Water at a temperature of about 100°-110° F. is undoubtedly most satisfactory for rinsing. The reason for this is, of course, evident. Milk contains all of the materials enumerated previously, and these materials will react with and use up some of the cleaner added. Thus, as a matter of economy and efficiency, the milk should be removed as completely as possible by rinsing.

FIGURE 2



RELATIVE MINIMAL QUANTITIES OF SODIUM METAPHOSPHATE AND SODIUM PYROPHOSPHATE NECESSARY TO PREVENT PRECIPITATION IN 0.25 PER CENT $Na_3PO_4 \cdot 12H_2O$ SOLUTION.

Following this rinsing operation, the detergent solution in the proper concentration is applied to the equipment in an appropriate manner. In every case, however, in which cleaning solution is prepared in the dairy, it is excellent practice to prepare such solutions by dissolving the required amount of cleaning material in a small amount of water in a bucket, and to pour the resulting concentrated solution into the equipment which is to be cleaned. In other words, the solid detergent should never be placed in direct contact with dairy equipment. It is wise, too, to be extremely careful in handling the concentrated solution prepared in the bucket, since all strongly alkaline solutions are rather dangerous if handled carelessly. During the pouring of such solutions from the bucket into the equipment, one must be particularly careful not to splash any of the solution into the eyes. For most hand-washing operations, the temperature of the detergent solution will never be in excess of about 120° F. For soaking operations, it may be higher.

Following the application of the cleaning solution, the equipment is rinsed, first with warm water, then with cold water, until it has been thoroughly cooled down. After the final rinsing, equipment such as heater units and exchangers should be dismantled for inspection to make certain that a satisfactory job has been done.

The general procedure indicated above is satisfactory for the cleaning of all types of dairy equipment, except those types cleaned in machines where the order of operations is determined by the type of machine. This type of cleaning deals primarily with cans and bottles.

With reference to the former, the type of cleaner described above, namely, the mixture of calcium-sequestering substance with an alkali, should give good results, and experience bears this out. The alkali most suitable, I believe, for the washing of cans is sodium metasilicate, due to its small corrosive effect on tin. The calcium-sequestering material in combination with the alkaline silicate when used in a can washer effectively prevents the formation of milkstone on both the cans and machine and assures the delivery of a can excellent from a sanitary point of view.

It is essential in the can-washing operation that the machine be operating efficiently. This seems to be so obvious that mention of it might be considered superfluous. However, in many instances investigated, it has been found that the machine was operating so inefficiently that it was quite impossible to obtain clean cans with any detergent. Certain points in the can-washing operation are so important and so easily remedied that it might be advisable to enumerate them.

1. Much strength may be lost at the beginning of the operation if the wash solution is made up carelessly. As a general rule the charge should be added and the dispenser turned on just before actual can-washing is started. During the day's operation the pumps and machine should not be allowed to operate for any length of time without cans in the machine. Waste is certain to result.
2. The overflow pipe in rinse tank may stand at a higher level than the overflow pipe in the wash tank. This causes a continuous excessive dilution of the wash tank by passage of water through check valve from rinse tank to wash tank.
3. Excessive dilution of the wash water by rinse water should be remedied by the use of baffles properly placed. Wash water may be wasting into the pre-rinse basin or rinse water wasting into the wash tank due to inefficient baffling.
4. Wash solution may be carried out of the wash tank or pre-rinse water carried into the wash tank by the depressions in the bottoms of the inverted cans or in the lids. This may be corrected by suitable baffling of the sprays or by installation of steam blowers.
5. Where wash solution is sprayed into cans by means of steam-injector pumps (steam siphon) the dilution caused by the incoming water necessary to control temperature is so great that it is uneconomical to maintain the proper concentration of any detergent. The best practice in this case is to install centrifugal pumps.

If these points are carefully observed and a good detergent is used, it is possible to obtain cans free from film and odor, with very low bacteria counts, and to maintain the machine almost entirely free of scale. Many of the newer types

of can washers have remedied the faults indicated above, leading to vastly improved efficiency.

The other operation in dairy cleaning in which a machine is used, is bottle washing. Bottles are generally conveyed mechanically through solutions of alkali of various strengths and at various temperatures for varying lengths of time. It is desired to obtain clean, free-rinsing bottles with low bacteria counts. The data at hand on bottle washing are almost overwhelming in amount, but widest practice is the use of approximately 2 to 3 percent of alkali of which a large portion is caustic soda (10, 11). Practical experience has indicated that a mixture of 80-90 percent caustic soda with 10-20 percent of trisodium phosphate or sodium metasilicate gives reasonably good results (11, 12).

The argument as to the necessity of adding the small amount of trisodium phosphate or other alkali to the sodium hydroxide still goes on and words are hurled with reckless abandon (10, 11, 12, 13). The advocates of the addition of other materials to caustic soda insist that better rinsing is obtained,—the opponents say it is not so. Without attempting to settle the question, it may be said that many of the largest and most progressive dairies have moved in favor of the addition of the small amount of other alkali to the sodium hydroxide.

As might be expected from our previous discussion, an appreciable amount of scale which is undesirable and costly to remove accumulates on the bottle carriers and rinse equipment of soaker-type machines, especially in hard water. It would be reasonable to assume that the addition of a calcium-sequestering material to the soaker solutions would eliminate, or at least minimize, the formation of lime scale. To some extent this is true, but experience in the field with these new materials has been too limited up to the present time to make any definite recommendations with reference to scale prevention on the carriers, although some favorable results have been claimed, both with reference to scale prevention and improvement in the appearance of the bottles (11, 12). Proper treatment of the rinse water can prevent entirely the formation of scale on the rinsing mechanism resulting from precipitation of the temporary hardness in water (14, 15, 16).

With reference to farm-utensil and milking-machine cleaning, we might assume that the same principles in choosing a detergent would apply. While our limited experience again precludes a final answer, here, too, the use of a precipitate-preventing material in conjunction with alkaline cleaners of the proper type might be expected to lead to good results. Since washing of this type is done manually, the alkaline materials must be of such a nature that no harm results to the operator. The general procedure of rinsing preceding washing should be followed. Recent work indicates that the use of materials of this type on milking machines leads to results far better than those obtained with alkalies alone (17).

CONCLUSION

Surveying our experience broadly, we might say that the best detergent available to the dairy industry today is one in which there is contained an efficient calcium-sequestering material for the control or prevention of alkaline-earth-metal precipitates, an alkali sufficient in amount to do a good cleaning job, and of a type least harmful both to operator and equipment.

It might be added, though, that in addition to a good detergent there is required a reasonably well worked out cleaning procedure, equipment of the proper type and in good condition, and, last but not least, a fair proportion of an ingredient which we have not been able to mix into detergents—common sense.

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Oleomargarine Standard

The Federal Security Administrator has announced new oleomargarine standards in the *Federal Register*, June 7, pages 2761 - 63, obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., 10c per copy, cash accompanying order (no stamps).

The product shall contain no less than 80 percent fat, and any of the following constituents: the flavoring diacetyl, lecithin or glycerides of the fatty acids, sodium benzoate or the acid, vitamin A not less than 9000 USP units per pound and with or without vitamin D.

These products were allowed on the basis of the presentations of the producers that they were to be used to make oleomargarine to simulate butter.

The Treatment of Dairy Wastes. Sylvan D. Montagna. Sewage Works Journal, Vol. 12, No. 1, January 1940, pp. 108-111. *Pub. Health Engin. Abs.* xx, S, 100.

A producer of milk and manufactured milk products has successfully treated dairy wastes by the activated-sludge process. It treats an average of 50,000 gallons of waste daily. The essential units of this plant are a lime tank, the receiving chamber or wet well, mixing chamber, primary settling basin, aeration and final settling basins.

Lime solution, added in the miving chamber, serves to neutralize the lactic acid and precipitate the suspended caseins in the raw waste to form a sludge, and to prevent septic conditions in the primary settling basin. Agitation is by means of diffused air. Part of the sludge from the primary settling basin is returned to the mixing chamber for recirculation. Sludge removed from the primary settling basin (400 to 500 gallons daily, 50 percent settleable solids) is conveyed by tank truck to an adjacent field.

The lactic-acid-forming bacteria in the aeration basin convert the milk sugars to lactic acid, thereby reducing the pH to between 7.6 and 7.8, the most favorable reaction for this type of bacteria. A further decomposition of the milk sugars occurs simultaneously to form carbon dioxide and water. Sufficient aeration is maintained to keep the dissolved oxygen above 2 parts per million. Sludge from the final settling basin is returned to the aeration tank for recirculation and seeding. The final effluent of the plant is discharged into a small stream.

The analyses of samples indicate a B.O.D. range of 260 to 1,800 (average 545) p.p.m. for the raw wastes; 98.4 percent B.O.D. reduction is effected by the treatment.

R. S. SHAW.

A Comparison of Dowicide A and Chlorine (Diversol) For Use in Milking Machines *

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Unless properly cared for, milking machines are serious sources of contamination in milk. To correct this condition, numerous methods and germicidal agents were tried for their ability to cleanse and properly sanitize the machines. Experimental work by various investigators has been carried out along two main lines which included a study of various detergents such as trisodium phosphate, sodium hydroxide, carbonate, metasilicate, and metaphosphate; and a study of various sterilizing agents both physical and chemical.

As a result of these investigations, certain methods have been suggested which, if properly carried out, will render a milking machine sufficiently clean and free of bacteria.

Due to the deleterious action of heat on the rubber parts of a milking machine as well as the cost and limited facilities usually available for producing hot water or steam on farms for proper physical sterilization, chemical sterilization is more commonly used.

EXPERIMENTAL

The work reported in this paper is a study of sodium orthophenyl-phenate (Dowicide A) as a suitable germicide for use in milking machines. The experiments were carried out over a period of one year on two different farms. For the first six months only two milking machines were used. One was treated with Dowicide A and the other was used as a control. It was decided at the end of six months to add a third machine and to use some form of chlorine for comparative purposes. Diversol, a combination of chlorine and trisodium phosphate, was chosen as the form of chlorine compound to use.

The experimental procedure was as follows:

I. Preparation of cows for milking and method of cleaning milking machine.
   A. Preparation of cows for milking.
      1. Cows were clipped as often as needed for clean milk production.
      2. The udder of each cow was washed before each milking as follows:
         a. Control with two gallons plain water.
         b. Dowicide A with two gallons of 1 to 200 solution of Dowicide A.
         c. Chlorine with two gallons of a solution containing approimately 150 p.p.m. of available chlorine (Diversol).
   B. Preparation of milking machines immediately before milking.
      1. Dowicide A. The teat-cups and hose were removed from the 1 to 200 solution of Dowicide A in which they were immersed from one milking time to the next. Daily samples of this solution were taken for bacterial analysis. The milking machine was rinsed with two gallons of a 1 to 200 solution of Dowicide A by by shaking vigorously five

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times. This solution was saved for future use.

2. Chlorine. The teat-cups and hose were removed from the chlorine solution in which they were immersed between milkings, tested for p.p.m. of chlorine and discarded. Two gallons of approximately 150 p.p.m. chlorine solution were drawn into the machine, shaken vigorously five times, and discarded.
3. A sample was secured for bacterial analysis from each of the three machines by drawing two liters of sterile water through the teat-cups into the machine and rinsing the machine by shaking vigorously five times before taking the sample.

C. Method of using the milking machines.

1. Before milking, the teat-cups were dipped into two gallons of plain water, 1 to 200 solution of Dowicide A or approximately 150 p.p.m. of chlorine solution before each cow was milked with the respective machine.
2. The milk from each machine was kept in a separate can, and a composite sample of this milk was taken for a bacterial analysis. In the case of the milk from the machine treated with Dowicide A, a sample was taken for the phosphatase test.
3. All machines were rotated daily so that they were only used every third day on the same cow in order to eliminate individual differences in the bacterial content of each cow's milk.

D. Cleaning of milking machines after milking.

1. All machines were rinsed immediately after milking by drawing four gallons of cold water through the hose and teat-cups into the machine and shaking vigorously five times and emptied after which the same procedure was repeated with one gallon of hot water.
2. The control machine and parts were then stored without further treatment until the next milking.
3. The machines receiving the Dowicide A and chlorine treatments respectively received further treatment by drawing two gallons of a 1 to 200 solution of Dowicide A and two gallons of approximately 150 p.p.m. of chlorine solution through the hose and teat-cups into the respective machines shaking vigorously five times and emptying. The bacterial content of these solutions was determined daily.

   The teat-cups and hose from these machines were soaked in a 1 to 200 solution of Dowicide A and a solution of approximately 150 p.p.m. of chlorine respectively between milkings. The chlorine solution was tested before and after the soaking period to determine the p.p.m. of available chlorine.

