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Editorials

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

"Message of the President"

THIRTY-THREE years of successful organization are behind us; ahead of us looms a new year, one with which the continued cooperation of the members will bring new advances. During its years of operation the Association has done a great deal to unify and standardize the science of milk control, but much remains to be done in this particular phase. We must all unite on one sound program that will establish control work on a more unified basis. Such a control program will of necessity entail the addition of some requirements in certain instances and the dropping of some in others. A unified program to be successful must be based on those production and processing essentials that are economically sound and that have a definite bearing on the results that are being demanded in the finished product by the consumer. We must never forget that the consumer is our real BOSS and must be satisfied with our end results—a bottle of good milk.

Certain basic factors affecting the end product must be kept in mind in planning a basic unified program. All these factors are measurable in the finished product that is offered to the consumer. First of these factors should be safety. Certainly safety is the paramount item to consider when we are to use the product ourselves or to provide our families or others with this essential food product. Milk must build health—never cause illness or disease. After proper provisions for a safe product are made, major consideration of which is the proper and adequate pasteurization of the product and the prevention of contamination after pasteurization, we can give consideration to the other factors that have been proven to be economically sound. Flavor of milk is perhaps the public's only way of judging a milk. They demand a milk with a clean, desirable flavor, and any program must be so planned that this will be accomplished. Next, and perhaps so closely associated with flavor that it should be considered along with it, is the odor factor. Odor is usually so closely associated with flavor that it cannot be easily separated. However, the factors that cause objectionable odors can readily be controlled and merit prime consideration in any program. Cleanliness, a health watchword, needs application to the milk supply so that the public will get a bottle of milk that is essentially free from foreign material. They are entitled to and should receive a clean milk and not a cleaned milk. To accomplish this, much thought and consideration must be given to the planning of the control work in the producing areas. Lastly, but of increasing importance, is the factor of keeping quality. The greatest tribute to the progress that milk control has made in this direction through the efficient work of present and past members of this association, was the requirement of the Office of Defense Transportation that milk deliveries be reduced, in most cases be operated on an every-other-day basis. Such a program would not have been possible within the memory of most of the present members of the Association. The milk simply would not have kept long enough to have made this feasible a few short years ago. This is a tribute to progress but also an incentive to keep up the good work and still improve this vital factor in the milk supply of any community.

During the coming year, let's all give special thought to the standardization of requirements—particularly the simplification of them and the elimination of non-essential details. Let's eliminate trade barriers erected in the guise of milk control regulations. To this end it is hoped that the report of the Committee on the Unification and Simplification of Ordinances will have their work completed and in form to present to the association at our next annual meeting so that it may be discussed and form a real basis for the advancement of milk control work of the future.

Best wishes for a happy and successful year.

RUSSELL R. PALMER
President

Biographical Sketch

RUSSELL R. PALMER

Mr. Russell R. Palmer, newly elected President of the International Association of Milk Sanitarians, was born in Detroit, Michigan, on October 13, 1900. He graduated from the Michigan State College in 1922 with the degree of B.S. in Agriculture, and took his M.S. in dairy production in 1924. He attended several short courses for milk and food officials at the University of Michigan and lectured on milk control at Ohio State University, Wayne University, University of Michigan, and Michigan State College.

He started work with the Detroit Department of Health on July 1, 1924, as country milk inspector. He was later transferred to the city where he was put in charge of inspection of certified and grade A farms as well as inspection work on city milk plants. On January 16, 1928, he was appointed Chief Milk Inspector, and has filled that position to date.

He is Past President, Michigan Milk Inspectors Association; Past President, Michigan State Club of Detroit; Past Director, Michigan Allied Dairy Association; Member of Michigan Academy of Science; Member of Michigan Bacteriological Society; Secretary-Treasurer of Wayne County Medical Milk Commission; and Member of Brooklyn Lodge No. 169, F. & A. M.

J. H. S.

Frozen Desserts vs. Frozen Dairy Foods

REPRESENTATIVES of industry are advocating and requesting that the name "frozen desserts" be changed to "frozen dairy foods."

Why is the ice cream industry concerning itself with the change of name from frozen desserts to frozen dairy foods? Because: according to R. C. Hibben, Executive Secretary, International Association Ice Cream Manufacturers,

(1) Ice cream in a great many cases is not used as a dessert but part of a meal. When a person goes to the soda fountain and orders a sandwich, glass of milk, and a dish of ice cream, he is thinking in terms of ice cream as part of the meal, the same as the sandwich or the glass of milk.
(2) When nutritionists build menus, too often the dessert has been an extra on the list rather than figured into the calory or nutritional value of the meal itself. Classifying ice cream under the word, frozen desserts, puts it in a class with a lot of less nutritious foods. Using the term, frozen dairy food, raises ice cream's importance to the meal along with the other food in menu building.
(3) The industry suffered at the start of the war and today is still not properly classified in some war agencies, as a confection. However, this is not true with the Nutrition and Food Conservation Branch, WFA, which classifies ice cream in group 4, along with other dairy products, of the 7 basic food groups.
(4) The right terminology of a product is very helpful in the sale of such product. Right now the ice cream industry is restricted but both Government and the dairy farmer are looking to the ice cream industry to help carry the load of the surplus after the war. When the military and lend-lease orders dry up there is in prospect large surpluses of milk which might run as high as from nine to twelve billion pounds annually. The ice cream industry is recognized by the Government and the dairy farmer as the industry that uses milk for its cream and solids in the flush season, when the dairy farmer needs this market the most. If by using the word, frozen dairy foods, instead of frozen desserts the industry is in any way helped in increasing its consumption of milk from the present six billion pound level to seven or eight billion pounds in the postwar period the change will be very much worthwhile.

The objection seems to be to the word "dessert." The word dessert is variously defined as "the last dinner course." "A service of pastry, fruits, or sweetmeats at the close of a feast or dinner." "A reward." There is nothing objectionable in any of these definitions. As a matter of fact, they all connote very pleasurable experiences and are, therefore, real assets. Desserts according to the dietitian may be and often are used to "put over" or "sell" a meal. A very ordinary meal if concluded with a fine dessert turns out to be a very good meal.

Furthermore, desserts in addition to having food value, have flavor and emotional values which are real assets and are not generally appreciated.

Presumably, it would make very little difference to the vast multitude of ice-cream-eating children or to the average adult just whether you called them frozen desserts or frozen dairy foods, just so they tasted the same. However, if there is any advantage to be gained in changing the name, there should be no objection. The principal considerations will still be—are they nutritious, sanitary, and pleasurable.

There seems to be some misunderstanding about the way dietitians or nutritionists handle desserts. In the first place, desserts generally consist principally of concentrated carbohydrates and hydrocarbons such as sugar and fats. Thus in planning menus for a reducing diet they are among the first items eliminated. On the other hand, when a high caloric diet is desired, desserts form a very important and integral part especially in the case of children or those with a fastidious appetite. One can hardly assume that the nutritionist would be fooled by merely changing the name or that the average individual would change his eating habits or likes and dislikes because the name had been changed.

In conclusion, industry is asking public health agencies and legislative and governmental bodies to change the name from frozen desserts to frozen dairy foods. Therefore, it has been suggested that industry should be willing to make similar changes to those which it is requesting others to make. For example, instead of the International Association of Ice Cream Manufacturers, it could be International Association of Frozen Dairy Food Manufacturers. The term "ice cream" is not nearly as comprehensive or representative of the industry as is the term "frozen desserts." Therefore, if we are going to change the name, let us all change to the same name and have it over with.

F. W. F.

He Was Too Busy

A MILK sanitarian was recently asked why he belonged to the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS. "To get the JOURNAL," was his reply. "I don't go to the meetings. I don't have time. Besides, you can get everything in the JOURNAL."

That brings up the question as to what makes the JOURNAL possible. The answer to this question is, of course, active membership and active interest in the Association. Without this active interest, there would be no JOURNAL and no Association.

Every member is busy with his own work. This is especially true in these times. Officers of the Association are probably more busy than the average member. Yet they must find time or the Association would cease to function.

Attending the annual meetings offers much that is missed in the JOURNAL. It has often been said that the "jam sessions" during program intervals develop into discussions equal in value to the papers themselves. Corridor discussions of mutual problems assist the sanitarian in appraising his own progress.

Taking an active part in Association affairs helps the sanitarian to feel that he is a part of the Association. At the recent annual meeting, the president called for volunteers to work on a standing committee. Only six members responded.

The president of the Association recently asked a member if he would act as chairman of one of the standing committees. To himself the member said, "I can't take this assignment. I'm snowed under with work now. I'd be a darn fool to add this to an already overburdened schedule." Then the thought occurred to him that if he did not support the Association and its officers he was indeed a poor member. Why belong to an association if you do not support it? Do you deserve the benefits of the JOURNAL if you do not help make it a going concern?

The "let George do it" attitude did not make the Association; it did not make America; and it will not make a successful milk sanitarian. If you are going to be a milk sanitarian, try to be a good one.

J. R. J.

ANNUAL MEETING, October 18–20, 1945

Deshler Wallick Hotel, Columbus, Ohio

The Determination of Copper in Milk Powder by a Direct Carbamate Method

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The importance of even minute amounts of copper as a catalyst for detrimental oxidative changes in dairy products has long been recognized and several colorimetric methods have been described for estimating the copper content of these products. The need for the selection of an accurate rapid method for the determination of copper to be used in connection with a study of the keeping quality of whole milk powder gave rise to this study.