The experimental procedure has been given in detail to show that the methods of treating the machines and milking the cows were the same in each case. The precaution was also taken of milking different cows on alternate days so as to do away with individual differences in the bacterial content of the milk from the cows. The use of three individual milking machines simultaneously was also considered essential if strictly comparable data were to be obtained.

The Dowicide A solution was used in all cases for a period of at least seven days. The chlorine solution used was Diversol. The directions given on the container were followed in making and using the solution. The available chlorine content of the solutions was kept as nearly 150 p.p.m. as possible, ranging between a maximum of 188 and a minimum of 102 p.p.m. of available chlorine. During the course of the experiments various strength solutions of Dowicide were tried ranging from 1 to 200 to 1 to 500. The data for these experiments are recorded in Tables 1 and 2.

Preliminary experiments were carried out on a farm where hired help did all the work. Directions were followed so carelessly and the results so unreliable that the work at this farm had to be discontinued. A second farm was selected where the directions given were followed and where the care of the cows and equipment as well as the milking was done by the owner of the farm. His production of low count milk is a matter of record. It should be stated also that the cows on this farm were free from mastitis, infectious abortion, and tuberculosis as demonstrated by bacteriological, serological, and immuniological tests.

RESULTS

In Table 1 are found the weekly averages of the bacterial counts over a six months period from January to July. Bacterial counts are given for the sterile rinse water and the milk from the machines. The rinse water from the control machine has a high bacterial content, much higher than from the two chemically treated machines, but the milk from the untreated machine had a very low bacterial plate count.

A comparison of the bacterial plate count of the rinse water from the two chemically treated machines shows it to have a lower count than the untreated machine. Likewise the milk from these machines has a lower plate count than from the control machine. It will also be noted in Table 1 that the plate counts of the rinse water and milk from all three milking machines were lower in the winter than in the spring and early summer. However, the plate counts from the chemically treated machines were generally lower than the control during these periods.

SURVIVAL OF THERMOPHILES AT 20° C.

A study was made of the influence of Dowicide A and chlorine (Diversol) on the reduction of thermophiles. Milking machines may be a prolific source of this particular group of bacteria. During the work on the milking machines a study was made of the number of thermophilic bacteria present over a three week period in each of the three milking machines receiving the different types of treatment. The rinse water from the control machines has plate counts of thermophilic bacteria ranging from 0 to 400,000 per ml. whereas the rinse water from the machines receiving the chemical treatments seldom had any present. The thermophilic bacterial plate count for Dowicide A treated machines ranged from 0 to 5000 and for Diversol treated machines from 0 to 48,000.

PLAN OF EXPERIMENT

To test the action of the two chemicals on the viability of thermophiles, four organisms were used, viz., *Bacillus coagulans* and thermophiles isolated from the following sources: milk powder, raw milk, and sugar. The organisms were grown in a peptonized milk medium and incubated at 55° C. for 24 hours. They were then inoculated into the following: milk diluted 1:200; milk diluted 1:200 plus Dowicide A 1:200; Dowicide A 1:200; milk 1:200 plus Chlorine 125 p.p.m. (Diversol) and Chlorine 125 p.p.m. (Diversol). A count was taken of the number of thermophilic bacteria introduced into each of the above solutions and then two minutes thereafter and at the end of six, 12 and 24 hours. This was done for each thermophile. The inoculated tubes were kept at 20° C. for this series of experiments to simulate conditions commonly found in the dairy barn.

TABLE 1.

Recapitulation of Weekly Averages Secured over a Six Months Period with Milking Machines Treated with Dowicide A and Chlorine (Diversol)

Date	CONTROL		DOWICIDE A					CHLORINE (DIVERSOL)			
	Bacteria Sterile rinse water from milking machine before milking	Bacteria in milk from this machine	Age of soln. (days)	Strength Dowicide solution used	Bacteria, sterile rinse water from milking machine	Bacteria in milk from this machine	Phosphatase test	P.p.m. Cl. used to rinse machine before milking	Bacteria sterile rinse water from this machine	Bacteria milk from this machine	P.p.m. Cl. used to soak teat cups & hose
1-21-40	392,375	2,844	7	1:500	97,125	4,619	——	161.2	20,625	5,900	165.6
1-29-40	641,833	3,450	7	1:500	88,571	1,614	——	144.3	17,833	2,250	127.7
2- 5-40	36,500	4,333	7	1:500	38,000	2,200	——	155.3	174,833	2,030	166.0
2-12-40	44,422	2,514	7	1:500	47,866	1,210	——	147.0	5,571	2,292	160.0
2-19-40	25,300	3,000	7	1:500	24,600	1:110	——	137.0	9,860	1,250	151.0
2-26-40	492,571	4,242	9	1:400	70,857	2,950	——	149.0	18,428	2,436	147.2
3-19-40	534,076	2,857	16	1:400	15,707	2,564	——	128.0	11,615	3,412	133.0
4-10-40	319,871	5,069	17	1:400	48,462	4,115	——	126.0	9,500	3,646	121.0
5- 8-40	17,352,500	6,492	16	1:200	16,092	4,305	——	133.0	14,166	4,029	129.0
5-25-40	7,750,000	3,161	11	1:200	11,011	3,100	——	136.0	17,200	6,350	135.0
6-13-40	25,598,000	3,512	6	1:200	7,800	3,632	——	135.0	332,500	5,915	135.0
6-26-40	4,836,600	7,055	7	1:200	20,300	7,940	——	135.0	44,272	9,559	135.0

TABLE 2.

Influence of Milk on Thermophiles at 20° C. in Presence of Dowicide A (1:200) and in Chlorine (125 p. p m.) (Diversol)

Culture and Additions	0 hour	2 minutes exposure	6 hours exposure	12 hours exposure	24 hours exposure	Residual Chlorine
Bacillus coagulans						
Milk 1:200	2,290,000	.....	2,200,000	1,895,000	1,465,000	.....
Milk 1:200 + Dowicide A 1:200	2,290,000	0	0	0	0	.....
Dowicide A 1:200	2,290,000	0	0	0	0	.....
Milk 1:200 + Cl 125 ppm	2,290,000	630,000	55	3	0	1.05 ppm
Chlorine 125 ppm	2,290,000	880	0	0	0	2.7 ppm
Thermophile from milk powder						
Milk 1:200	620,000	.....	1,030,000	670,000	1,040,000	.....
Milk 1:200 + Dowicide A 1:200	620,000	11,900	10,500	10,600	9,700	.....
Dowicide 1:200	620,000	10,900	7,000	12,300	4,500	.....
Milk 1:200 + Cl 125 ppm	620,000	57,800	7,100	8,600	4,800	1.5 ppm
Chlorine 125 ppm	620,000	20,700	3,700	3,250	1,550	1.4 ppm
Thermophile N_2—raw milk						
Milk 1:200	235,000	.....	160,000	120,000	112,000	.....
Milk 1:200 Dowicide A 1:200	235,000	850	1,370	1,260	910	.....
Dowicide A 1:200	235,000	1,250	1,360	1,400	1,070	.....
Milk 1:200 + Cl 125 ppm	235,000	73,000	1,920	1,630	1,120	1.5 ppm
Chlorine 125 ppm	235,000	10,000	150	190	30	2.8 ppm
Thermophile N_3—sugar						
Milk 1:200	170,000	.....	160,000	170,000	150,000	.....
Milk 1:200 + Dowicide A 1:200	170,000	52,000	60,000	28,500	36,500	.....
Dowicide A 1:200	170,000	50,000	42,500	36,000	31,000	.....
Milk 1:200 + Cl 125 ppm	170,000	130,000	46,000	42,500	39,000	2.4 ppm
Chlorine 125 ppm	170,000	70,000	37,000	29,000	17,800	4.8 ppm

The results of one typical experiment in a series of three experiments are found in Table 2. The control shows a gradual dying off of bacteria at the end of 24 hours in most cases. The Dowicide A caused a great reduction of thermophiles in the first two minutes and not much reduction thereafter while the chlorine compound (Diversol) did not act as quickly as Dowicide A but at the end of six hours showed practically the same reduction. The presence of milk had no influence on the action of Dowicide A but reduced the effectiveness of chlorine.

SURVIVAL OF THERMOPHILES AT 55°C.

Another series of experiments was set up under the same conditions as those just described in which the inoculated tubes containing the various solutions were incubated at 55° C. instead of 20° C. The tubes were capped with parafilm to prevent excessive evaporation during the incubation period. Only two organisms, *Bacillus coagulans* and the thermophile isolated from milk powder, were used.

The results of a typical experiment in this series of experiments are given in Table 3. It will be seen that there was approximately a ten fold increase in the number of bacteria in the control whereas in the same dilution of milk treated with Dowicide A and Diversol there was a reduction. Again we find that Dowicide A acts more quickly than Diversol and that milk had no effect on it.

SPEED OF REACTION

Since previous experiments (Tables 2 and 3) had indicated that Dowicide A killed the thermophilic bacteria more quickly than Diversol, a number of experiments were done to check the results in a series of short exposures. The same four thermophiles were used as in the previous experiments. They were inoculated into milk diluted 1:200 with distilled water plus a 1:200 solution of Dowicide A and a 1:200 solution of milk plus 155 p.p.m. of chlorine (Diversol). Plates were made at the beginning and

TABLE 3.

Influence of Milk on Thermophiles at 55° C. in Presence of Dowicide A (1:200) and in Chlorine (125 p. p. m.) (Diversol)

Culture and Additions	0 hour	2 minutes exposure	6 hours exposure	12 hours exposure	24 hours exposure	Residual Chlorine
Bacillus coagulans						
Milk 1:200	1,230,000	.....	9,000,000	10,000,000	10,000,000	.....
Milk 1:200 + Dowicide 1:200	1,230,000	0	10	5	0	.....
Dowicide 1:200	1,230,000	50	60	10	0	.....
Milk 1:200 + Chlorine 125 ppm	1,230,000	420,000	10	20	0	0
Chlorine 125 ppm	1,230,000	382,000	0	0	0	**
Thermophile from milk powder			6,000,000	10,000,000	10,000,000	.....
Milk 1:200	1,040,000	.....	8,300	5,900	310	.....
Milk 1:200 + Dowicide 1:200	1,040,000	11,500	2,450	1,100	45	.....
Dowicide 1:200	1,040,000	11,500	4,800	5,300	2,000	0
Milk 1:200 + Chlorine 125 ppm	1,040,000	600,000	880	1,490	770	1.8 ppm
Chlorine 125 ppm	1,040,000	35,000				

**Tube broken before chlorine determination made.

Remarks:
0—no bacteria
Residual chlorine taken at end of 24 hour plating.

at the end of 1, 2, 4, and 10 minute exposures to the chemicals in the dilute milk. Diluted milk was used in all these experiments to simulate the rinse water from milking machines.

The results are given in Table 4 and show what had been previously indicated in Tables 2 and 3 that under the conditions of these experiments Dowicide A is a much faster-acting chemical than chlorine as found in Diversol. The practical significance of this is that Dowicide A would be much better to rinse utensils in the dairy or for use in rinsing dishes, silverware, glasses, etc. than Diversol.

PHOSPHATASE TEST

Since Dowicide A is a phenol compound, sodium orthophenyl phenate, the question naturally arises, what would be the influence of the presence of this compound on the phosphatase test? This question was kept in mind from the very beginning of the experiment and the phosphatase test run on every sample of milk after it had been pasteurized. In no case did we find a positive test (Table 1).

As previously described, the teat-cups were dipped in two gallons of plain water, and the milking machine was rinsed with two liters of sterile water before milking. This was sufficient to dilute the Dowicide A to a point that did not interfere with the phosphatase test of the milk.

Experiments were also carried out by the addition of various amounts of Dowicide A to raw milk and then pasteurizing it, and also to pasteurized milk. These experiments showed that it was necessary to have Dowicide A present in a concentration greater than 1:50,000 before a positive test was obtained.

SUMMARY

1. The average of bacterial plate counts of the rinse water and of milk over a six-months period from milking machines cleaned with a 1:200 to 1:500 solution of Dowicide A or with 102 to 188 p.p.m. of chlorine solution were consistently lower than those from the control milking machine receiving no germicidal treatment.
2. There was a greater difference in the bacterial counts obtained during the spring and summer months than during the winter months between the control milking machine receiving

TABLE 4.

Speed of Reaction of Dowicide A (1:200) and of Chlorine (155 p.p.m.) Against Four Thermophiles in the Presence of Milk (1:200)

Culture and Treatment	Control	Time of Exposure			
		1 min.	2 min.	4 min.	10 min.
Bacillus coagulans					
Dowicide A 1:200 + Milk 1:200	915,000	0	0	0	0
Chlorine 155 ppm + Milk 1:200	915,000	840,000	430,000	440,000	487,000
Milk powder thermophile					
Dowicide A 1:200 + Milk 1:200	1,500,000	80	135	100	280
Chlorine 155 ppm + Milk 1:200	1,500,000	1,450,000	330,000	510,000	620,000
Thermophile N_2—raw milk					
Dowicide A 1:200 + Milk 1:200	470,000	10	85	30	5
Chlorine 155 ppm + Milk 1:200	470,000	470,000	590,000	230,000	340,000
Thermophile N_3—sugar					
Dowicide A 1:200 + Milk 1:200	390,000	610	1,500	2,100	1,300
Chlorine 155 ppm + Milk 1:200	390,000	260,000	210,000	133,000	29,000

0 no bacteria.

no germicidal treatment and the two machines receiving the respective germicidal treatments.

3. A solution of 1:200 Dowicide A compared very favorably with a solution containing 102 to 188 p.p.m. of chlorine as a germicidal agent in sanitizing milking machines. It has the added advantage of being a stable solution usable for a week or more without apparent deterioration in value.
4. Milk from the farm studied had a remarkably low bacterial count at all seasons in all three milking machines. The milk came from a herd which was free from mastitis, infectious abortion, and tuberculosis as demonstrated by bacteriological, serological and immunological tests. This, plus the sanitary precautions taken at milking time and the fact that the milk was cooled and plated within a short time, would explain the low counts. However, the bacterial counts were consistently lower from the milk taken from the two milking machines receiving a germicidal treatment than from the control machine receiving no germicidal treatment.
5. The phosphatase test was negative in every case for the samples of milk taken from the milking machine receiving the Dowicide A treatment.
6. Dowicide A is a very quick-acting germicide indicating its usefulness in rinse water.

New Procedure in Evaporating Milk to Save Shipping Space

A new method of making evaporated milk to enable processors to put 25 percent more milk solids in the standard can or case, and thus save valuable shipping space as well as considerable quantities of tin for defense uses, has been announced by the U. S. Department of Agriculture.

Evaporated milk made by the usual procedure contains only about 26 percent of milk solids—the maximum concentration that will stand the high temperatures of sterilization without curdling.

Dr. B. H. Webb and Dr. R. W. Bell of the Bureau of Dairy Industry, who devised the new procedure, found that if milk is forewarmed at temperatures considerably higher than the conventional 95° C., it may be concentrated to a milk solids content of 32½ percent, without curdling in the heat of sterilization. The extent of concentration depends somewhat on characteristics of the milk. Use of the new method in an evaporated milk plant would require only a tubular heater—a small item of expense in the average plant.

With evaporated milk containing 32½ percent solids instead of the usual 26 percent, a standard case of 48 cans would contain 226 ounces of milk solids instead of the usual 181, or nearly 25 percent more actual nutritive value per case. The new procedure would result in a net saving of 1.68 pounds of tin per 100 cases, and a net saving of 20 percent in the number of cases, tin cans, and shipping space required.

The Present Status of Homogenized Milk From the Physician's Point of View *

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The rapidly increasing use of fresh homogenized milk by the consuming public in many of our larger cities and towns has called into the front rank a variety of problems related to plant procedures, sanitary supervision, and public health.

Homogenization itself is no newcomer to the milk market. Its history dates back at least to 1899, when Gaulin, in order to prevent fat separation during milk transport, developed an apparatus consisting of a battery of fine capillary tubes through which milk could be forced. Three years later he originated the technique of forcibly pumping milk between two plane surfaces pressed together by a powerful spring. This principle lies behind most of the homogenizers in current use, although many improvements in the original device have taken place. The most significant innovation has been the development, in the past few years, of all-steel chambers and valves which can be completely dismantled and thoroughly sterilized.

More recently, sound waves or "sonization" has been applied to homogenization by Chambers (1). Commercially this process has been adapted to electromagnetic oscillators of the kind used in submarine communication and depth sounding. As milk flows slowly between two vibrating discs held 1/32 of an inch apart, sound impulses pass through it, shattering the cream aggregations and breaking down the fat globules.

Homogenized milk, when compared with ordinary market milks, is widely claimed to possess four distinctive advantages of medical interest and importance, namely: (1) uniform distribution of fat, (2) altered flavor, (3) high sanitary quality, and (4) altered curd properties resulting in better digestibility. This paper will limit itself to discussion of those aspects of these features which are of importance to the physician.

1. UNIFORM DISTRIBUTION OF FAT

Homogeneous dispersion of the shattered butter fat droplets is the most distinctive physical characteristic. The butter fat is uniformly available and the fat-soluble vitamins are evenly distributed. Removal of the cream and serving of skim milk as a substitute for the full strength product is not possible, and, as demonstrated by Kelly, school children who drink milk through straws inserted through bottle caps will not lose most of the cream content when they fail to drain the whole bottle. But on the other hand the elimination of the visible cream permits the possibility of reduction in butter fat content of milk without the consumer being the wiser.

Along with a number of other requirements, the pediatrician interested in raising babies would like to see the fat content of homogenized milk kept at a more or less constant level from day to day, free from marked fluctuations, and furthermore would appreciate being enlightened as to the approximate fat percentage of the milk he is prescribing.

In mixed milks, speaking generally, the average diameter of the butter fat particles is in the neighborhood of four micra, though variable and dependent on a number of different factors. Few particles are larger than ten micra. Shaking of milk throws the fat globules into repeated contact, so that they more readily clump together. Pooling of the milk-

* Paper read before the joint meeting of the International Association of Milk Sanitarians and The New York State Association of Dairy and Milk Inspectors, October 18, 1940.

ings from many cows of every breed and in all stages of lactation eliminates most of the differences among individual milk samples.

These facts have an important bearing on the phenomenon of cream rise, since, to quote Doan, (2) globules having a diameter of less than about 2.75 micra ordinarily do not rise in sufficient numbers to produce a visible cream line after a forty-eight-hour standing period. When the average size has been further reduced to near one micron by intensive mechanical treatment of the milk, analysis following centrifuging will reveal only small differences between the fat content of the upper and lower layers. With this degree of dispersion, particle clumping no longer takes place. The finer the dispersion, the more prominent becomes the layer of sedimented sludge at the bottom of the bottle unless clarification has been performed.

The definition for homogenized milk proposed by the United States Public Health Service* is designed to ensure extreme and efficient breaking down of the fat particles. From the standpoint of protecting the consumer, one wonders whether these specifications are perhaps too rigid, since some otherwise efficient apparatus may not shatter all milks as fine. For example, the fat particle dispersion achieved by the sonic apparatus is less than that attained with the high pressure machine, yet sonization does succeed in wiping out the cream line and clinical feeding trials show that such sonized milk possesses significant advantages over unprocessed milk.

2. ALTERATION OF FLAVOR

In this connection several observations are pertinent. One is that the majority of individuals seem to like the taste of homogenized milk better than that of the unprocessed product, and are therefore likely to increase their daily consumption of milk. Another feature of homogenized milk is its peculiar property of masking the scorched flavor which becomes apparent when pasteurization temperatures somewhat above the legal minimum have been employed. A study now in progress (3) on the many homogenized milks offered for sale in Philadelphia is showing that temperatures of at least 150° F. or even higher for thirty minutes do not injure the flavor. This capacity of homogenized milk to conceal augmented pasteurization heat is of obvious importance as a sanitary safeguard, because it both kills off more bacteria and gives a broader margin of safety to the pasteurization procedure.

3. HIGH SANITARY QUALITY

Many of the new problems stem from the desire of distributors to offer for sale a fresh milk so clean and digestible as to be suitable for infant feeding without much manipulation in the home. Of course there exists already a wide range of cow's milk preparations satisfactory for infant feeding, built on boiled milk, powdered milk, canned milk, acidified milk, and other modifications. Nevertheless, the availability of an attractive form of milk possessing unusual qualities of palatability, sanitation, and digestibility would seem of importance not only to babies, but to children beyond infancy, individuals with digestive difficulties, and old people.

All homogenized milk designed for infant feeding without being boiled must be processed in conformity with the highest sanitary standards. Of necessity pasteurization becomes an integral step in preparation, since the lipases which remain latent and inactive in unagitated raw milk become stimulated and activated following fat dispersal. These enzymes are destroyed by pasteurizing heat. One of the good features of homogenized milk is the necessity for its being pasteurized.

Last spring a large plant, laboratory, and feeding study on homogenized milk was completed in Philadelphia (4), using

* "Homogenized milk is milk which has been treated in such a manner as to insure the break up of the fat globules to such an extent that after 48 hours of storage no visible cream separation occurs on the milk and the fat percentages of the top 100 cc. of milk in a quart bottle, or of proportionate volumes in containers of other sizes, does not differ by more than five per cent of itself from the fat percentage of the remaining milk as determined after thorough mixing."

milk of Grade A quality with approximately 4 percent butterfat content. Included in the investigation were observations on two temperatures of pasteurization, 145° F. and 160° F., maintaining a thirty-minute holding period with each. Although all circumstances were not strictly comparable, due to shifts in bacterial counts on raw milk as seasons change, the higher heat treatment, as would be anticipated, killed off larger numbers of bacteria. At the higher temperature the count usually remained below 2,000 per ml. during the summer, and fluctuated around 500 per ml. during the winter months. With the lower value of 145° F., the summer counts on the finished product were somewhat higher, though never exceeding 10,000 per ml.

Further studies on plant processing are still in progress with the willing cooperation of dairies selling homogenized milk of both A and B grades. Holding temperatures of at least 150° F. for thirty minutes are being used, and all equipment is of the latest type and kept always in perfectly sanitary condition. Although the bacterial counts on the commercial raw milks show the usual differences between grades, the final bacterial counts on the daily output show no significant differences, and are comparable in quality with those observed in our laboratory study.

In many cities, there is considerable controversy regarding the relative efficiency of the homogenizing process as related in time to the heat treatment of pasteurization. Some sanitarians would prefer to subject the milk to pasteurization after it has been homogenized, as a precaution against contamination in the latter machine, whereas many plant managers are convinced that the plant operations are more efficient when pasteurization precedes homogenization. Certainly when heated milk flows through the high pressure homogenizer after leaving the pasteurizer, internal friction within the machine raises the temperature of the milk a few additional degrees. This can be considered a reassuring factor. In our own investigation, the processing steps had been, in order, clarification, pasteurization for thirty minutes, homogenization, and bottling. Over the fifteen months' period covered in the study, no undesirable occurrences were encountered which could be attributed to homogenization following pasteurization. There is need for carefully controlled studies in this field.

Clarification is generally recommended as a concomitant of high-pressure homogenization. Removal of sedimenting bacteria and leucocytes appears not to harm the nutritional properties of the milk, and from the aesthetic point of view is highly desirable.

For safety in infant feeding, low count milk free from pathogens is essential.

4. IMPROVED CURDLING CHARACTERISTICS

The present wave of interest in homogenized milk springs largely from a mass of new information concerning its curdling qualities. When cow's milk enters the human stomach, it encounters certain conditions of acidity, enzyme secretion, temperature, and motility which interact upon the milk to precipitate promptly the protein and trapped fat in the form of discrete but sticky cheesy masses. The size and character of these coagula depend on the interaction of factors both intrinsic in the milk and extrinsic to the gastric juice. Everything else being equal, milk which has been homogenized yields curds which are smaller and softer than those from unprocessed milk.

In order to study and measure the curdling characteristics of milk, several laboratory methods have been devised. The one most widely used is the curd tension test, in a form now somewhat modified from that originated by Hill in 1923. In this test warmed milk is made to coagulate by introducing a standard mixture of pepsin and weak hydrochloric acid; a special wheel-shaped knife is then forced through the stationary clot which forms. The resistance of the clot to the passage of the knife is its "curd tension." It has been shown by Theophilus (5), Chambers, Doan (6) and others, that re-

duction in curd tension of milk runs more or less parallel to the extent of fat particle breakdown.

A newer method of studying milk curds consists of a series of rubber bags which hang in a water bath kept at human body temperature. To milk placed in the bags, synthetic gastric juice composed of pepsin dissolved in hydrochloric acid is added. While the curdling proceeds an oscillating platform imparts wave-like movements. The coagulated masses of milk which are formed under these circumstances run closely parallel to those which actually form during human digestion, so far as can be determined.