One of the most important colorimetric reagents for copper is sodium diethyldithiocarbamate introduced by Callan and Henderson (2). The merits of this reagent are in evidence from the work of Conn and collaborators (3), Coulson (4), and from the discussion by Sandell (14). Few metals interfere with the carbamate determination, and with the exception of cobalt, nickel and bismuth (5), these interferences can be eliminated by extraction of the copper carbamate with carbon tetrachloride from an ammoniacal citrate solution at pH 8.5–9.0 (10, 4, 14).

Most published methods for determination of copper in milk products call for separation of copper from the other constituents of milk ash. Ammonium hydroxide separation, hydrogen sulfide precipitation, and electrolytic deposition have been the common methods for isolation of copper. Because these methods are tedious, slow, and perhaps not entirely reliable for micro-quantities of copper, Coulson (4) proposed a study of a direct carbamate method, using the procedure of Haddock and Evers (10) for the elimination of interference from iron and certain other metals.

The results of the collaborative study by Coulson (4) on the determination of copper in solutions of milk ash showed need for further study before this direct method would be applicable for this purpose. When solutions were made alkaline, precipitation of calcium phosphate occurred and there was evidence that occlusion of copper resulted, making the observed values for copper low. Coulson suggested that the use of a smaller sample, additional quantities of citric acid or extraction with successive portions of carbon tetrachloride may lead to better results in the application of this method to milk.

Drabkin (5) indicated that in most biological materials of animal origin, the contamination by nickel, cobalt, and bismuth would be so low that no serious problem in the carbamate method for copper would result. These metals are apparently not found in milk in detectable quantities (13), although the possibility of nickel contamination from some nickel equipment in use in the dairy industry is recognized. Under these circumstances an abbreviated procedure may not be applicable. Greenleaf (9) also suggested the use of an abbreviated procedure if it were known that nickel, cobalt and bismuth were absent.

Hussong and Hammer (11) have successfully used wet digestion with Coulson's (4) direct method for determination of copper in butter.

Because of the speed and simplicity of a direct procedure, and its apparent possibilities as indicated by the literature, it was felt that further study of its application to the determination of copper in milk powder was justified.

EXPERIMENTAL

A. Preparation of Reagents:

Redistilled water was used for all dilutions. All glassware was cleaned thoroughly and rinsed with redistilled nitric acid, followed by redistilled water. All reagents were stored in pyrex containers.

(1) Hydrochloric acid (1–1). Equal volumes of concentrated HCl and redistilled water.

(2) Citric acid solution (15 percent solution of reagent grade citric acid in redistilled water).

(3) Ammonium hydroxide. Concentrated, C.P.

(4) Cresol red. (0.02 gram per 100 ml. redistilled water).

(5) Sodium diethyldithiocarbamate solution. One gram of sodium diethyldithiocarbamate was dissolved in redistilled water, diluted to one liter, and stored in dark colored bottle.

(6) Carbon tetrachloride C.P.

(7) Standard copper solution. 0.5000 g. of electrolytic copper foil was dissolved in 15 ml. 6 normal nitric acid, warmed gently to effect solution and expel fumes. When cool, the solution was diluted to 500 ml. with redistilled water. From this solution a working standard containing one microgram per ml. was prepared.

B. Apparatus used:

(1) Platinum ashing dishes. (5 cm. diameter, capacity 25 ml.)

(2) Platinum tipped tongs.

(3) Muffle furnace equipped with rheostat and pyrometer.

(4) Coleman spectrophotometer — test tube cuvettes (19 mm.).

(5) 125 ml. pyrex separatory funnels; pipettes, and other standard glassware.

C. Procedure:

The sample solution of milk ash, prepared in a manner described later, was transferred to a 125 ml. separatory funnel. Ten ml. of citric acid and five drops of cresol red indicator were added. The pH was adjusted to pH 8.5–9.0 with concentrated NH_4OH. Approximately 0.5 ml. NH_4OH were necessary after the solution reached the violet color of cresol red, as evidenced by pH determinations of these solutions using a glass electrode. The volume was then made up to 55 ml. with redistilled water and 10 ml. carbamate solution were added. Five minutes were allowed for copper carbamate color formation and exactly 10 ml. carbon tetrachloride were added. After a period of two minutes of vigorous shaking, the carbon tetrachloride layer was allowed to settle and was drawn off into a clean dry test tube. The tubes were stoppered and allowed to stand ten minutes. The copper carbamate-carbon tetrachloride solutions were then transferred to cuvettes and the transmittancy was determined in the spectrophotometer at 440 millimicrons with a blank of all reagents treated similarly set at 100 percent transmission. The copper content was estimated from a standard reference curve prepared as described below.

PREPARATION OF STANDARD REFERENCE CURVE

Spectral transmittance data shown in Figure 1 indicated maximum absorption at a wave length of 440 millimicrons, so all readings have been made at this wave length.

For the preparation of the standard reference curve, 5 ml. (1–1) HCl were first added to the separatory funnel, followed by known quantities of copper, and 10 ml. citric acid solution. From this point, the method used was as described in the procedure above. Curves prepared with solutions of milk ash containing known amounts of copper compared favorably with those obtained by the above procedure for the preparation of a standard reference curve.

The electrolytic strength of solu-

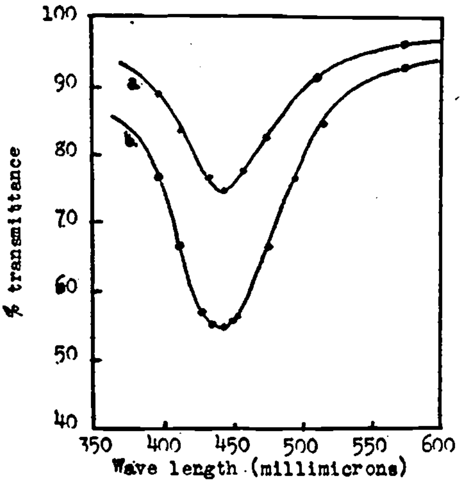

FIGURE 1

Transmittance curves for copper carbamate in 10 ml. carbon tetrachloride

a. 5 micrograms copper

b. 10 micrograms copper

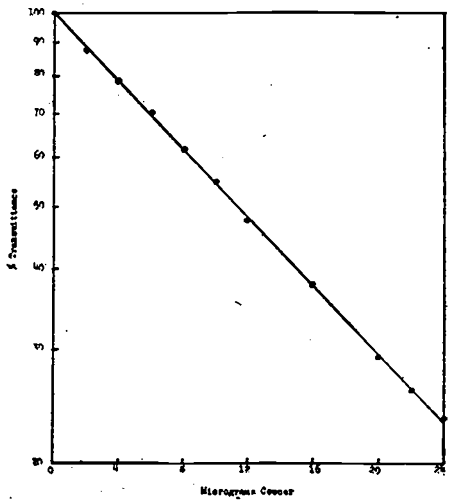

FIGURE 2

Transmittance-concentration curve for copper diethyldithiocarbamate in carbon tetrachloride, 440 millimicrons

tions, as mentioned by Greenleaf (9), appears to be an important factor in the extraction of copper carbamate. Under the conditions of the procedure followed, it was found that two minutes of vigorous shaking were necessary to complete the extraction when 20 micrograms of copper were present.

Most procedures for the carbamate method call for a working range of concentration of 10–100 micrograms of copper as copper carbamate in 10 ml. carbon tetrachloride. From the log transmittance-concentration curve (Figure 2), it can be seen that Beer's law is closely followed in the range of 0–24 micrograms copper.

RECOVERY OF COPPER FROM SOLUTIONS CONTAINING OTHER METALS

From the literature it appeared that sample size may be the limiting factor in the use of a direct carbamate procedure for milk powder because of the large quantity of calcium phosphate present in solutions of its ash. This fact meant the possible necessity of a high degree of accuracy when as low as five micrograms of copper are present.

Because most of the data on interference from other metals have been obtained at concentrations of 20 micrograms–100 micrograms copper, it was felt that accuracy of determination in the presence of some of these metals should be checked at lower level of copper concentration.

From the data in Table 1 it can be seen that 5 micrograms of copper can be accurately recovered in the presence of considerable quantities of iron, manganese, tin and zinc, metals which are normally present in milk.

Nickel, of course, interferes and it seems that nickel concentration equal to copper concentration is beyond tolerance when a high degree of accuracy is desired.

The data also show that approximately 80 milligrams of di-calcium phosphate are the maximum permissible amount. Above this concentration turbidities occurred when rendering the solution ammoniacal, and it appears that occlusion of copper resulted. This is of importance in so much as it limits sample size. From observation, using dry ashing and the

TABLE 1

RECOVERY OF COPPER FROM SOLUTIONS CONTAINING OTHER METALS

(5 micrograms copper added to each solution)

	Micrograms	*Cu. found (micrograms)*	*Error (micrograms)*
Fe+++	0	5.0	0.0
	25	4.9	—0.1
	50	4.9	—0.1
	75	5.1	+0.1
	100	5.3	+0.3
Mn++	0	5.0	0.0
	5	4.9	—0.1
	10	5.0	0.0
Sn++	50	4.9	—0.1
	100	5.0	0.0
	200	5.2	+0.2
Zn++	50	4.9	—0.1
	100	5.2	+0.2
	200	5.0	0.0
Di-calcium phosphate	15 mg.	5.0	0.0
	30 mg.	5.1	+0.1
	60 mg.	5.1	+0.1
	80 mg.	4.8	—0.2
	100 mg.*	3.2	—1.8
	200 mg.*	2.0	—3.0
	300 mg.*	1.5	—3.5
Ni++	0	4.9	—0.1
	5	5.6	+0.6
	10	6.6	+1.6
	20	7.8	+2.8

* Solutions were turbid at time of extraction of copper carbamate with carbon tetrachloride.

previously outlined procedure, it was found that the aliquot should be limited to the corresponding sample of five grams for whole milk powder if difficulty from turbidity is to be avoided on neutralizing to pH 8.5–9.0.