The end results of homogenization up on the curds depend on a number of factors, such as the curd tension and other properties of the original raw milk, the circumstances of pasteurization, the technique of operation of the machine, and the state of mechanical efficiency of its parts. Not all homogenized milks yield equally small curds. Destruction of the cream line does not necessarily result in a soft curd milk. The homogenization must be done thoroughly and carefully. When properly processed, homogenized milk, speaking generally, gives rise to curds which resemble in magnitude and quality those from boiled milk.

Data from our laboratory indicate that the influence of customary pasteurization temperature—145° F. for thirty minutes —on the curd tension and curd size of raw milk is detectable but negligible. Conditions of 150° F. for thirty minutes have a small influence, but treatment at 160° F. for thirty minutes produces a significant effect. Such changes in the curd are in the same direction but supplementary to those induced by the fat dispersion.

In our study a large number of babies were satisfactorily raised on homogenized milk fed undiluted and unboiled and otherwise unmodified except for the addition of necessary soluble carbohydrate. One group of babies received unboiled formulas made from milk homogenized by sound waves (sonic process). A second group were given formulas made from milk which had passed through a homogenizer of the low-pressure type (750 pounds). The third group received formulas made from milk which had been forced through a high-pressure homogenizer (2,500 pounds). The fourth group —the controls—were fed identical formulas made from pasteurized unhomogenized milk which had been boiled for five minutes at their individual homes. The purpose behind this grouping was to compare the various kinds of homogenized milk with each other and with boiled milk, which is one of the standard modifications of cow's milk widely used in infant feeding.

The study lasted more than a year, and included plant, laboratory, and clinical observations. All the milk originated from a single source and was treated in a milk pasteurizing plant under strictly controlled conditions. Using the facilities of the out-patient well-baby clinic of a large hospital and of several infant feeding stations and infant nursing homes, some 800 healthy babies—divided into the four comparable groups—were fed the various kinds of milk. The babies were transferred to these formulas on being weaned, as a rule, and only rarely were carried beyond the age of ten or eleven months. They were kept under careful medical supervision. For all four groups of babies, those on processed milks and those on unprocessed milks boiled in the home, the mean curves of growth were essentially identical and conformed to the accepted standard for healthy normal infants. Generally speaking, the children took their formulas well, and grew and throve normally. The number of gastrointestinal upsets was small, not much greater with one kind of milk than with another.

The making of formulas with homogenized milks was markedly simplified. Elimination of the steps of boiling, filtering, and cooling saved the nurses and mothers an appreciable number of minutes each day, and reduced the opportunities for accidental household contamination of the contents of the formula bottles.

It was concluded that pasteurization and homogenization of whole milk under the conditions of the study results in the creation of a milk product possessing soft curd properties and small curd characteristics, features much to be desired in the artificial feeding of infants.

Marked reduction of the curd tension levels was achieved with all milks used in the feeding experiments. The readings on high-pressure homogenized milk varied from 5 to 20 gm. (break-through) depending on the season of the year and the temperature used in pasteurizing. The low-pressure homogenized milk and the sonized milk ranged between 10 and 30 gm., with the former giving readings which were a little higher than those given by the sonized product pasteurized at the same temperature. The raw milk ranged from 40 to 60 gm. Readings on the pasteurized milk before boiling were usually a few grams lower than on the raw milk. After boiling for five minutes the level fell to 5 to 10 gm. The curds which formed in the artificial digestion chamber showed alterations of the same general character as those observed with the curd tension apparatus.

One must emphasize that the choice of one form of milk, such as homogenized milk, over other available kinds of modified milks for infant feedings is a matter for individual physicians to decide. We would all agree in theory, however, that the availability at a later age of a milk with digestion characteristics equal or superior to a modified milk is highly desirable.

Homogenized milks which are recommended to the physician for infant feeding present specific health problems which demand attention from dairy sanitarians. These problems are concerned with regulation of freshness, uniformity, and high quality; with maintenance of the fat content at a level of optimal desirability and limited day to day variability; with recommending techniques for plant operations; with setting standards for sanitary excellence in terms of low bacterial counts, and for good digestibility in terms of curd tension or curd size values; and finally with creating organizations or regulations which will serve to control and check on the bottled product. If homogenized milk is to be fed to babies without being boiled, it must be processed in conformity with conditions which yield the best obtainable results. The pediatrician and the public need some warranty to this effect. The medical profession, the dairy sanitarians, the milk distributors, and the milk producers must work hand in hand in the development of standards, regulations, and control so that the ultimate consumer receives absolute protection.

Some steps in this direction are being worked out in Philadelphia. Over the country as a whole the status of homogenized milk is not yet at such a uniformly high peak that indiscriminate feeding of normal babies without boiling of the milk can be considered safe. Minimum standards must receive general recognition and adoption.

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Studies of the Resazurin-Rennet Test *

(Preliminary Report)

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There is a growing interest on the part of health officials in deck tests to supplement field inspections. The ideal test is one which, in addition to being inexpensive, gives results in a short time, can be performed on a large number of samples without undue fatigue, and will give an accurate picture of the quality of the milk under test. None of the commonly used platform tests meet all of these specifications. In addition it was felt that in reflecting actual farm conditions through laboratory examination of milk samples, most of the tests were inadequate. It is true that all of the tests will detect a certain amount of poor quality milk but it is equally true that the same tests will fail to detect all of it. Thus it is known that only a small fraction of the milk from mastitis cows is ever detected by any one test and eliminated from the supply.

About a year and a half ago it was decided to study the application of the resazurin test as described by Ramsdell, Johnson, and Evans. (1) Before final arrangements could be completed, i.e. time allotted and equipment assembled, we secured from England a reprint of an article in which J. T. Davis (2) of the National Institute for Research in Dairying, University of Reading, described a new test, the resazurin-rennet test. In his words it "fills the need for a simple quick method which will assess the desirable qualities in milk." The test, it is claimed by that author, will give the operator all the essential information as to the bacteriological and chemical quality of the milk under test. It was decided to include this test in our program.

As finally set up our plan called for the simultaneous testing of replicate samples by the methylene blue reduction method, the resazurin test, the resazurin-rennet test, together with the direct microscopic examination of a film from the same samples. All of the milk was to be subjected to the odor test following the usual commercial procedure. The main feature of the program was to relate the findings of the deck tests to actual farm and herd conditions. To this end inspections of the utensils and cooling facilities on the farm and the veterinary examinations of the milking animals was undertaken.

SAMPLING

Samples were collected from the mixed milk in the weigh vat. A copper dipper of some 35 ml. capacity was used. This was "sterilized" between samples by the method recommended by the New York State Department of Agriculture and Markets. (3) Three portions of 10 ml. each were distributed in separate tubes and from one of these the samples for direct microscopic examination was withdrawn.

TESTS AND INTERPRETATIONS

Odor Test. All cans of milk were smelled by the plant operator. Milk was accepted or rejected by the plant on the basis of this man's judgment.

Methylene Blue Reduction Method. Standard methods of the American Public Health Association (4) were followed in the preparation of the dye solution in the setting of samples and in incubation temperature. The results were read at the end of one hour and two hours' incubation. Milk which remained blue for

* Presented at joint meeting of the New York State Association of Dairy and Milk Inspectors, and the International Association of Milk Sanitarians, Oct. 17-19, 1940, New York, New York.

two hours was considered of fair or better than fair quality.

Resazurin Test. The procedure described by Ramsdell, Johnson, and Evans (1) was followed, 0.1 of a 0.05 percent solution of Eastman resazurin was added to 10 ml. of sample. Results were read at the end of one hour. All milk which remained blue was considered to be of good quality. Color changes toward pink and white were taken to indicate milk of inferior quality.

Direct microscopic examination was carried out according to standard methods of the American Public Health Association with the following changes. The samples were removed from the tube by means of a platinum loop designed to deliver 0.01 ml. Staining was by means of the Newman's #2 combined stain.

The resazurin-rennet test used is described by Davis (2) as follows:

"Solution required.

"Place 10 ml. of 0.05 percent resazurin (Eastman) in a 100 ml. cylinder, add 0.1-0.2 ml. commercial rennet and make up to 100 ml. with glass-distilled water. The strength of rennet should be so adjusted that normal milks clot in $> \frac{1}{2}$ but < 1 hour. A normal milk may be defined as bulk milk from cows in full lactation, free or almost free of mastitis, and of fairly low count ($< 100{,}000$).

"The solution should be discarded after 1 hour as the rennet enzyme is inactivated in dilute solution. For this reason only sufficient quantity to perform the number of tests required should be made up, e.g. 50 ml. for 50 tests. It is more convenient to add, eg., 1.5 ml. of a 1 in 10 rennet solution instead of 0.15 ml. rennet.

"Apparatus.

"(i) Water bath at 37° C. with rack for test tubes. (ii) Standard B.S.I. test tubes etched at 10 ml. and with rubber bungs. (iii) 1 ml. pipettes.

"Method.

"The calibrated tubers are filled to the 10 ml. mark with the samples to be tested and 1 ml. of the resazurin-rennet solution added, a sterile bung inserted the contents mixed by inversion and the tube placed in a water bath at 37° C.

"Recordings.

"The tubes are examined after ½ and 1 hour. This permits the detection of bad, intermediate, and good quality milks from both the chemical and bacteriological points of view. If desired they may also be examined after ¼ and 2 hours, which permits the detection of very bad and very good milks. The color of the dye (blue, lilac, mauve, mauve-pink, pink, or white) and clotting of the milk are recorded side by side. Clotting is detected by tilting the tube. If the coagulum leaves the side of the tub it is recorded as "soft clot" (sC), and if clotting has merely begun, as indicated by thickening, it is recorded as "viscous" (V).

"Discussion of test.

"The test combines in a simple manner the resazurin and rennet tests. The former is a dye which is easily reduced by bacteria and cells in milk, and the latter an enzyme whose speed of clotting milk is affected by changes in chemical composition of the latter as the result of mastitis or other abnormalities. Broadly speaking, we may classify the resazurin results as follows:

No change in original color (blue) after 1 hour=Good.

No change in original color (blue) after ½ hour but change after 1 hour=Indifferent.

Change to mauve, mauve-pink or white (colorless) in ½ hour=Bad.

The rennet reactions are similarly classified as follows:

Clot in ½ hour .....=Fast
Clot in $>$ ½ hour but $<$ 1 hour....=Normal
Not clotted in 1 hour .....=Slow

" . . . Rapid clotting is due to acid conditions either as the result of bacterial growth or because the milk is from recently calved cows, many of which give milk of high acidity. Slow clotting is due to chemical abnormality, such milks usually being of low acidity (high pH), low casein and calcium, and high globulin. A large number of comparative tests has shown that the resazurin does not affect the results of the rennet test. Clotting may slightly accelerate the reduction of resazurin, and when clotted the resazurin milk is somewhat paler in color than otherwise. This is presumably an optical effect and does not seriously affect the result, as with resazurin it is primarily color quality which is measured.

In our work we have abridged these directions somewhat.

1 The results were read once at the end of 1 hour of incubation.
2 No attempt was made to evaluate changes in color, that is, the samples either remained blue or showed a change in color.
3 Four types of results, namely 2, 3, 8 and 9, as listed in the preceding table covered all of the milk tested by us.

Using the above procedures 730 samples were tested. All of this milk had passed the odor test prior to sampling.

RESULTS

Where used in this discussion the word quality refers to commercial desirability and does not necessarily imply safety.

Odor Test. Only seven cans of milk were rejected by the plant operators because of poor odor. Sample from all seven cans were subjected to the four tests. Of the seven, three decolorized methylene blue in two hours or less; six caused a color change in the resazurin test; six had a direct microscopic count of over 100,000; all were found unsatisfactory by the resazurin-rennet test.

Methylene Blue. Of 730 samples, 24 or 3.2 percent decolorized methylene blue in two hours or less.

Direct Microscopic. Of 730 samples, 52 or 7.1 percent had a direct microscopic count of 100,000 or over.

Resazurin. Of 730 samples, 137 or 18.7 percent had changed in color toward pink after one hour incubation.

Resazurin-rennet. Of 730 Samples, 266 or 36.4 percent were classed as unsatisfactory either because of failure to coagulate or because of a change in color or because of a combination of both reactions.

On the basis of this series of tests it appeared as though a considerable amount of poor quality milk was escaping detection by some of our most commonly used tests. Conversely, the resazurin-rennet test appeared to be a highly efficient method of eliminating a large volume of milk of questionable quality from fluid supplies.

Naturally such performance raised some questions—was the test condemning milk of satisfactory quality? Was the milk condemned actually produced or handled so as to impair its quality? Was milk of poor quality escaping detection?

To answer these and other questions it was decided to evaluate this test, not by comparing results with other commonly used standard tests but by relating the results to actual farm and herd conditions. This plan was feasible because test results were available early enough in the day so that follow-up work on the farm could be done on the same day on which the samples were taken.