INTERFERENCE FROM NICKEL

Drabkin (5) studied the absorption characteristics of the carbamates of nickel cobalt and bismuth and he (6) reported that 10 micrograms of these metals had little effect on the results for copper (25 micrograms of copper), using visual or photoelectric filter photometry. The data in Table 1 and Table 3 indicate a more serious error at the 5 microgram level of copper using the proposed procedure.

Nickel carbamate, it was found, exhibits maximum absorption at a wave length of 385 millimicrons. Figure 3 shows the effect of varying amounts of nickel in the presence of 5 micrograms of copper on the spectral transmittance of the carbamate-carbon tetrachloride

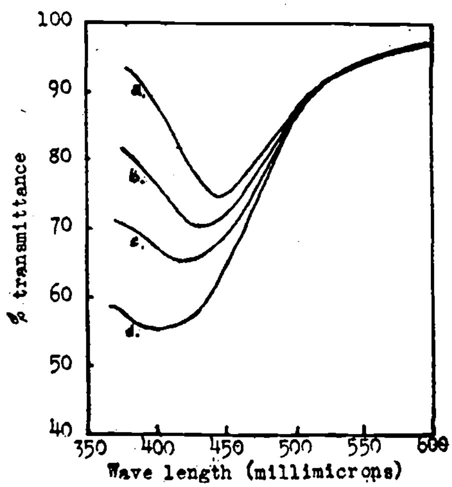

FIGURE 3

Influence of nickel on spectral transmittance

a. 5 micrograms copper
b. 5 micrograms copper+5 micrograms nickel
5 micrograms copper+ 10 micrograms nickel
d. 5 micrograms copper+20 micrograms nickel

solutions. It can be seen that as the quantity of nickel increases, there is a shift in the wave length at which maximum absorption occurs and the absorption peak becomes less pronounced. At a wave length of approximately 480 millimicrons to 500 millimicrons, the curves converge. This would suggest the possibility of elimination of interference from nickel by measuring the percent transmittance at this wave length; however, the high percent transmittance at this wave length would make measurements much more inaccurate especially when only 4–5 micrograms of copper were present.

Unsuccessful attempts were made to apply the dimethyl glyoxime method of Butler and Allen (1) to eliminate nickel interference. This was perhaps due to the extremely low concentrations of nickel and copper with which the present study dealt. Addition of 15 fold excess of dimethyl glyoxime failed to quantitatively remove the nickel and the amounts remaining were considered excessive.

If nickel is known to be present, other methods of determination must be used (5) (9) (14) (15). It should be stated that nickel, however, has evidently not been found in milk and its products unless contaminated by nickel equipment.

SAMPLE PREPARATION

While preference is usually given to wet oxidation methods, some difficulty was encountered in the present study when mixtures of nitric, sulfuric and perchloric acid were used. The blanks were high and results were variable. Possibly too, because of the high calcium content of milk ash, difficulty with solution of calcium sulfate resulted, which could cause loss of copper (14).

Attention was then directed to a dry ashing procedure. As a result of preliminary investigation, it was found that the following method gave satisfactory results. Five gram samples of milk powder were weighed into a platinum ashing dish and placed in the muffle furnace. The temperature of the muffle was less than 300° C. When fumes given off by the powder ceased (usually half hour) the temperature of the muffle was slowly raised to 500–550° C. and allowed to remain at that temperature until the carbonacious material was destroyed. For milk powder this was usually accomplished in 4–5 hours. Addition of nitric acid and evaporation to dryness prior to placing in the muffle did not appreciably shorten the total time of ashing. Five ml. (1–1) HCl were added to the ash; the mixture was carefully heated to boiling to effect solution and held at this temperature for five minutes. The milk ash solution was then transferred directly to the separatory funnel or to a 50 ml. volumetric flask and the platinum dish was rinsed with two successive 10 ml. portions of hot redistilled water, the washings also being transferred to the separatory funnel or volumetric flask. In case transfer was made to volumetric flask, the contents were made up to volume with redistilled water and an aliquot was transferred to the separatory funnel. The determination from there proceeded as outlined in the procedure beginning with the addition of the citric acid solution.

The above method for sample preparation can be used for the determination of iron in milk powder (12). Aliquots of the same solution of milk ash can be taken for both determinations.

EFFECT OF LENGTH OF TIME OF DRY ASHING ON THE OBSERVED COPPER CONTENT

Gebhart and Sommer (8) dry ashed milk in silica dishes and used a modification of the Pyridine-Thiocyanate method of Elvehjem and Lindow (7) for their determination of copper. Their results showed appreciable losses of copper when high ashing temperatures and excessive times were used. They concluded that a temperature not exceeding 510–565° C. and a time of not over 3–4 hours should be used to insure satisfactory recovery of added copper. They were able to recover 91–96 per cent of added copper by this procedure.

Conn and collaborators (3) were able to secure equally satisfactory results by using Gebhart's and Sommer's (8) method of ashing, isolating the copper by H_2S precipitation, and subsequently determinating the copper with carbamate.

Sandell (14) states that failure to recover copper after dry ashing is probably not due to volatilization but rather to partial conversion of copper to an acid in soluble form by reaction with the material of the ashing vessel or with certain constituents of the ash.

TABLE 2

EFFECT OF LENGTH OF TIME OF DRY ASHING AT 500° C.–550° C. ON OBSERVED COPPER CONTENT OF WHOLE MILK POWDER (Copper Added to Powder Before Ashing)

Sample No.	*P.P.M. Cu (added)*	*Ashing time*	*P.P.M. Cu (observed)*
5209	—	4 hrs.	0.86
	—	5 hrs.	0.90
	—	6 hrs.	0.90
	—	18 hrs.	0.85
	—	21 hrs.	0.90
	—	2 hrs.	0.82
	1.00	2 hrs.	1.78
	—	4 hrs.	0.82
	1.00	4 hrs.	1.86
	—	18 hrs.	0.82
	1.00	18 hrs.	1.80
J–12	—	4 hrs.	1.55
	1.00	4 hrs.	2.53
	—	18 hrs.	1.48
	1.00	18 hrs.	2.43
H–17	—	4 hrs.	1.10
	1.00	4 hrs.	2.13
	2.00	4 hrs.	3.08
	3.00	4 hrs.	4.05
	—	18 hrs.	1.17
	1.00	18 hrs.	1.98

Table 2 shows that the effect of ashing time was of very little importance when the ashing was done in platinum dishes by the method described. Complete recovery of copper resulted when samples were ashed at 500° C. for 18 hours. However, usually at least a four hour ashing period is necessary to completely remove the carbon.

From the results of the study on dry ashing, it was concluded that 4–5 hours ashing time in platinum dishes at 500–550° C. could be used satisfactorily; and if it was more convenient to keep the samples in the muffle over night, satisfactory results could be obtained.

EFFECT OF ADDITION OF METALS TO MILK POWDER BEFORE ASHING ON THE OBSERVED COPPER CONTENT

In order to determine the effect of addition of other metals upon the accuracy of the test, metals were added to five grams of milk powder before ashing in such quantities that the total amount present was well beyond the range normally present in the milk powder. Because of the quantity of water which accompanied the addition of these metals, the ashing procedure was slightly altered. The samples were first placed in a drying oven at 105° C. until dry (1½ hrs.) and then transferred to the muffle furnace at 300° C. The procedure as described was then followed and the total ashing time was six hours.

The data, shown in Table 3, indicate that the presence of the metals, iron, manganese and zinc as well as 1,000 p.p.m. added dicalcium phosphate, had no appreciable effect on the observed copper content nor on recovery of added copper. The interference from nickel is of the same order of magnitude as found in the data of Table 1.

THE COPPER CONTENT OF MILK, CONDENSED MILK, AND MILK POWDER

The method as outlined was used to determine the copper content of milk, condensed milk and milk powder from the same lot of milk to get an idea of the amount of copper dissolved in milk from several sources in the production line. The suggestion of Drabkin (5) was followed for ashing milk and condensed milk except that only 31 grams of whole milk and 15 grams

TABLE 3

EFFECT OF ADDITION OF OTHER METALS TO POWDERED MILK BEFORE ASHING ON THE OBSERVED COPPER CONTENT

Sample No.	*Metal added*	*P.P.M. (powder basis) Metal added*	*P.P.M. Copper (observed)*
5208	—	—	0.83
5208	Fe	5.0	0.80
5208	Fe	10.0	0.85
5208	Fe	20.0	0.85
QMC #3	—	—	0.78
QMC #3	Ni	1.0	0.88
QMC #3	Ni	2.0	1.18
QMC #3	Ni	3.0	1.43
5210	—	—	0.82
5210	Cu	1.0	1.86
5210	Zn	5.0	0.88
	Fe	5.0	
	Mn	2.0	
	Di-calcium phosphate	1000.0	
5210	Same as above, but 1 p.p.m. Cu in addition		1.80

of condensed milk were used. This procedure calls for the addition of hydrochloric acid to the samples to prevent foaming and evaporation of the samples to dryness on a hot plate before placing them in the muffle furnace.

The results (Table 4) for raw milk are in line with those reported by others (3) (7) (8) (15). Results on two samples of pasteurized milk showed copper contents of 0.11 p.p.m. and 0.13 p.p.m. respectively.