The field work consisted of the actual inspection of milking utensils, cooling and storage facilities and methods, together with a detailed and complete udder examination of each cow in the milking herd, by veterinarians of the New York State Department of Health especially qualified for this type of professional service.

The udder examination of the milking animals consisted of the digital manipulation of the glandular tissue of each quarter, and a careful check of the teats, teat canals, and superficial surfaces of the udder for injuries. In addition, a visual examination of the freshly-drawn secretion of each quarter of the udder in clean test tubes with special attention to the presence of flakes, clots, stringy or watery milk or the presence of red blood cells were made. The specimens were then subjected to the bromthymol blue test.

Sixty-one farms were investigated. Among these were a number on which, according to the deck tests, production and herd conditions were good.

The findings are summarized in Table 1.

SUMMARY

Replicate tests of 730 weigh vat samples of milk which had passed the odor test were made by the methylene blue test, the direct microscopic examination, the resazurin test and the rennet-resazurin test—3.2 percent decolorized methylene blue in two hours or less—7.1 percent showed a count of over 100,000 by direct microscopic count—18.7 percent caused color changes indicating poor quality in the resazurin test, and 36.4 percent were classed as unsatisfactory by the resazurin-rennet.

Accuracy of the tests in detecting unsatisfactory farm conditions based on the series checked was as follows: methylene blue 14 percent, direct microscopic 23 percent, resazurin 50 percent, resazurin-rennet 89 percent.

CONCLUSIONS

Under the conditions existing during this study, the odor test detected only a small fraction of poor quality milk on the receiving deck. A considerable amount of poor quality milk escaped de-

TABLE 1.

Summary of Farm and Herd Conditions as Compared with Deck Test Results

Test	Unsatisfactory by farm inspection			Satisfactory on farm inspections					
	Unsat. by test (agreement)	Satis. by test	Total unsat. farms	Unsat. by test	Sat. by test (agreement)	Total satis. farms	Total agreements	Total disagreements	Total farms
					Numbers				
Methylene blue	6	38	44	0	17	17	23	38	61
Direct microscopic	10	34	44	0	17	17	27	34	61
Resazurin	22	22	44	0	17	17	39	22	61
Resazurin-rennet	39	5	44	4	13	17	52	9	61
					Percentages				
Methylene blue	14	86	100	0	100	100	38	62	100
Direct microspocic	23	77	100	0	100	100	44	56	100
Resazurin	50	50	100	0	100	100	64	36	100
Resazurin-rennet	89	11	100	24	76	100	85	15	100

tection when the methylene blue test, the direct microscopic examination, or the resazurin test were employed alone.

The resazurin-rennet test appeared to detect more milk of unsatisfactory quality than any of the four other tests employed.

The accuracy of the resazurin-rennet test in detecting improper farm and herd conditions was much greater than any of the four other tests.

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Refrigeration of Precooked Ham. Health News, N. Y. State Dept. of Health, **18**, 10-11 (Jan. 20, 1941). *Pub Health Eng. Abs.* xxi, Mi, 23.

A number of small outbreaks of food poisoning have been reported in New York State in recent years in which the epidemiological evidence clearly pointed to ham as the source of infection. One of these was apparently due to eating precooked ham. Laboratory examination of a specimen of the ham revealed large numbers of *Staphylococcus aureus*, and a Gram-negative bacillus with characteristics of *B. coli*. Precooked hams which are not refrigerated are apt to become contaminated. "It would appear, therefore, that so-called tenderized or precooked hams are a good medium for the growth of staphylococci and other microorganisms and that they approach custard-filled pastries as perishable foods requiring careful handling and proper refrigeration up to the time of consumption."

ELMER W. CAMPBELL.

The Need of Sanitary Control in the Dispensing of Frozen Dairy Products *

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INADEQUATE FACILITIES

A large proportion of frozen desserts are manufactured in a white tiled plant provided with modern machinery and handled by trained workmen who look after the product from start to finish like a trained nurse handling a new-born baby. This product is now delivered to many different types of places. Some are clean and sanitary; others are filthy and dirty.

They may be placed in a refrigerator cabinet used to store meat, vegetables, soft drinks, and other food materials. Now it isn't that the other foods are necessarily dangerous, but most of them are raw products and will be cooked before using while the frozen dessert is a finished product and is ready to serve. There is no further treatment to insure its safety. Furthermore, it is an easily contaminated food, susceptible to odors and bacterial contamination. Hence, we enact the regulation that ice cream cabinets shall be used only for frozen desserts.

Then there is the question of inadequate refrigeration facilities. Many places are small and do not have sufficient room for adequate storage facilities. This is especially true of small places attempting to manufacture frozen desserts. They do not have sufficient space to store the mix and the many different kinds of ice cream and frozen desserts which the public demands. The result is inadequately cooled, crowded, and dirty refrigerators.

FROZEN DESSERTS A SIDELINE

Possibly the greatest criticism against the dispensing of frozen desserts is the fact that it is only a sideline. For this reason, these products are not given serious attention and receive the same treatment as a patent medicine, a bushel of potatoes, or canned vegetables. When one considers the many different types of places from which frozen desserts are served, one can readily understand the reason for this. They are dispensed from restaurants, drug stores, candy stores, groceries, dairy bars, 5 and 10c stores, beer gardens, roadside stands, and every conceivable sort of place.

In such places, frozen desserts are just one of many articles which are sold. The operators do not have the time nor take the trouble to care for them as they should. Therefore, they receive no special consideration. In a modern ice cream plant, frozen desserts are an only child and are treated with great care and consideration.

TYPE OF EMPLOYEE DISPENSING FROZEN DESSERTS

Even more important than the places from which frozen desserts are served is the type of people serving them. In the plant in which they are manufactured, the employees are taught the potential health hazards of the product with which they are working. Some of us advocate the licensing of the persons directly connected with the manufacture of frozen desserts and other dairy products in order to reduce the hazards to a minimum. This seems inconsistent in view of the way they are subsequently handled.

In many of the places dispensing ice cream, the employees are paid low wages which is not conducive to a high type of worker. The labor turn-over is frequent.

* Presented at Ice Cream Short Course, University of Illinois, Urbana, Ill., March 17-21, 1941.

No sooner is a worker taught the correct way to handle frozen desserts than he finds a better job paying higher wages. This combination of circumstances leads to highly undesirable conditions in dispensing them.

Who in this group has not gone into such a place to buy a dish of ice cream and left disgusted. Some people have told me that they have gotten up and walked out of such places. Here is a typical picture. You go in to purchase a refreshing delicacy. You find a young boy or girl in their teens dressed in a none too clean white apron or dress. If you sit at a counter, you see a pile of dirty dishes stacked high along side of a sink. They are busy washing the dishes and glasses in still dirtier water. The dishes and glasses are given a quick swish through the water and are dipped into another sink containing none too clean water. While thus engaged, they look up and ask, "What will it be?" About this time, you should get up and walk out if you have any regard for your health. Conditions like this should not be tolerated and I am happy to say are not being tolerated in many cities.

It has been shown that dishes can and do carry harmful bacteria. Cummings, who has done a great deal of work on eating-utensil sanitation, showed without a doubt that in army camps improper washing and drying of dishes, silverware, and glasses were the means of carrying a great many infections. Data from his work and that of other investigators support the thesis that improperly washed eating utensils are important carriers of saliva-borne diseases. Dishes washed in the ordinary way leave about one-third of the bacteria originally present. When one considers that there are many carriers of pneumonia and that one percent are distributors of tuberculosis, then some idea may be gained of the hazard of improperly washed eating utensils. Such diseases are septic sore throat, trench mouth, and diphtheria in addition to pneumonia, influenza, and tuberculosis are other diseases under inspection in utensil sanitation. Evidence either direct or indirect has implicated all of them in this connection.

The greatest difficulty in many places serving ice cream is the inadequate facilities for properly washing the eating utensils. They may be located in a drug store or in other places where space is at a premium so that adequate facilities for hot water and dish washing equipment are lacking.

Public health officials are taking cognizance of the hazards that exist in connection with soda bars, restaurants, places serving alcoholic and soft drinks, as well as public eating places in general as evidenced by the activity of the American Public Health Association in this direction. There is now a suggested procedure for determining the bacterial content as well as standard methods for the examination of dish-washing devices. In addition to this many cities have passed ordinances requiring a certain standard of cleanliness as judged by the bacteriological examination of the eating utensils.

DIPPER CONTAMINATION

Not only is the method of washing dishes at places serving ice cream objectionable, but also the manner in which the scoops used to serve the ice cream are handled. They are usually left in either still or running water for several hours or longer. During this time there is a sufficient accumulation of ice cream so as to make an ideal medium for the growth of bacteria. The containers in which the scoops are kept are exposed to the salivary spray of the attendants by their coughing, sneezing, or talking, thereby inoculating the scoop container. We have demonstrated that there was a correlation between the general sanitation of the retail establishment and the bacterial content of the dipper water. Those showing the highest count in the dipper water did not receive a high sanitary rating.

Some cities now require that all scoops or other implements used in dishing ice cream be kept in water flowing at such a rate so as practically to eliminate the possibility of reproduction and growth of bacteria. Krog and Dougherty sug-

gest as a result of their work that contamination from this source can be greatly reduced by placing the scoops or other dispensing utensils on a dry rack protected from flies, dust, and other contamination, instead of in water, and rinsing after and before each use, with either hot or cold tap water. This is an excellent suggestion, less expensive and is effective in reducing contamination.

A NEW PROBLEM IN DISPENSING

L. C. Bulmer, Director of the Bureau of Food and Dairy Inspection, Birmingham, Alabama, brings to light an aspect of dispensing frozen desserts which some of you may have encountered or which may exist without your knowledge. It is of sufficient interest to bring to your attention. He states: "The Department of Health of the City of Birmingham, Alabama, in 1940, required popsicles and similar ice cream novelties to be distributed and sold in a completely sealed package or wrapper in order to make tampering with the same immediately obvious to the consumer. Such products are frequently held by peddlers for indefinite periods of time before sale and many instances of tampering, such as licking, have been reported.

"A practical means of sealing such packages or wrappers presents a problem which has not yet been entirely solved. The following steps toward progress have been made:

"1. The use of a hand-operated stapling machine which inserted brads or staples in the bag or container on each side of the stick This proved unsatisfactory in that the staples tore out on handling and occassionally a child's thumb was punctured in removing the staple. Too, there was the hazard of staples getting into the product.

"2. The method of sealing the container by use of a specially prepared adhesive tape. This did not prove practical as storage caused the tape to lose its adhesive properties.

"3. In the process of being studied are two other means of sealing. Both make use of a container which encloses the popsickle stick. One is a container which has a glue lip across its inner edge and is sealed by the application of heat. The other is the use of a paper punching machine which makes a series of interlocking punches all the way across the end of the bag. At present, both lend promise toward a satisfactory solution to the problem.

"To afford a satisfactorily sealed container, the following factors are involved:

"From the public health point of view:

(a) To provide complete protection for product.

(b) To render tamper-proof and seal in such manner that requires tearing of container to remove product.

"From the industry's point of view:

(a) To retain present low cost container.

(b) To provide low cost equipment of sealing container.

(c) To enable rapid and automatic sealing of product.

(d) To involve little or no additional labor cost to perform operation."

SANITARY FACTORS IN SERVING

Bacteriological analysis of the fruits, flavoring syrups, dipper water, spoons, and dishes, as well as the ice cream in 50 different establishments showed that the dipper water consistently contributed the greatest number of bacteria to a dish of ice cream of any of the items studied.

Of the syrups chocolate syrup contributed the most bacteria. One sample showed a count of 2,170,000 per ml. and many samples showed the presence of coliform bacteria. Of the fruits, strawberries and cherries contained the most organisms. One sample of lemon syrup had a yeast content of 11,000,000 per gram.

The dishes and spoons showed a comparatively small number of bacteria. However, both cities in which the study was made have regulations covering the washing of dishes, glassware, and silverware which are enforced.

DISHWASHING

Many cities now require that all the dishes, silverware, and glassware used in serving be properly washed. Dishes, glasses, and spoons used in serving frozen desserts should be washed in water at 140° F. to which has been added one percent of a detergent. Lower temperatures may be used but there is corresponding loss of germicidal effectiveness at lower temperatures such as 110, 120 or 130° F. Water at a temperature of 140° F. to which has been added one percent of a good detergent is the lowest best practical temperature to use.

After the dishes, glasses, and spoons are washed, they should be rinsed in water at a temperature of not less than 170° F.