TABLE IV

COPPER CONTAMINATION FROM EQUIPMENT USED IN PROCESSING MILK FOR THE MANUFACTURES OF WHOLE MILK POWDER

Product	*Grams sample*	*Total solids*	*Micrograms copper* *	*Cu P.P.M.* *	*Micrograms/gram solids*
Raw Milk	31	12.0%	3.0	0.097	0.860
			3.4	0.109	
Condensed whole milk	15	43.0%	5.8	0.387	0.930
			6.1	0.406	
Milk powder	4.0	98.0%	5.6	1.40	1.46
			5.8	1.45	

* Duplicate ashing.

In discussing the data of Table 4 it should be mentioned that 1,600 pounds of 145° F. Milk were exposed to one foot of 1½" line of exposed copper on the way to the vacuum pan. The powder was made from 60 pounds of the condensed milk fore-warmed to 140° F. and in going to the dryer, it was exposed to a small bronze plug in the high pressure pump and one section (6") of poorly tinned, 1" tinned-copper sanitary line. Because the capacity of the dryer was less than the pump, an overflow leading back to the supply tank was provided and a portion of the condensed milk was recirculated through these lines for the duration of drying (¾ hr.).

When milk from this same supply (but a different lot) was processed and spray dried in an industrial research laboratory in the absence of exposed copper, the values of 0.85 p.p.m. to 0.90 p.p.m. copper were secured. These results, listed in Table 2, sample no. 5209, show good agreement with the 0.86 microgram copper/gram of solids found in the milk shown in Table 4.

COMPARATIVE RESULTS OF TWO LABORATORIES

Three samples of milk powder and one sample of ice cream powder were analyzed for copper by this laboratory and by the research laboratory of Dean Milk Company, Rockford, Illinois, using this method. It is evident from the data below that satisfactory agreement was obtained.

		P.P.M. Copper	
Products	*Sample no.*	*Dean's*	*Univ. Ill.*
Dried whole milk	QMC #3	0.73	0.75
	H-17	1.46	1.51
	J-12	0.90	1.05
Ice cream powder,	10-6-44	0.97	0.94

DISCUSSION AND SUMMARY

The data presented indicate that in the absence of nickel contamination, sufficiently reliable results can be obtained by dry ashing milk powder and subsequently determining the copper content on solutions of its ash by employing the carbamate method, without isolation of the copper. This abbreviated procedure is rapid and simple and is applicable to milk products because interfering metals are not normally present.

Regulation of sample size is of importance in order that phosphate precipitation on neutralizing to pH 8.5–9.0 will be prevented.

It is obvious, in view of the fact that very small quantities of copper (usually 3–10 micrograms) are present in the sample of appropriate size, that extreme care must be exercised in cleaning glassware, in preparation of reagents, and in manipulation of the test, in order to prevent copper contamination.

The ashing procedure described in this study is applicable to the determination of iron in milk powder. Aliquots of the same solution of milk ash can be taken for both determinations.

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REFERENCES CITED

1. Butler, L. I., and Allen, H. O. Copper and Cobalt in Plants. *J. Assoc. Official Agr. Chem.*, **25**, 567 (1942).

2. Callan, Thomas, and Henderson, J. A. Russell. A New Reagent for the Colorimetric Determination of Minute Amounts of Copper. *Analyst*, **54**, 650 (1929).

3. Conn, Lillian, Johnson, A. H., Trebler, H. A., and Karpenka, V. Determination of Minute Amounts of Copper in Milk. *Ind. Eng. Chem.*, Anal. Ed., **7**, 15 (1935).

4. Coulson, E. J. Report on Copper. *Jour. Assoc. Official Agr. Chem.*, **20**, 178 (1937).

5. Drabkin, D. L. Report on Copper. *Jour. Assoc. Official Agr. Chem.*, **22**, 320 (1939).

6. Drabkin, D. L. Report on Copper. *Jour. Assoc. Official Agr. Chem.*, **23**, 301 (1940).

7. Elvehjem, C. A., and Lindow, C. W. The Determination of Copper in Biological Materials. *Jour. Biol. Chem.*, **81**, 435 (1929).

8. Gebhart, H. T., and Sommer, H. H. Determination of Copper in Dairy Products. *Ind. Eng. Chem.*, Anal. Ed., **3**, 24 (1931).

9. Greenleaf, C. A. Report on Copper. *Jour. Assoc. Official Agr. Chem.*, **25**, 385 (1942).

10. Haddock, L. A., and Evers, Norman. Determination of Minute Amounts of Copper in Presence of Iron and Certain Other Metals. *Analyst*, 57, 495 (1932).

11. Hussong, R. V., and Hammer, B. W. Importance of Copper in Certain Color Changes in Butter. *Food Research*, **9**, 289 (1944).

12. Pyenson, Harry, and Tracy, P. H. A 1, 10—Phenanthroline Method for the Determination of Iron in Powdered Milk. Unpublished data of the Department of Dairy Husbandry, University of Illinois.

13. Rogers, L. A., Associates of. Fundamentals of Dairy Science. *Reinhold Publishing Corporation.* 616 pp. New York, 1935.

14. Sandell, E. B. Colorimetric Determination of Traces of Metals. *Interscience Publishers*, New York, 465 pp., 1944.

15. Sylvester, N. D., and Lampitt, L. H. The Determination of Copper in Foods with Special Reference to Milk. *Analyst*, **60**, 376 (1935).

Modified Trommsdorff Method as a Means of Selecting Potentially Sediment-Free Milk for Homogenization*

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SEDIMENT formation in homogenized milk continues to be a problem to many milk distributors despite the knowledge of effective control measures, such as clarification. The designing and introduction of completely demountable, cleanable homogenizers has removed largely the homogenizer as a source of sediment. Today more than heretofore emphasis is being placed upon the quality of the milk to be homogenized. The sediment-disc method has been shown to be unreliable for the selection of milk for homogenization purposes (9).

Since leucocytes play an important role in sediment formation in homogenized milk (1), a modification of the Trommsdorff "Milchleukozytenprobe" (6), which he used in the detection of mastitic milk, suggested possibilities of a centrifugal method of selecting potentially sediment-free milk for homogenization. The Trommsdorff method consists of centrifuging a 10 ml. sample in a special, calibrated centrifuge tube for 10 minutes and then reading off the percentage of sediment directly. Hammer (1938) stated that the method gave no information on the composition of sediment but was relatively satisfactory for detecting excessive numbers of body cells in milk. To this end a modified form of the Trommsdorff method was devised and used to determine the possibility of selecting potentially sediment-free milk for homogenization.

MODIFIED TROMMSDORFF METHOD

Three principles were brought into use in adapting the Trommsdorff method to the purposes desired, namely: (a) use of a larger volume of milk to secure more sediment; (b) concentrating the sediment in the cream layer through gravitation; and (c) releasing the sediment of the cream through heat treatment and centrifugal force.

The work of Peters (1944) had shown that the addition of 0.5 gm. of separator slime per quart of clarified, homogenized milk was sufficient to produce visible sediment in the milk upon storage. Since a quart of milk weighs about 975 gm., this would mean that 0.05 percent by weight of suspended matter was sufficient to produce sediment in homogenized milk. In order to measure such a small percentage accurately a large sample of milk with a special type of centrifuge tube would be required.

The behavior of leucocytes in nonhomogenized and in homogenized milk indicated that up to 98 percent of the total number of leucocytes were carried up into the cream layer in the case of nonhomogenized milk (1, 5, 10). Since leucocytes make up a large part of the sediment of homogenized milk, it was thought that by allowing raw milk to cream in separatory funnels, the skimmilk could be drawn off, leaving the cream with nearly all the suspended matter in it. In this fashion a high concentration of sediment could be obtained from a large volume of milk, thus allowing for greater accuracy in measuring the sediment after centrifuging.

Babcock and Russell (1896) studied the microscopic appearance of heated milk and cream and found that by using heat treatments above 65° C.,

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the fat globules were homogeneously distributed throughout the microscopic field. The fat aggregations which were characteristic of the preparations with raw milk and cream were entirely lacking in the heated samples. Later Russell and Hoffman (1908) observed that when milk was heated to 70° C., the homogeneously distributed fat permitted the liberated leucocytes to respond more freely to centrifugal force. Thus heating of the cream to 70° C. prior to centrifuging was thought to be of value in order to obtain complete deposition of the cellular constituents held in the cream.

A high speed centrifuge with suitable calibrated centrifuge tubes seemed to be desirable in order to perform the test. Special centrifuge tubes, such as are recommended and used for determining water and sediment in crude mineral oil and fuel oils, were obtained and used in the following work. The centrifuge tubes had a total capacity of approximately 125 ml. with a graduated capacity of 100 ml. The smallest graduated division was 0.05 ml. which allowed for a determination of a minimum of 0.005 percent sediment per sample.

EXPERIMENTAL

Influence of added leucocytes

Clean, fresh milk obtained from the college herd was clarified and pasteurized after which washed leucocytes were added to a series of samples at rates of 0.1, 0.2, 0.4 and 0.8 gm. per quart respectively. The milk was clarified at 90° to 95° F. and was pasteurized at 143° to 145° F. for 30 minutes. The washed leucocytes were secured by repeated washing of separator slime in physiological salt solutions, centrifuging and decanting. One-liter portions of the raw, raw clarified, pasteurized not clarified, clarified pasteurized, and of the four lots to which washed leucocytes were added were saved in one-liter separatory funnels and held at 40° F. for 48 hours. The remainder of each lot of milk was homogenized separately at 2,500 pounds pressure, bottled in quart bottles, cooled, and stored at 40° F. for 48 hours.

At the end of the storage period the skimmilk portion of the milk in the separatory funnels was drawn off, the cream was collected and heated in a hot water bath to 70° C. (168° F.), cooled to about 50° C. (122° F.), and centrifuged in a high speed centrifuge at 2,500 r.p.m. for 30 minutes.

The quart bottles containing homogenized milk were inspected for visible sediment. The intensity of the sediment was recorded as follows:

0, no sediment
1, slight sediment
2, distinct sediment
3, pronounced sediment
4, very pronounced sediment

Samples of milk were collected during the different stages of processing for making leucocyte counts. The leucocyte counts were made, using a bright-line, improved Neubauer counting chamber and Toisson's fluid as a stain. The data secured are presented in Table 1.

In general, the modified Trommsdorff method yielded a volume of sediment which compared favorably with the amount of washed leucocytes added and with that which might be anticipated following clarification. However, the amount of sediment present gave little indication of the extent of sedimentation in the homogenized product.

The nonclarified, homogenized milk showed a greater intensity of sediment than did the clarified homogenized milk to which 0.8 gm. of washed leucocytes had been added. According to the modified Trommsdorff test the amount of sediment in the latter milk was markedly greater than that obtained in the nonclarified milk which showed the maximum intensity of sediment. No sedimentation was observed in the clarified, homogenized milk to

TABLE 1

THE CORRELATION BETWEEN THE AMOUNT OF SEDIMENT OBTAINED BY CENTRIFUGING THE CREAM LAYER OF NONHOMOGENIZED MILK AND THE INTENSITY OF SEDIMENT IN THE HOMOGENIZED PRODUCT

Treatment of sample	*Volume (ml.) of sediment in one liter of nonhomogenized milk in trial*			*Intensity of sediment in homogenized milk in trial*		
	1	2	3	1	2	3
Raw						
Not clarified	0.40	0.25	4.50*	—	—	—
Clarified	0.00	0.00	0.25	—	—	—
Pasteurized						
Not clarified	0.15	0.45	0.25	3	3	3
Clarified	0.10	0.00	0.50	0	0	0
" +0.1 gm. leucocytes	0.20	0.20	2.50*	0	0	0
" +0.2 " "	0.30	0.20	2.50*	0	0	0
" +0.4 " "	0.35	0.45	0.50	1	1	1
" +0.8 " "	0.90	0.50	2.00*	2	2	2

* Including large volume of white sediment.

which 0.1 and 0.2 gm. of washed leucocytes were added even though in two of the three trials the centrifugal test revealed more sediment than was noted in the nonclarified milk. Clarified milk having an addition of 0.4 gm. of washed leucocytes showed slight sedimentation. In two of the three trials this milk had at least twice as much sediment as the nonclarified milk, yet failed to show sedimentation to the same degree of intensity. The number of leucocytes in these samples and their relationship to sedimentation are shown in Table 2. The intensity of sediment in the homogenized milk could not be correlated either with the amount of sediment obtained by the modified Trommsdorff method or with the number of leucocytes present in the milk.

APPLICATION OF THE MODIFIED TROMMSDORFF METHOD TO PRODUCER MILK SELECTED AT RANDOM

A sufficient quantity of milk for study was obtained from patrons' milk as regularly delivered to the college creamery. While the milk supply was of good quality, it was recognized that the mixed milk would invariably yield sediment in the homogenized milk unless clarified. After the milk was tested for sediment the remainder was filtered through a filter cloth to remove any filterable sediment. A one-liter portion of the filtered milk was then taken and stored at 40° F. for 24 hours in a separatory funnel for creaming. After pasteurizing the remainder, another one-liter portion was secured

TABLE 2

THE RELATIONSHIP BETWEEN THE NUMBER OF LEUCOCYTES AND THE INTENSITY OF SEDIMENT IN HOMOGENIZED MILK (Avg. 3 trials)

Treatment of sample	*Leucocyte count per ml.*	*Intensity of sediment*
Raw		
Not clarified	20,000	—
Clarified	15,000	—
Pasteurized		
Not clarified	132,000	3
Clarified	36,000	0
" +0.1 gm. leucocytes	154,000	0
" +0.2 " "	341,000	0
" +0.4 " "	724,000	1
" +0.8 " "	1,264,000	2

and stored in a separatory funnel for creaming. The remainder of the milk was homogenized at 2,500 pounds pressure, bottled and stored at 40° F. for 48 hours, after which time it was examined for sediment. At the end of the storage period the milk in the separatory funnels was drawn off into respective layers of skimmilk and cream which were studied as previously described. The data secured are presented in Tables 3, 4, and 5.

No correlation seemed to exist between the sediment score of the milk, the intensity of sediment in the bottled homogenized milk, and the volume of sediment obtained by the modified Trommsdorff method. The results obtained from a study of 15 unselected milk samples are presented in Table 3. The data indicate the little value either of the sediment score of the milk or of the volume of sediment obtained from the milk by the modified Trommsdorff method when it comes to predicting whether sedimentation is going to take place in the milk upon homogenization.

INFLUENCE OF PASTEURIZATION ON THE FILTERING ACTION OF THE RISING FAT GLOBULES

Measurements of the cream values in the separatory funnels showed that the cream volume of the raw milk in every case was equal to or larger than that of the respective milk pasteurized. Similarly, the leucocyte counts of the skim milk portion below the cream layers revealed that a greater migration of the leucocytes into the cream layer occurred in the raw than in the pasteurized milk. Nearly all the samples of the raw skimmilk showed counts below 20,000 per ml. while those of the pasteurized milk showed counts ranging from below 20,000 to 80,000 per ml. These data are not tabulated.

However, wide variations existed in the amount of sediment obtained from the creams of the raw and pasteurized milk (Table 4). Nine out of the fifteen samples of sediment obtained from the cream of the raw milk yielded higher leucocyte counts than the sediment from the cream of the pasteurized milk, resulting in average counts of 971,000,000 and 895,000,000 per ml. respectively. The data in Table 4 show the relationship between the amount of leucocytes per ml. of sediment in the cream from raw and from pasteurized milk.

Definite cream, skimmilk, and sediment layers were formed upon high-speed centrifuging of the heat-treated

TABLE 3

THE RELATIONSHIP BETWEEN THE VOLUME OF SEDIMENT OBTAINED BY THE MODIFIED TROMMSDORFF METHOD, THE SEDIMENT SCORE OF THE MILK, AND THE INTENSITY OF SEDIMENTATION OF HOMOGENIZED MILK

Sample No.	*Volume of sediment obtained by the modified Trommsdorff method (ml/1)*	*Sediment score of milk*	*Intensity of sediment in homogenized milk*
1	0.225	9.0	3
2	0.075	7.5	2
3	0.097	8.5	3
4	0.225	8.0	3
5	0.100	8.5	3
6	0.150	8.0	3
7	0.120	8.0	1
8	0.225	8.5	1
9	0.585	8.5	3
10	0.150	9.0	2
11	0.120	7.0	2.5
12	0.225	7.5	3
13	0.050	(lost)	0.5
14	0.600	7.5	4
15	0.100	8.5	3

TABLE 4

THE RELATIONSHIP BETWEEN THE AMOUNT OF SEDIMENT AND THE NUMBER OF LEUCOCYTES PER ML. OF SEDIMENT IN CREAM FROM RESPECTIVE SAMPLES OF RAW AND PASTEURIZED MILK

Sample No.	*Volume (ml.) of sediment in cream from one liter of milk when*		*Leucocytes per ml. of sediment as calculated from actual counts obtained from sediment in cream from one liter of milk when*	
	Raw	*Pasteurized*	*Raw Millions*	*Pasteurized Millions*
1	0.225	0.150	298	1,320
2	0.075	0.360	2,272	337
3	0.097	0.180	1,190	592
4	0.225	0.120	677	514
5	0.100	0.100	2,412	708
6	0.150	0.480	346	900
7	0.120	0.200	500	825
8	0.225	0.100	860	432
9	0.585	0.150	466	1,040
10	0.150	0.075	1,080	1,220
11	0.120	0.450	2,960	1,022
12	0.225	0.240	1,120	700
13	0.050	0.050	2,760	3,680
14	0.600	0.172	496	1,457
15	0.100	0.100	1,460	1,260

gravity cream obtained from the raw and pasteurized milk. Microscopic examination of these layers showed that the leucocytes of the cream from the raw milk responded to the centrifugal force more readily than did those from the cream of the pasteurized milk (Table 5), thus resulting in lower leucocytes counts in these layers. The same was true, also, of the leucocytes from the skimmilk portions, but to a lesser extent. The logarithmic average of the leucocytes in 15 unselected trials was 226,100 in case

TABLE 5

THE LEUCOCYTE COUNT OF THE CREAM AND SKIMMILK LAYERS FORMED BY HIGH SPEED CENTRIFUGING OF RAW AND PASTEURIZED GRAVITY CREAM

Sample No.	*Leucocytes (per ml.) in the following portions* — *Cream*		*Skimmilk*	
	Raw	*Pasteurized*	*Raw*	*Pasteurized*
1	100,000	300,000	300,000	300,000
2	50,000	1,400,000	300,000	5,000,000
3	500,000	1,000,000	200,000	100,000
4	2,000,000	2,200,000	2,000,000	400,000
5	1,700,000	700,000	50,000	500,000
6	50,000	400,000	700,000	700,000
7	100,000	3,000,000	400,000	900,000
8	50,000	2,600,000	300,000	300,000
9	(lost)	1,000,000	100,000	900,000
10	600,000	5,200,000	600,000	50,000
11	300,000	500,000	50,000	50,000
12	200,000	2,200,000	100,000	50,000
13	100,000	100,000	50,000	50,000
14	400,000	4,600,000	200,000	700,000
15	300,000	400,000	50,000	600,000
Log. Avg.	226,100	1,051,000	195,200	298,600

of the raw cream as contrasted to 1,051,000 per milliliter in the pasteurized cream. The skimmilk had averages of 195,200 and 298,600 in the raw and pasteurized products respectively. Thus in making the modified Trommsdorff test for sediment in milk no advantage seems to be gained by pasteurizing the milk prior to creaming the sample.