DIFFICULTIES OF OBTAINING HOT WATER

An abundant supply of hot water should be required of all places serving the public food or drinks. I appreciate that this is easier said than done. Just last week an engineer who designs such equipment for a large manufacturer told me that they had trouble making hot water heaters that would supply a volume of hot water at 180° F. He said that after the temperature arose above 160° F., there was trouble with water vapor.

Unless hot water is from 10 to 20 degrees above the desired temperature, there is too great a heat loss when it is added to the dishes or after it has been used for some time.

A simple, inexpensive, yet very efficient dish washer designed and used by a small operator in our town consists of two steel drums approximately 24 x 30 inches with a drain at the bottom. Under each is a gas burner to heat the water to any desired temperature up to boiling. Dishes are washed in the first drum and placed on a dipping rack and rinsed in 170 to 180° F. water by dipping them in the second drum after which they are placed on a rack and allowed to dry themselves. Care is used in handling the rinsed dishes so that only the edges are touched. Tests show that many of them are sterile and none have high bacterial counts. Some simple inexpensive device such as this is often superior in small places to more expensive and elaborate equipment.

CONCLUSION

In conclusion it can be said that frequently the sanitary precautions taken in producing frozen desserts by a trained personnel in a sanitary plant are nullified by dispensing the product in insanitary places by untrained employees who do not appreciate the nature of the product with which they are working.

Dishwashing facilities are inadequate in many places serving frozen desserts. There is not sufficient hot water or space to wash the dishes properly.

Dippers used in serving frozen desserts should be kept in running water or washed and placed in a suitable rack. They should not be permitted to stand in a basin of water for long periods of time as is frequently the case.

Thermoduric Bacteria in Pasteurized Milk. A review of Literature. J. L. Hileman. Jour. of Dairy Sci., 23, 1143-1160 (Nov. 1940). *Pub Health Eng. Abs.* xxi. Mi, 14.

Thermoduric bacteria most commonly found in pasteurized milk are generally some species of micrococci. These thermoduric or heat-resistant micrococci usually find their way into a milk supply from improperly cleaned and sterilized utensils on the producing farm. Milking machines have been found to be a very common source of these organisms. Likewise, several different species have been isolated from cultures taken from milk cans.

It has been found that many species of these micrococci are normal inhabitants of the bovine udder and that the milk itself is continually seeding the farm utensils. Improved sterilization methods not only do not kill these organisms, but in many instances tend to enhance their heat-resistant characteristics. Some forms of chemical sterilization with the hypochlorites and chloramines tend only to dessiccate the cells and thus increase their thermal resistance.

Any effort to reduce materially members of heat-resistant bacteria in a pasteurized-milk supply must of necessity be accompanied by a campaign to improve sanitation and sterilization methods on the farm.

CURTICE B. WILLIAMS.

Legal Aspects

Restaurant Law Held Invalid*

(Wisconsin Supreme Court; *State ex rel. F. W. Woolworth Co.* v. *State Board of Health et al.*, 298 N.W. 183; decided May 20, 1941.) (Chapter 440 of the Wisconsin Laws of 1935 added to the Wisconsin statute relating to the licensing of restaurants a subsection which provided that no permit should be issued to operate or maintain any restaurant where there was conducted any other business, except the sale of fermented malt and nonintoxicating beverages, intoxicating liquors, chewing gum, candies and other confections, or newspapers, unless such restaurant and the kitchens or other places used in connection therewith were completely and effectively separated from such other business in the same room or place by substantial partitions extending from the floor to the ceiling with self-closing doors for ingress and egress. The provisions of this subsection were applicable only to restaurants commencing business after the effective date of the subsection.

In a mandamus proceeding in which it was sought to compel the State board of health to grant a permit to conduct a restaurant, it was contended by the relator that the added subsection was void under the Federal and State constitutions as denying to it due process and equality before the law. The supreme court took the view that the contention of the relator had to be sustained and said that, the amendment being void, the existing statute remained in force. The basis for licensing the business involved, said the court, was that it was required for the protection of the public health and safety. "If protection of the public health and safety requires partitions in case of a business subsequently to be commenced, then by the same token it requires them in case of existing businesses; and if one operating an existing restaurant is not required to maintain the partition, and one about to establish a restaurant is required to maintain one, then manifestly the latter is denied equal protection with the former."

* *Pub. Health Repts.* 56, 1440 (1941).

Attack on Milk Ordinance Defeated *

(California District Court of Appeal, First District; *Natural Milk Producers Ass'n of California et al.* v. *City and County of San Francisco et al.*, 112 P.2d 930; decided May 1, 1941.) In a suit in which the plaintiffs were not successful in having enjoined the enforcement of certain provisions of a milk ordinance of the city and county of San Francisco, some of the matters considered by the court were as stated below.

One provision of the ordinance was that (a) certified milk, (b) guaranteed pasteurized milk, (c) grade A pasteurized milk, and (d) grade B pasteurized milk, and no other milk should be sold for human consumption. The plaintiffs claimed that the prohibition of the sale of nonpasteurized guaranteed raw milk and grade A milk was void because in conflict with a general statute, the agricultural code. But the court said that it did not find a single provision of the general statutes which stated in effect that guaranteed milk, grade A milk, and grade B milk need not be pasteurized before being sold in San Francisco.

Regarding a contention that the ordinance granted special privileges and immunities to certain vendors which were denied to others, the court said that, as there was nothing in the ordinance that would have prevented any one of the plaintiffs from applying for a permit to sell any one of the grades of milk mentioned it was patent that they could not assert that any special privilege had been granted to others which had been denied to them.

Another claim of the plaintiffs was that the ordinance contained invalid provisions delegating legislative powers. The provision regarding certified milk stated that such milk was market milk which conformed to the "rules, regulations, methods and standards for the production and distribution of certified milk adopted by the American Association of Medical Milk Commissions" and had to bear the certification of the milk commission of the San Francisco County Medical Society. It was argued that under this provision the American Association of Medical Milk Commissions was delegated the power to set the qualifications of certified milk. The court, however, found no merit in this contention. It said that, assuming that the association may from time to time change its rules and regulations and that certified milk would be greatly depressed in quality, the plaintiffs were not purchasers and could not complain. Also it was stated that the argument that the association may so amend its rules and regulations as to impose additional burdens on vendors of certified milk led nowhere. Finally the court said that, solely for the purposes of the instant decision, it would assume that the insertion of the words "rules, regulations," rendered said section invalid, but then went on to say that those words could be stricken out without in any manner affecting the rest of the ordinance.

Another contention of the plaintiffs dealt with the fact that the ordinance did not require certified milk, which was raw milk, to be pasteurized but did require all other grades of raw milk to be pasteurized. They asserted that the ordinance created two classes between which there was no "natural, constitutional, or intrinsic distinction." But the court said: "The record contains nothing which would warrant this court in holding that, as defined in said ordinance, certified milk is not as wholesome or more wholesome than any of the other grades of milk after they have been pasteurized. That being so no reason appears why certified milk should be pasteurized, no objection appears why the other grades of milk specified in the ordinance should not be pasteurized, and a valid distinction exists between certified milk (not pasteurized) and other grades required to be pasteurized."

Finally the court rejected the theory of the plaintiffs that the ordinance was unreasonable and, therefore, void. The trial court had found that allegation not true and the appellate court would not disturb its findings.

* *Pub. Health Repts.* **56**, 1289 (1941).

The New York City Health Department Wins Two Notable Court Decisions

Two decisions handed down recently by New York State courts add considerable force to the food laws and to the principle that the protection of the consumer should be the prime consideration in the application of these laws.

The first of these decisions, People vs. Swift & Co., (Inc.) Vol. 105, page 2679, N. Y. Law Journal 6/14/41, involved the question whether a conviction of the defendant for keeping unwholesome dressed poultry could be reversed on the ground that the defendant had acted in good faith and where evidence showed that the defendant maintained some kind of an inspection service.

The unwholesome poultry was found by inspectors of the New York City Health Department in a cellar refrigerator on the premises of the defendant. The defendant contended that this was a reserve supply which was always inspected prior to being offered for sale. However, it was established that the method of examination which consisted merely of opening the boxes of poultry and inspecting their breasts was not thorough enough to discover poultry which might be unfit for human consumption because of mold on the backs or hips of the chickens.

The Trial Court found the defendant guilty and imposed a fine of $100. The Appellate Division of the Supreme Court reversed this conviction on the ground that there was no guilty intent on the part of the defendant, in view of the fact that an inspection is maintained by the firm. However, on June 12, 1941, the Court of Appeals, the highest court in New York State, unanimously set aside the reversal by the Appellate Division and upheld the conviction by the Trial Court.

The Court of Appeals, in its opinion, ruled that violations of food laws are not excused by lack of guilty intent or by evidence of mere good faith on the part of the violator. Quoting from this opinion,

"The danger to human life and health from unwholesome food is so great that the courts generally have treated food differently from most other products. It has been placed in the same category as drugs, poisons and other instrumentalities which, if they are negligently dealt with, are ordinarily certain to affect seriously the public health and safety. The good intentions of the defendant would matter very little to consumers who might consume this poultry. Food laws are designed primarily, not for the punishment of the dealer, but for the protection of the consumer. In this field of law, the obligation to beware is on the seller rather than the buyer. Lack of proof of guilty intent does not satisfy that obligation."

The other decision, People vs. Benjamin Chase—Vol. 105, p. 2756, N. Y. Law Journal. 6/19/41, revolved about the point whether the responsibility for the sanitary conditions of a food plant rests solely with an owner corporation or also with an officer in charge of the business.

Benjamin Chase, an officer of a meat processing company, was convicted and fined $150 by the Municipal Term Court sitting as a Court of Special Sessions, upon the complaint of an inspector of the N. Y. C. Health Department, for allowing the establishment to be operated under insanitary conditions, in violation of Section 147 of the Sanitary Code. The defendant appealed his case to the Appellate Division of the Supreme Court on the ground that the corporation owning the business was solely liable for the sanitary violations. Furthermore, the defendant contended that the conditions reported by the inspector existed without his consent. The Appellate Division decision upheld the conviction unanimously. No opinion was written by this court.

The Appellate Division undoubtedly was in agreement with the Corporation Counsel who in his brief argued that, "Section 147 of the Sanitary Code for violation of which the defendant was convicted, provides, so far as relevant, that every person in charge of any room, factory, premises, or place where any food is manufactured or prepared must put and keep the same in a cleanly and wholesome condition." And further, "He (the defendant) is liable for that which is done with his knowledge, although not his consent, and knowledge may be proved by circumstantial evidence."

New Books and Other Publications

Meat for Millions. First Annual Report of the New York State Trichinosis Commission, Legislative Document No. 52, Fort Orange Press, Albany, 1941. 282 pages.

This is an exhaustive report on the prevalence of trichinosis as a disease and as a public health problem in the United States and particularly in New York State. The main part of the report, dealing with the technical aspects of the problem, is chaptered as follows: trichinosis as a disease, the apparent prevalence of human trichinella infestation, the relationship between the method of disposal of garbage and the incidence of trichinosis, the effectiveness of control of trichinosis through microscopic inspection of pork, results of studies in attempting to control through the skin testing of swine, the presence of the parasite in pork products on sale in New York State, educational efforts to control trichinosis, the licensing of slaughter-houses, tularemia, and discussion of meat inspection under Federal and state control.

Although the appearance and composition of the report are not very attractive, the book contains a wealth of good practical information. Copies can be obtained without charge while they last by writing to Senator Thomas C. Desmond, 94 Broadway, Newburgh, N. Y.

Food Analysis, by A. G. Woodman. Fourth Edition. McGraw-Hill Book Co., New York, N. Y. 1941. 607 pages. $4.00.

This new edition of the well-known textbook has been increased about ten percent over the previous edition, although the use of a larger page makes the book appear even larger still. The text and arrangement are essentially the same as in previous editions although new material has been added here and there throughout the text, with notable additions, as for example in the case of alcoholic beverages. The additions have served to bring the treatment more up to date, and also to elucidate the textual discussion. It is regretted (by this reviewer) that the author has treated the important application of the phosphatase test for the examination of pasteurized dairy products with only a paragraph, referring the reader to more advanced texts or reference sources. The value of the book as a text would also have been enhanced if the new method for the detection of mold in cream had been included, and this would have given opportunity, so to speak, for adding the commonly used microbiological technique for the examination of spoiled fruit products, since the use of the microscope is emphasized in the whole second chapter. Of course this would have led to the Breed direct microscopic examination of dairy products. A line had to be drawn some where.

The tone of the whole book has been raised in treatment and appearance. It is still the best book in its field of analytical procedure for student use.