DISCUSSION

While a simple, reliable sediment test applicable to raw milk, which could serve as a guide in selecting milk for homogenization purposes, would be of great value, the data obtained in these trials indicated that the modified Trommsdorff method, based upon scientific facts, would not be satisfactory for the above purpose. The method did respond in revealing within a reasonable limit of error the presence of sediment known to be present in definite amounts in control samples as well as varying quantities of sediment in samples of producer milk. However, there seemed to be little correlation between the amount of sediment present and the intensity of sedimentation in the homogenized product.

The occasional occurrence of much white sediment in the centrifuged cream samples indicated possibly that the different samples of the milk varied in the stability of the proteins. Charles (1934) observed that white sediment in homogenized milk was composed largely of casein. Thus milk with less stable proteins would tend to show a large amount of sediment upon centrifuging the gravity cream, providing the rising fat globules carried the destabilized protein into the cream layer along with the leucocytes and suspended foreign matter. Other factors, such as fat, which had been found by Schuppius (1907) to be present in the sediment when using the Trommsdorff method may also play a role in the volume of sediment deposited. Trials conducted by Peters (1944) with washed leucocytes and nonhomogenized milk had shown that a very strong attraction existed between the leucocytes and the fat globules. The attraction was strong enough to induce a downward movement of the fat globules with the settling of leucocytes. This observation would explain the presence of fat in the sediment as reported by Schuppius. A further study of this problem may be of interest and value. So many factors appear to affect the sedimentation in homogenized milk that the amount of sediment as shown by the modified Trommsdorff method is not of the greatest importance.

SUMMARY

A modified Trommsdorff method for determining the amount of sediment in milk has been presented. The method consists briefly in gravity creaming one liter of raw milk in a separatory funnel, drawing off the skimmilk layer, heating the cream to 70° C. to "liberate" the leucocytes and suspended material and centrifuging the heated cream at 50° C. in a high speed centrifuge using a petroleum water and sediment tube.

No correlation seemed to exist between the amount of sediment present in the milk as determined by the modified Trommsdorff method or the sediment score of the milk and the intensity of sedimentation in the homogenized product. Low leucocyte milk may sometimes show a greater intensity of sediment than high leucocyte milk.

LITERATURE CITED

1. Babcock, C. J. The Effect of Homogenization on Certain Characteristics of Milk. *U. S. Dept. Agr. Tech. Bul.* 438, 12 pp (1934).

2. Babcock, S. M., and Russell, H. L. Conditions Affecting the Consistency of Milk. *Wis. Agr. Exp. Sta, Thirteenth Rpt.*, 73–80 (1896).

3. Charles, D. A. Sedimentation in Homogenized Milk. *Master's Thesis, Univ. of Wis., Madison* (1934).

(Continued on page 31)

Flavor in Its Relation to Dairy Products

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Milk and dairy products are very susceptible to flavor changes because of their bland nature. Only traces of diacetyl and small quantities of lactic acid produce the characteristic flavor in sour cream butter. Furthermore, milk and dairy products readily absorb flavors from their surroundings and from certain feeds eaten by cows. Another source of off-flavors may be due to chemical or bacterial changes taking place in the milk or dairy product upon standing. For this reason flavor is a very important attribute of all dairy products. It is important economically since they are sold on the basis of their score a part of which is based on flavor. For example in butter and cheese, out of a possible 100 points, 45 points are for flavor while for ice cream it is only 30 and for milk 25.

Recent work (1) on some fundamental aspects of flavor has revealed some very interesting relationships between the three basic flavors—saltiness, sourness, and sweetness. Since milk and dairy products have salt, lactose, and lactic acid in varying degrees, a review of the findings of this work should be of interest to those working with these products.

Flavor is one of the most important attributes of any food produced for human consumption. No matter how attractive the food may be in appearance, how expensively it may be packaged, or how nutritious its contents, if it does not suit the "taste" of the consumer, future sales will be negligible. In ordinary food the flavor is a mixture of true tastes and odors accompanied by a multitude of oral sensitivities. The large number of flavors associated with food are mixed in character and are influenced by touch, heat, and cold as well as odor and taste. It is unfortunate that we do not have some objective means of measuring flavor rather than the present subjective method dependent upon the vagaries of the human senses. However, considerable information has been accumulated relative to the factors affecting the flavors of foods so that it is now possible to conduct experiments in which these factors can be standardized, thereby reducing certain errors to a minimum. This has been done insofar as possible in the work reported here.

This work deals primarily with three basic flavors—saltiness, sourness, and sweetness—and their influence on each other. Other investigators have studied them individually as acids, salt, or sugars from various standpoints—anatomically, chemically, and physiologically—but have not studied all of them with respect to their action on each other using the same judges and technique. In food, the flavor is not dependent upon any one of the basic flavors alone. Usually a mixture of two or more are present, such as salt and sugar, acid and salt, or acid, salt and sugar. It is, therefore, important to know the action of one on the other.

Factors Influencing Taste

Methods of measuring taste reactions are naturally varied, depending upon the purpose and the investigator. Some investigators allowed the judges to sample freely the test solution. Others have given measured amounts of the test solution; while a few placed small amounts on the protruded tongue.

The effect of temperature upon the

taste of sapid solutions has been shown to be of considerable importance, and optimum temperatures for individual substances have been established by several investigators. However, others have been unable to show a temperature coefficient.

The time interval between tasting and its effect upon sensory acuity remains uninvestigated. Reaction time to stimuli is a factor which has received little attention.

While some investigators believed that distilled water exhibited real tastelessness, others found distilled water to be most commonly described as a smooth bitter. Still others found that it took several days of tasting before the judges became accustomed to the tastelessness of distilled water.

A number of studies have been made to determine the taste threshold of a variety of substances, but they are of little comparative value since there was no uniformity in method or definition.

PHYSIOLOGY OF TASTE

Several of the earlier investigators believed that the sourness in acids was due to the hydrogen ion but that the intensity was due to other factors since organic acids of equal sourness had different H-ion concentrations. Others believed that the intensity of taste was dependent upon the speed at which the acid penetrated the taste cells. More recently attempts were made to correlate intensity of sourness with buffer action based on the belief that sourness was related with the acid's ability to reduce the pH of the buffer. It was noted that differences in the sourness of an acid could be attributed to variations in the pH of the saliva.

Saline taste, as typified by NaCl, can be excited by other salts to a greater or lesser degree. The chlorides, bromides, and iodides of potassium and lithium and the sulfates and nitrates of these same metals are more or less saline in taste.

Sweetness, according to one investigator, was dependent upon certain structural groups, and a system was set up based upon the constitution of the chemical compound whereby one was able to predict whether a substance would be sweet or bitter. The system was not quite adequate, however, for there were compounds that did not conform to it.

COMPETITION VS. COMPENSATION

Competition rather than compensation is the rule for taste mixtures. Tests have shown that small amounts of sodium chloride neutralized the sweet taste of sucrose and that a one percent solution of sodium chloride increased the sweetness of sugar solutions. It was also found that sourness of organic acids in sugar solutions is dependent upon the sugar concentration. The conclusion has also been advanced that sucrose decreased the sourness of hydrochloric acid and that sodium chloride had no effect.

THRESHOLDS OF SENSATION

Fifteen judges, with very limited or no previous tasting experience, were available throughout this part of the work. The judges were allowed only one tasting of each solution. Each judge tasted each substance twice, at different sittings so that each threshold value represents at least 30 judgings.

The tasting work was done on basic food flavors. Calcium chloride was used, however, to determine the effect of the anion in salts upon taste by varying the cation, using mono and divalent cations.

In recording the data the first solution in the series of increasing concentration that differed from distilled water in taste was the sensitivity threshold, whereas, the first solution in which the taste could be described was the taste threshold.

It was found that the results could be expressed best as the geometric means of the frequency distribution of the molar concentrations of the respective substances tested (Tables 1, 2, and 3). In these tables other pertinent in-

TABLE 1

RELATIVE TASTE POTENCY OF SALTS

Salts	Molar Concentration[1] Sensitivity Threshold	Molar Concentration[1] Taste Threshold	Percent Concentration Sensitivity Threshold	Percent Concentration Taste Threshold	Relative Values Sensitivity	Relative Values Taste	Percentage Sensitivity	Percentage Taste
NaCl	.011	.039	.064	.288	1.00	1.00	100.00	100.00
CaCl	.0076	.0126	.084	.140	1.31	0.61	76.00	163.00

[1] Expressed as the geometric mean of the frequency distribution of the solution tested.

TABLE 2

RELATIVE TASTE POTENCY OF ACIDS

Acids	Molar Concentration[1] Sensitivity Threshold	Molar Concentration[1] Taste Threshold	Percent Concentration Sensitivity Threshold	Percent Concentration Taste Threshold	Relative Values Sensitivity	Relative Values Taste	Percentage Sensitivity	Percentage Taste
HCl	.00050	.00078	.002	.003	1.00	1.00	100.00	100.00
Lactic	.00052	.00085	.005	.008	2.50	2.67	40.00	37.45
Maltic	.00043	.00075	.006	.010	3.00	3.33	33.33	30.03
Tartaric	.00041	.00070	.006	.011	3.00	3.67	33.33	27.25
Acetic	.00080	.00210	.005	.012	2.50	4.00	40.00	25.00
Citric	.00042	.00070	.008	.013	4.00	4.33	25.00	23.09

[1] Expressed as the geometric mean of the frequency distribution of the solution tested.

TABLE 3

RELATIVE TASTE POTENCY OF SUGARS

Sugars	Molar Concentration[1] Sensitivity Threshold	Molar Concentration[1] Taste Threshold	Percent Concentration Sensitivity Threshold	Percent Concentration Taste Threshold	Relative Values Sensitivity	Relative Values Taste	Percentage Sensitivity	Percentage Taste
Sucrose	.016	.037	0.56	1.30	1.00	1.00	100.00	100.00
Dextrose	.045	.090	0.80	1.63	1.43	1.25	69.93	80.00
Fructose	.020	.052	0.35	0.94	0.63	0.72	158.73	135.14
Maltose	.038	.080	1.36	2.89	2.43	2.22	41.15	45.05
Lactose	.072	.116	2.60	4.19	4.64	3.22	21.15	31.06

[1] Expressed as the geometric mean of the frequency distribution of the solution tested.

formation is also included to facilitate interpretation of the results. The "percent concentration" was calculated from the molar concentration. For the determination of the "relative values," the first substance listed was arbitrarily taken as 100 and the rest of the substances determined in terms of this substance by simple proportion. "Percentage" gives the relative effectiveness of the other substances in terms of the first substance listed.

DISCUSSION

Little needs to be written regarding the frequency distribution of the substances; in most cases they followed a normal distribution curve. It was intended that few or none of the judges should note any difference between the first solution and distilled water, and usually this was the case. However, little weight was given to the exceptions since imagination and other psychological factors were undoubtedly of considerable importance.

Salts: It seems only reasonable to conclude that intensity of taste of salts rests with the particular combination of anion and cation. Sodium chloride was always described as salty. Calcium chloride was usually described as salty, but in some cases it was described as a "bitter salt" and "unknown taste." It is hard to get a group of neutral salts like NaCl to test the influence of the cation and anion on taste since many of the salts are sufficiently acid or alkaline or have some other peculiar property which makes comparison impossible. The limited work done with $CaCl_2$ and NaCl, however, would indicate that $CaCl_2$ was not as sensitive or as strong as NaCl in its taste reactions as would be indicated by the chloride-ion concentration (Table 1).

Acids: According to the results (Table 2) the order of intensity of taste of acids was HCl, lactic, malic, tartaric, acetic, citric. One investigator had previously found the order of penetration of acids into tissue to be HCl, lactic, tartaric, malic, citric, acetic. However, where there were differences in the order, upon closer examination (Table 3) it is found that the difference was small.

COMPARISON OF TASTE AND TITRATION METHODS

Attempts were made to correlate sourness with titrations against a phosphate buffer.

Ten milliliters of buffer, pH 7.05, was titrated with each of ten different molar solutions of acid, ranging in molarity from 0.0001 to 0.005, until a pH of 4.45 was reached. The amount of each acid required to change the buffer solution from pH 7.05 to 4.45 was then plotted on the verticla axis and the molar concentration of the acid used on the horizontal axis. According to Beatty and Cragg, a line drawn from any point on the vertical axis parallel to the horizontal axis bisects the buffer titration curves at equi-sour molar concentrations.

A comparison was then made of the threshold values of various acids as determined by tasting with the values found on the plotted titration curves by the method of Beatty and Cragg [*J. Am. Chem. Soc.* **57**, 2347, (1935)].

The results of the two methods checked remarkedly well except for tartaric acid. With tartaric acid the threshold value obtained by tasting was approximately 30 percent higher than that by titration. This exception does not invalidate the titration method but it does indicate that it should be used with caution.

Sugars: There is little that need be written about the relative taste potency of sugars; Table 3 is self explanatory. The value for dextrose is somewhat higher than other workers have found, while the fructose value is lower. Generally, the results on the sugars correspond to the range of values found in the literature.

COMPETITIVE OR COMPENSATORY ACTION

Sodium chloride in sub—taste—threshold concentrations consistently reduced the sourness of all the acids tested but to varying degrees. It reduced the sourness of acetic, hydrochloric, and citric acids only moderately but sufficiently for a noticeable taste difference; while with lactic, malic, and tartaric acids, sodium chloride exhibited a marked effect in reducing sourness. The latter three acids behaved very much alike in their taste reactions with other substances throughout the entire experiments. NaCl increased the sweetness of all the sugars tested but to varying degrees. On the basis of concentration by weight, the relative effect of NaCl on sugars was maltose > lactose > fructose > dextrose > sucrose, while on the basis of molarity it was fructose > lactose > maltose > dextrose > sucrose.

It is interesting to note that hydrochloric acid has no effect upon the taste of NaCl. If the intensity of taste of NaCl was a result of the Cl ions, then hydrochloric acid should, if anything, increase the taste of salt by the addition of Cl ions. Seven of the 10 judges could notice no change in taste and three judges noted a reduction in taste. If the tendency is for a reduction in taste, it would seem that the Na ion has considerable to do with the intensity of taste of salt since the Na ions are reduced by the action of a common ion.

A study was made of the influence of NaCl on acids and sugars when the NaCl was present in sub-taste-threshold values, and the results are tabulated in the original paper. Results on NaCl and sugars when the acids were present in sub-taste-threshold amounts are also shown. In these results we find that the HCl had no effect on the taste of NaCl while all the other acids increased the saltiness of NaCl. With the sugars none of the acids had any effect on the sweetness of dextrose except HCl and acetic acid which reduced the sweetness.

The sweetness of sucrose was increased by lactic, malic, citric, and tartaric and was unchanged by HCl and acetic acids. The sweetness of fructose was reduced by all the acids except HCl and citric acids in which cases it was unchanged. To check the possibility that the increase in sweetness of sucrose was due to inversion, the respective concentrations of sucrose and acids were checked with a polariscope and no inversion was found.

In the results of the influence of the sugars in sub-taste-threshold amounts upon NaCl and the acids, the sugars consistently reduced the saltiness and sourness of NaCl and the acids, respectively. Sucrose reduced the sourness of malic and tartaric acids to a greater extent than any of the other sugars. There was less difference between sucrose and the other sugars in reducing the sourness of the other acids.

Is There Competition or Compensation?

The question now arises, is there competition or compensation between the three basic food flavors when two or more of them are present in a food? According to the definitions previously set up in this paper for competition and compensation in flavors, a substance was competitive when the sub-taste-threshold concentration had no effect on the contrasting substance, while it was compensatory if the sub-taste-threshold added or detracted from the taste of the contrasting substance.

In the detailed effects of the acids, sugars, and sodium chloride on each other, it will be noted, for example, that sodium chloride in sub-taste-threshold amounts had a compensatory action on acids and sugar since it decreased the sourness of acids and increased the sweetness of sugars. Sub-taste-threshold concentrations of acids, except hydrochloric, and sugars likewise had a compensatory action on sodium chloride since they increased and decreased the salinity, respectively. Hydrochloric acid was competitive with sodium chloride.

Summary

The order of sensitivity to taste was sodium chloride < calcium chloride while the order of potency of taste was calcium chloride < sodium chloride. These differences were such that it is likely that both cation and anion play a part.

The buffer-titration method compared very favorably with the threshold taste method for determining the sourness of acids, except for tartaric acid where there was considerable difference.

The order of intensity of sourness for acids was hydrochloric acid > lactic acid > malic acid > tartaric acid > acetic acid > citric acid. Specific values for each are given.

The order of intensity of sweetness for sugars was fructose > sucrose > dextrose > maltose > lactose.

The effect of sodium chloride was to reduce the sourness of acids and to increase the sweetness of sugars. The reduction of sourness of acids by NaCl was particularly noticeable for lactic, malic, and tartaric acids.

None of the acids had any effect on the sweetness of dextrose except hydrochloric and acetic acids which reduced the sweetness.

Acids increased the saltiness of sodium chloride, except hydrochloric acid which showed no effect.

Hydrochloric and acetic acids had no effect upon the sweetness of sucrose. The remaining acids increased its sweetness. It was found that at the concentrations used, the acids caused no inversion of the sucrose as measured by the polariscope.

(Continued on page 60)

What Is Clean Milk?*

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If you were to ask the question, "What is clean milk?", you would probably get almost as many *different* answers as you would get replies, even among those working in the dairy industry. It is not to be supposed that all of you will agree with my answer and I am not so sure that I would give the same answer five years from now or that I would have given this answer five years ago. This is merely to indicate that our viewpoints change and our emphasis varies as our knowledge increases and as conditions change. I do not even go so far as to say that my answer to the question is correct *now* but I am going to discuss it with you for what it may be worth.

Clean milk may be defined in terms of "four freedoms." Not *the* four freedoms which you may immediately think of, but four freedoms nonetheless.

First, and most obviously, clean milk is milk which is *free* from dirt, dust, hair, bedding, manure or any other foreign or extraneous material, soluble or insoluble. But more than this, it must not *have contained* any appreciable quantities of these materials, at any time, between milking and consumption. *Cleaned* milk is not *clean* milk.

Second, and frequently ignored, clean milk is milk which is *free* from objectionable or unnatural flavors and odors, whether these are secreted, contaminate the milk after secretion or develop through biological or chemical action.