JOURNAL OF MILK TECHNOLOGY

Official Publication of the

International Association of Milk Sanitarians

(Association Organized 1911)

THE JOURNAL OF MILK TECHNOLOGY is issued bimonthly beginning with the January number. Each volume comprises six numbers. It is published by the International Association of Milk Sanitarians, and is printed by The Chronicle Press, Inc., Orange, N. J., U. S. A.

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Association News

California Association of Dairy and Milk Inspectors

The California Association of Dairy and Milk Inspectors will hold their twenty-fifth annual convention in Sacramento, California, October 13 to 16, 1941. Dr. C. L. Megowan, Sacramento, is Chairman of the Reception Committee. Although the details of the program have not been released, enough is known that we can say that *Chairman* A. E. Reynolds of the State Department of Agriculture is preparing a program that no dairy and milk inspector of California can afford to miss.

At the last session of the legislature of the State of California, several new laws, relating to dairy and milk inspection were passed. It was made mandatory to install indicating thermometers on pasteurizing equipment. A minimum score of 80 must be maintained on milk products plants. Some new definitions were added to the Agriculture Code. Power was given to enjoin Code violations. Duplicate inspection fees were eliminated.

LEONARD E. NISSON,
Secretary-Treasurer.

The Chicago Dairy Technology Society

The government's request for more cheese and evaporated milk coupled with an increased demand for milk, butter and ice cream resulting from seasonal factors as well as the increased purchasing power and demand of the consumer, has kept our members unusually busy during the summer period. Milk prices to the producer and the consumer have been rising due to increased production costs and increased demand. The high prices paid by cheese factories are making it increasingly difficult for creameries and condenseries to maintain their desired volume of business. Rather acute shortages are expected in some fluid milk markets in the fall as a result of the increased demands for the use of milk.

As customary, there have been no meetings of the Chicago Dairy Technology Society during the summer months. The first fall meeting will be held at the Hotel Sherman on September 9, at 6:30. J. D. Ingle, program chairman, reports that Doctor G. M. Trout, Professor of Dairy Manufactures, Michigan State College, will speak on "Oxidized Flavors in Dairy Products."

P. H. TRACY,
Secretary

Kansas Association of Milk Sanitarians

The Kansas Association of Milk Sanitarians will hold its twelfth annual meeting at Kansas State College, November 13 and 14, 1941. The meetings will be held in Room 212, West Waters Hall.

Subjects of interest to all the milk sanitarians in the state will be discussed. It is hoped that the completed program will be available around September 15.

W. J. CAULFIELD,
Secretary-Treasurer.

Michigan Association of Dairy and Milk Inspectors

The Michigan Association of Dairy and Milk Inspectors have enjoyed a successful year. Carrying out the program begun three years ago of holding two meetings a year, the same schedule was followed this year. Both gatherings have exceeded the attendance records established in previous years.

The Annual meeting was held in Grand Rapids in March at the time of the Allied Dairy Convention and Show. In July the Annual Summer Conference was held at Michigan State College. One hundred twenty-five persons were in attendance for most of the three day session. Lectures and discussions occupied the forenoons and laboratory sessions the afternoons. Baseball, golf, a banquet, and "bull" sessions filled the spare time.

Almost everyone agreed that it was the most informative short course held.

The four committees appointed two years ago under the Chairmanship of Dr. E. F. Meyer of Grand Rapids to draw up regulations and coordinate farm, milk plant, ice cream, and butter standards have continued their good work.

The dairy farm and milk plant committees submitted their reports to the Working Committee of the Allied Dairy Association to be used in working up a state-wide model milk ordinance.

Four members of the Association representing three units of the Allied served on the committee. This committee has been working for nearly a year and hope to have the final draft of the ordinance completed very shortly.

No new laws were adopted by the Legislature this year.

Two prominent members of the Association are officers of the International Association of Sanitarians. They are Dr. F. W. Fabian and Dr. Russell R. Palmer. At least a dozen members are now planning to attend the INTERNATIONAL ASSOCIATION meeting in Tulsa in October.

HAROLD J. BARNUM,
Secretary-Treasurer.

New York State Association of Dairy and Milk Inspectors

The local committees headed by Mr. N. J. Hohl and Mrs. Marian Albee are urging members to bring their wives to the annual meeting of the Association at the Hotel Statler in Buffalo on September 24, 25 and 26, 1941. A full program of entertainment for the ladies is being developed.

Preliminary plans for entertainment of members and guests include a trip to see Niagara Falls at night under colored lights.

The technical program is about completed and includes many topics of current interest and of practical application to daily field work.

W. D. TIEDEMAN,
Secretary-Treasurer.

Pacific Northwest Association of Dairy and Milk Inspectors

The twenty-ninth annual meeting of the Pacific Northwest Association of Dairy and Milk Inspectors was held at Walla Walla, Washington, on June 26-7-8. More than 60 city, county, and state milk sanitarians and field men from Washington, Oregon, and Idaho were in attendance. Twelve interesting papers were presented.

The program was of a very practical nature in that subjects bringing the Inspector into close practical relations with the dairymen were discussed with actual field demonstrations.

It was felt by the program committee that the inspector has become more than just an inspector, and should be in a position to lend his services to all phases of the dairy industry, leading to a better understanding of conditions necessary for the production of a good, wholesome, clean, and sanitary product.

This was the largest attendance of any meeting so far in the history of the organization. The meeting next year will be at Salem, Oregon. A. W. Metzger, Chief of the Division of Foods & Dairies, of the Department of Agriculture, Oregon, is the newly elected President, and Frank W. Kehrli of the Milk Division of the Bureau of Health of Portland, Oregon, was re-elected as Secretary-Treasurer.

E. EUGENE CHADWICK,
President.

FRANK W. KEHRLI,
Secretary-Treasurer.

THIRTIETH ANNUAL CONVENTION
INTERNATIONAL ASSOCIATION OF MILK SANITARIANS
Tulsa, Oklahoma
HOTEL MAYO
October 27, 28 and 29, 1941

October 27th

Morning Session

Welcome

Dr. R. M. Adams, ***Superintendent of Health, Tulsa, Oklahoma***

Hon. C. H. Veale, ***Mayor, Tulsa.***

Dr. G. F. Mathews, ***State Commissioner of Health, Oklahoma City, Okla.***

Milking Machine Problems and Methods of Meeting Them

George H. Hopson, ***De Laval Separator Company, New York, N. Y.***

Milk Supply Requirements of the Eighth Corps Area

Col. W. Lee Hart, ***Eighth Corps Area, Fort Sam Houston, Texas.***

Interstate Trade Barriers

Joseph H. Taggart, ***U. S. Department of Commerce, Kansas City, Mo.***

Afternoon Session

Milk Supplies for the Navy

Lt. Commander Theodore R. Meyer, ***U. S. Naval Air Station, Corpus Christi, Texas.***

Public Health Service Restaurant Sanitation Program

A. W. Fuchs, ***U. S. Public Health Service, Washington, D. C.***

Applied Laboratory Methods (Report)

T. H. Butterworth, ***San Antonio, Texas***

Promotional Work in Milk Control (Movie)

J. R. Jennings, ***State Department of Health, Des Moines, Iowa.***

October 28th

Morning Session

Relationship Between the Veterinarian and the Milk Sanitarian

J. G. Hardenburgh, ***American Veterinary Medical Assoc., Chicago, Ill.***

Communicable Diseases Affecting Man

P. B. Brooks, M.D., ***State Department of Health, Albany, N. Y.***

Milk Sanitarians' Role in Milk Legislation

H. C. Eriksen, ***Department of Health, Santa Barbara, California.***

Milk Sanitation in Mexico

M. A. Heinzman, ***Ventura County Health Department, Ventura, Cal.***

Afternoon Session

Dairy Farm Methods (Report)

H. N. Parker, ***Department of Health, Jacksonville, Florida.***

The Progress, Cost, and Results of Electric Refrigeration on Dairy Farms

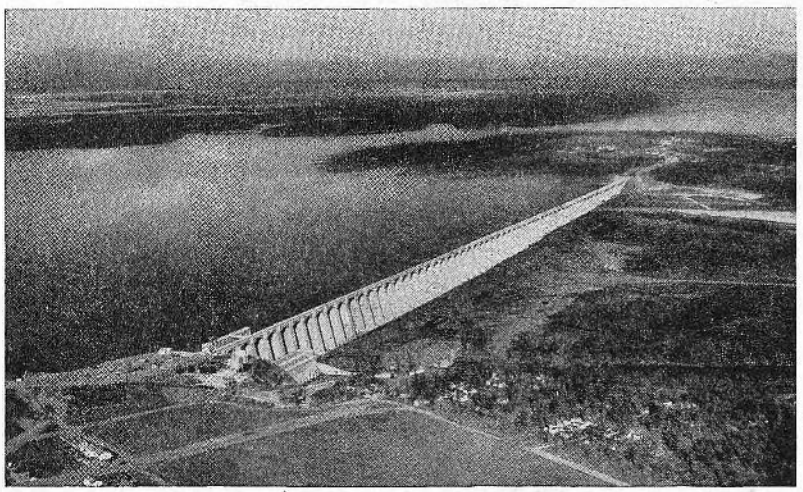
L. M. Graves and R. D. Bushong, ***Department of Health, Memphis, Tenn.***

A New Centralized Mass-Production System Applied to Milk

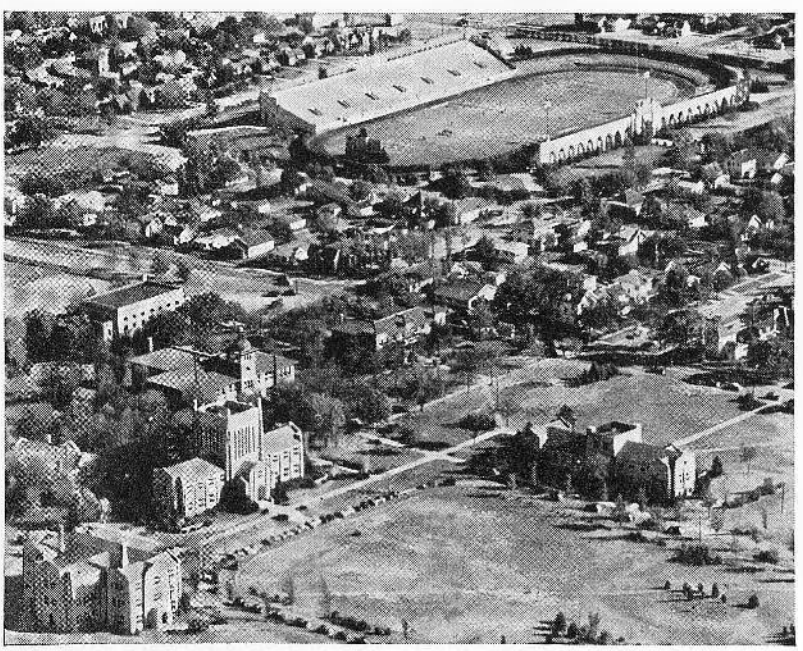
J. H. Shrader, ***Wollaston, Mass.,*** **and Wm. B. Palmer,** ***Orange, N. J.***

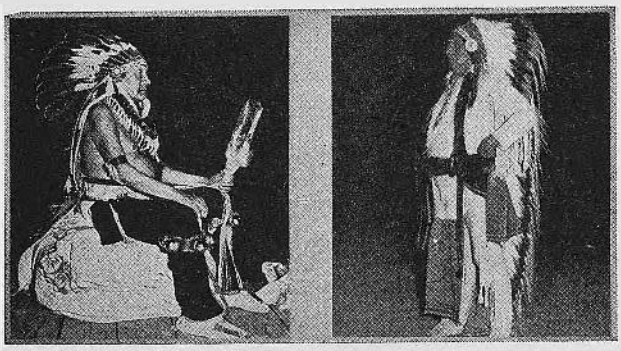
TULSA — OUR 1941 CONVENTION CITY

By R. G. Ross, D.V.M.
City Health Department, Tulsa, Oklahoma

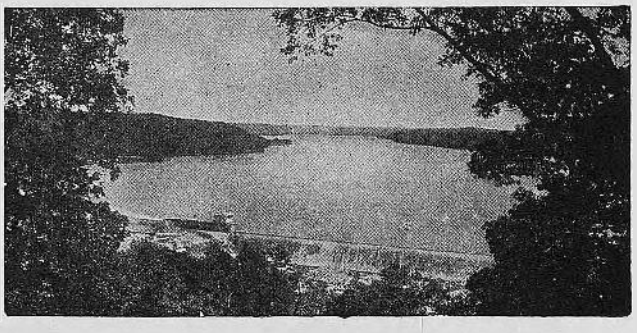


(Above) One of man's newest achievements, Grand River Dam in Northeast Oklahoma, on the road from the east to Tulsa. (Below) The University of Tulsa campus.

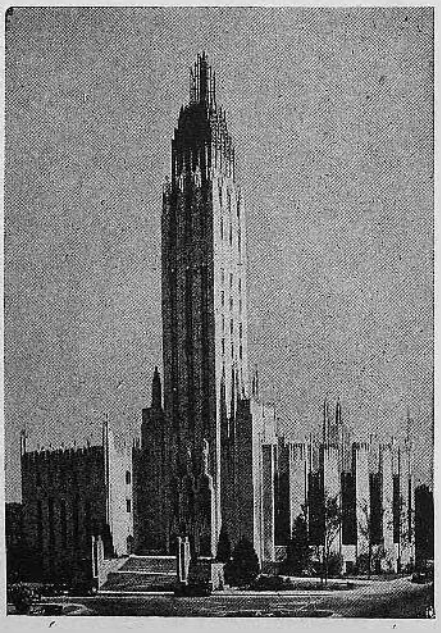




Dressed in tribal finery, these Indian chiefs preside over special ceremonies, now reserved for unusual occasions, near Tulsa, Okla., where the Milk Sanitarians will hold their annual convention, October 27, 28, and 29, 1941.



Drinking water comes from beautiful Lake Spavinaw, nestled in the Ozark foothills, 60 miles away.



One of the most unusual buildings anywhere is Boston Avenue Methodist church in Tulsa, shown at left.

This will be but one of many spots to be remembered by **International Association of Milk Sanitarians** conventioneers. Ladies are likely to visit Will Rogers Memorial, Philbrook Art Center, a country club and other places. At the banquet, the spirit of the old west for which Oklahoma is famous is expected to break out all over the place. Don't miss any part of the fun. Be there in *Tulsa, Okla., October 27 to 29, 1941,* for the BEST, held in the WEST. Hotel reservations should be made early. Write to the **Mayo Hotel,** headquarters, for details.

Farm Water Supplies

W. S. Johnson, *State Board of Health, Jefferson City, Mo.*

Bacteriological Control of Milk Quality

L. Little, *Sterling Meadow Gold Dairy, Oklahoma City, Okla.*

Evening Session

Banquet

October 29th

Morning Session

Can Washing Machines

W. B. Palmer, *Executive Officer, Milk Association of the Oranges and Maplewood, Orange, N. J.*

High-Temperature, Short-Time Pasteurization

M. B. Starnes, *City Department of Health, Dallas, Texas.*

Sanitary Procedure (Report)

W. D. Tiedeman, *State Department of Health, Albany, N. Y.*

Business Session

Afternoon Session

Inspection and Field Trips

New Members
International Association of Milk Sanitarians

*Bailey, J. L., Jr., Sales Representative, Johnson & Johnson, 105 Howard St., S.E., Atlanta, Ga.

*Bryant, C. B. A., Sales Representative, Johnson & Johnson, General Delivery, Box 455, Montgomery, Mich.

Connor, George E., Farm Dairy Inspector, Tulsa Health Department, 1244 So. College, Tulsa, Okla.

*Fleming, R. S., Director of Research Laboratory, Borden Company, 600 N. Franklin St., Syracuse, N. Y.

*Garis, E. N., Sales Representative, Johnson & Johnson, 358 Adams St., Freeland, Pa.

*Gilsdorf, A. G., Sales Representative, Johnson & Johnson, Fairy Drive & Chenoweth Lane, Louisville, Ky.

*Josephson, W. A., Sales Representative, Johnson & Johnson, 5 Stearns Road, Wellesley, Mass.

Keith, J. I., Professor and Head, Department of Food Engineering, Oklahoma A. & M. College, Stillwater, Okla.

*Kestner, N. J., Sales Representative, Johnson & Johnson, 4001 Alcove Ave., North Hollywood, Cal.

*Kihlstrum, E. E., Sales Representative, Johnson & Johnson, 1516 46th St., Des Moines, Iowa.

*Kimmer, L. C., Sales Representative, Johnson & Johnson, 940 South Pickwick St., Springfield, Mo.

*Kirley, Patrick E., Laboratory Technician, Wright & Wagner Dairy Co., 1343 6th St., Beloit, Wis.

*Koehler, R. L., Sales Representative, Johnson & Johnson, 1046 East Main St., Owosso, Mich.

Krehl, William Henry, Technician, 2903 College St., Jacksonville, Fla.

*Negus, A. I., Jr., Sales Representative, Johnson & Johnson, Martin's Ferry, Ohio.

Newman, J. X., Director, Montana Hygienic Laboratory, St. James Hospital Laboratory, Butte, Montana.

*Polwort, W. E., City Milk Inspector, City Hall, Enid, Okla.

*Settle, Lester L., Milk Sanitarian, Creek County Health Unit, 1103 E. Mcleod, Sapulpa, Okla.

*Smith, Leroy, Dairy Inspector, Tulsa Department of Health, 1304 So. Oswego St., Tulsa, Okla.

*Smith, William N., Yonkers Health Department, Yonkers, N. Y.

CHANGE OF ADDRESS

Milone, N. A. to State Dept. of Health, Middletown, N. Y.

Tetzlaff, Frank, McLean, Virginia (formerly 181 Park Ave., Freeport, N. Y.)

Thomas, Robert C. to State Health Department, Raleigh, N. C.

"Doctor Jones" Says—*

Well, I hear rumors of another of these cream puff outbreaks up the line a ways—not a very big one, from what they tell me. But it's about time we had another to sort of liven things up. That staphylococcus bug—yes, sir, it's a bad actor.

This so-called "cream filling" they put in cream puffs and eclairs and what not—it's just the kind of culture medium germs like. If the germs are there and you keep it at ordinary room temperature awhile they'll grow like—like—well, like germs. I can't think of anything right this minute that'll grow as fast.

You see these staphylococci—they're the common cause of boils and furuncles and so on and it ain't uncommon to find 'em on people's hands—if you take cultures, that is; and their specialty—you get 'em at just the right temperature in something they thrive on and they'll produce a poison (a toxin) that you take it in your stomach and it won't be long before you'll hear from it. In the course of a few hours you'll be due for a spell of gastroenteritis: stomach and bowel trouble, with gripes and all the fixings. It's like a pair of tight shoes: they don't very often kill anybody but they're terrible uncomfortable. Of course putting staphylococci in cream puffs—it ain't intentional but you know how people are sometimes: they ain't always as careful as they might be.

The trouble with this "cream filling" stuff—they cook it up all right but it's so thick it's hard to cool it down more'n so fast. Before it's thoroughly cold, if the bugs are there they've had time to get in their work.

Quite some time back they discovered trouble was coming from a lot of these cream-filled pastries put out by one concern: cases in several different places where they'd been distributed—and they weren't sure they'd located 'em all. So they sent out a notice to the papers—the Health Department did, giving the name of the concern and advising anybody that got any of that lot not to use 'em. One of the stores here—they told me a salesman came in and he says: "What do you think of those blankety blank blanks up there to Albany, putting out a notice like that! I wonder if they don't know," he says, "the effect that sort of stuff has on business." If he'd had a little personal experience with the effect of staphylococcus toxin on digestive business I reckon he'd have sung a different tune.

Yes—I'm fond of cream puffs and so on myself and it's possible to rebake 'em, filling and all, so they're all right. But I want to be darn sure they're doing it, myself, before I eat 'em.

PAUL B. BROOKS, M.D.

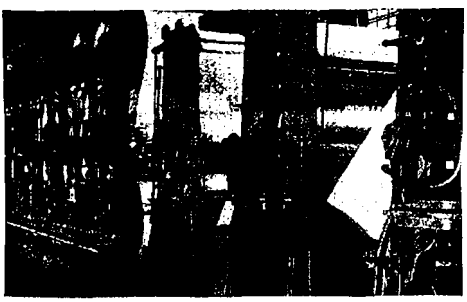
* *Health News*, New York State Department of Health, December 9, 1940.

Why Sealright Means Safer Protection

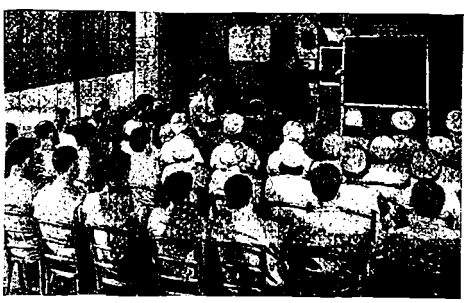
For Milk and Dairy Products

When the Sealright emblem appears on paper milk bottles, bottle caps and hoods, it means that the product inside that container has been given the finest sanitary protection money can buy. For Sealright spares no effort—no expense—to insure the purity of its products. Look at the snapshots shown on this page. They were taken in the great Sealright plant at Fulton, New York. They show why Sealright products have come to be recognized as the ultimate in sanitary protection.

ON GUARD—ALWAYS! Laboratory tests double check every step in Sealright's manufacturing operations. To insure rigid hygienic standards, nothing is left to chance. Under this strict laboratory control, millions of Sealright caps and containers are made daily.



EXTRA CLEAN CAPS AND CONTAINERS demand extra clean paper. Sealright takes no chances. Sealright makes its own special highly sanitary paper from pure, new spruce pulp, on equipment used for no other purpose.

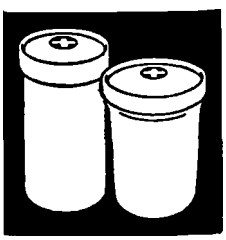


IT TAKES HEALTHY WORKERS to make clean containers. Sealright employees attend special hygiene classes, learn to use sanitary care in their work, get health examinations regularly.

SEALRIGHT CO., INC.

FULTON, N. Y.

Kansas City, Kansas — Los Angeles, California

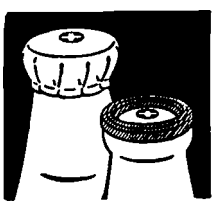


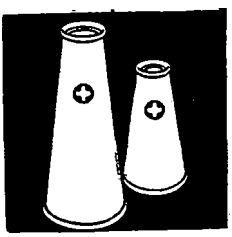
SEALRIGHT
CONTAINERS

ROUND AND NESTYLE—for cottage cheese, ice cream and other moist foods.

SEALRIGHT
PAPER MILK BOTTLES

The modern, sanitary, business-building container for milk sold in stores.





SEALRIGHT
MILK BOTTLE CAPS

Made in many styles—both cover caps and regular—to suit every capping need.

We use SEALRIGHT SANITARY SERVICE for Your Protection

THIS EMBLEM SAFEGUARDS HEALTH

When you see it on paper milk bottles, bottle caps and hoods, or containers, you know that the manufacturer of the products inside is extra careful of their purity and cleanliness.

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Thirtieth Annual Convention

INTERNATIONAL ASSOCIATION OF MILK SANITARIANS

TULSA, OKLAHOMA

Oct. 27, 28, 29, 1941

Headquarters: Hotel Mayo

Application for Membership

....194.....

TO THE INTERNATIONAL ASSOCIATION OF MILK SANITARIANS, INC.:

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

(Membership includes subscription to Journal of Milk Technology)

Name .....

Address (mailing) .....

PRESENT POSITION

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

Organization .....

PREVIOUS POSITION

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

Organization .....

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

Organization .....

GIVE FOLLOWING INFORMATION

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

Give additional information you desire to have considered

.....

.....

.....

Application endorsed by

Active or Associate member } .....

.....

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

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

Active Membership open to Government Officials and Employees.
Associate Membership open to Members of Industry and others.

DIFCO

Detection of

MOLDS *and* YEASTS

in Dairy Products

Bacto-Potato Dextrose Agar is recommended for determination of the mold and yeast count of butter. This product is also used extensively for isolation and cultivation of molds and yeasts in other dairy products.

Bacto-Potato Dextrose Agar is prepared according to the formula specified in "Standard Methods for the Examination of Dairy Products" of the American Public Health Association. Medium prepared from the dehydrated product conforms in every way to the standard medium. After sterilization the medium will have a reaction of pH 5.6 which may readily be adjusted to pH 3.5 by addition of sterile tartaric acid.

Bacto-Malt Agar is also an excellent medium for detection of molds and yeasts in butter. This medium is widely used for determining the mold and yeast count of butter and other dairy products, and is particularly useful in revealing sources of contamination by these organisms.

Bacto-Malt Agar is readily prepared and has a reaction of pH 5.5 after sterilization in the autoclave. This reaction may readily be adjusted to pH 3.5 by addition of lactic acid.

Printed in U. S. A.