Third, and most often discussed, and regulated, clean milk is milk which has been so adequately protected that it is reasonably free from bacterial contamination and bacterial multiplication, at all points and in all stages of its handling. transportation and processing between the cow and the consumer.

Fourth, and of paramount importance, clean milk is milk which is absolutely *free* of living pathogenic organisms capable of causing human disease, whether this is accomplished by pasteurization or by surrounding the production and handling of milk with sufficient precautions to eliminate all possibility of their presence.

Even this definition of clean milk is not very specific for it uses such terms as "appreciable," "adequate," "objectionable," "sufficient," "reasonably" and these would require further definition and explanation if we were to be absolutely exact. It seems necessary, however, to allow some tolerance in the case of dirt, flavor and bacterial population, for otherwise no milk produced or distributed today could classify as clean milk and there would be no possibility of defining clean milk in terms of the abilities, facilities and conditions for producing or distributing milk, which vary in different places. Clean milk, therefore, must either be a relative term which varies from place to place and from time to time or there is no such thing as clean milk. There should be no tolerance, however, with respect to the fourth freedom specifying that milk must be free from disease bacteria for this is directly related to public health and no milk that is unsafe, even in the slightest degree, can ever be considered clean.

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In discussing the four freedoms postulated for clean milk, I propose to talk in terms of basic considerations, avoiding the details of application, and to emphasize the production of milk rather than the processing.

FREEDOM FROM EXTRANEOUS MATERIAL

The protection of milk from contamination with dirt involves precautions which have had so much attention in the past that the story has become tiresome. The precautions are, of course, vitally important and include such things as clean cows, stables and barnyards; the protection of milk houses and utensils from dust; the clipping of cows and grooming before milking; the rinsing of utensils before use; avoiding dust laden air during milking; and, above all, cleanly habits on the part of those doing the milking. It is difficult to impose cleanliness and clean habits by regulations and policing but it is frequently possible to obtain the desired end by subtle appeal to a man's pride in his work or even in some cases by inducing a sense of shame for his lack of cleanliness. Many inspectors find, too, that merited praise for certain accomplishments stimulates further commendable efforts in other directions. There is a decided need for a little more psychology, or you may prefer the word diplomacy, in programs for improving milk supplies or in merely keeping a milk supply in line with the minimum requirements in effect.

No matter how well a producer does his work or how carefully all the precautions are adhered to, some dirt will get into the milk during the milking operation. Then the question arises: shall the dirt be removed by immediate filtration or shall it not? There are two schools of thought in the matter. One holds that all extraneous material should be removed as soon as possible, for some of it will disintegrate, if allowed time, releasing greater numbers of bacteria into the milk and some will gradually go into solution, possibly affecting flavor. The other thought is that producers should not be allowed to filter milk on the farm because such a practice makes the sediment test at the plant worthless as a means of evaluating the producers care in production. Also, it is argued that where filtration is allowed, the producer is likely to depend on it to remove dirt rather than to use the necessary care in preventing contamination in the first place. The answer to the question is not easy and it may vary in different sections. I think, however, that we must keep in mind the objects of cleanliness and sanitation in milk production. We are interested in these things because we wish to place in the hands of the consumer the highest quality of safe milk that is possible to provide. We are not primaily interested in whether filtration on the farm will make it more or less difficult to judge the producers performance. Only a person who is thoroughly familiar with conditions and practices in a given area can accurately answer this question. I, personally, feel that it is better to allow farm filtration and to foster the idea that filtration on the farm is not simply a procedure for cleaning dirty milk but is in fact a sediment test upon which a producer may *daily* judge his own performance and seek to improve his methods. If used in this way, farm filtration should be an implement to the improvement of the quality of the milk supply. Unfortunately, it is seldom that one encounters a producer who views filtration in this light.

FREEDOM FROM OBJECTIONABLE FLAVORS

The factor of flavor in clean milk production is frequently ignored, possibly because it is not usually connected with sanitation and healthfulness. Yet, I would not consider it proper to call milk clean, no matter how fine it is in other respects, if the flavor is not *clean*. By clean flavor is meant the typical, bland, delicate, flavor of normal milk. Pasteurized milk has a slight heated flavor but, since this is typical of pasteurized milk and so long as it is not excessive, it may still be considered clean.

The flavor of milk may be affected before it is drawn from the cow's udder. Indeed, this is most often the case with off-flavored milk at the farm, for absorption of flavors by the milk during or after milking is practically negligible. Many food substances which cows eat will impart a flavor to the milk. This occurs because certain odoriferous substances are absorbed into the blood stream from the digestive tract very readily and very quickly, and some of them are taken from the circulating blood by the cells of the mammary gland along with other blood components needed for the fabrication of milk. The odor of garlic is noticeable in the blood of a cow about 15 minutes after the eating of garlic and appears in the milk within about 30 minutes. Many feeds and weeds impart a flavor to milk in this manner. Some are very objectionable, others not so objectionable, but all contribute to unclean-flavored milk.

The three most important considerations in avoiding off-flavors in milk from the food of the cow are: (1) The avoidance of obnoxious foods insofar as possible or practicable, (2) Limitation of the amount of the offending food material eaten and (3) the allowance of a three to four hour time interval between consumption of the food and milking. This third point can be put into practice without great difficulty as routine procedure and is effective except in extreme cases. Cows should be taken off pasture several hours before milking. They should not be stall fed before or during milking, but after the milk is drawn.

It is possible to greatly improve pastures by procedures which are now being advocated by most state institutions. Even permanent pastures respond to fertilization, reseeding and a clipping program which prevents weeds from going to seed. Any dairymen handicapped by weedy pastures should obtain informtaion from his state agricultural college on the subject of pasture improvement. It will not only aid in eliminating off-flavored milk, but will pay dividends in reducing feed costs of milk production.

It was previously stated that milk does not usually absorb odors from the air during milking and handling. This does not mean that the condition of the air in the stable is of no importance. Far from it. It has been rather definitely proven that cows quartered in an atmosphere rank with manure, silage, or other odors will subsequently secrete milk having these unclean flavors. In such cases the offending substance is inhaled by the animals into their lungs where it is absorbed by the blood and carried throughout the body. The result is comparable to the situation mentioned previously where the odorous substance is absorbed by the blood from the digestive tract. In either case the flavorful material is taken from the blood stream by the cells of the mammary gland and secreted with the milk. This being true, proper stable ventilation, removal of manure and the avoidance of odors in the air of the stable are important considerations in producing a clean flavored milk. Such milk flavors as cowy, barny and manurial are probably more often caused by inattention to the condition of the barn air than to other things. In the winter time when the animals are kept in closed stables all night, the morning's milk may be far from clean in flavor unless ventilation is good and stables are well cleaned daily.

Some off-flavors, not related to what the cow eats or breathes, are sometimes present when milk leaves the farm. Some of these are due to bacterial contamination or multiplication. A salty flavor may be caused by mastitis infections or prolonged lactation and milk in the late stages of lactation may exhibit a rancid flavor. Medicinal flavors may result from the careless use of medicated preparations, poor practices in spraying for flies or disinfecting and in some cases from injections by veterinarians in the treatment of certain ailments of cows. Oxidized flavor also sometimes results, particularly in the winter time, when milk is exposed to improperly tinned, copper or iron surfaces or to sunlight. There is good evidence to show that the use of green roughages such as the molasses or acid silages, are very helpful winter feeds in reducing the susceptibility of milk toward oxidation. In general, oxidized flavor is much more a problem of the milk dealer than of the milk producer even though some of the responsibility for its later development rests squarely with the producer.

In any attempt to improve the flavor of milk distributed to consumers, it is not enough to simply recognize that milk is abnormal in flavor. The flavor should be identified, its probable cause appreciated and steps taken to correct it. Too frequently producers and dealers even if they know the flavor of milk is defective are not able to identify it and, therefore, are at a loss to correct it. An experienced inspector at the plant intake is a real asset. He not only is able to keep inferior milk out of the plant receipts, but is able to diagnose the inferiority and thereby assist the producer in overcoming it.

FREEDOM FROM HIGH BACTERIAL POPULATION

Clean milk is most often thought of as low bacterial count milk and we have heard and read more about this freedom, over the years, than the other three. This is perhaps only natural because the number of bacteria in milk is something rather definite, as commonly measured, and because the bacterial count is related to the use of proper sanitary precautions in production and the care with which they are employed.

Milk taken asceptically from a normal mammary gland contains bacteria. The numbers are relatively small, seldom being more than a thousand or so per ml. of milk and are usually greater in the first few streams from the udder than in milk drawn later. The udder, therefore, is not sterile as is sometimes supposed. Frequently, bacteria in the udder are able to invade the secreting tissues due to injury, rough handling, prolonged machine milking, lowered resistance, etc., and inflammations result which are usually termed mastitis. Mastitic udders or quarters secrete milk of higher bacterial count. Sometimes the populations run into the tens of millions per ml. of milk. In any attempt to produce low count milk, mastitis must be controlled if for no other reason. Mastitis has received and is receiving so much attention that no producer should have difficulty in obtaining information or assistance in putting into operation a system of control. One thing that can and should be done, even without a system is to use a strip cup on each quarter of each udder just before milking. This accomplishes two things. It removes the first few streams of milk from the udder, which are always highest in bacterial count, thereby eliminating them from the milking and, it detects some active cases of mastitis which might otherwise escape notice.

Anything which will protect milk from dirt will protect it from bacterial contamination for all dirt contains bacteria. Manure contains billions of organisms per gram and it takes very little of such contamination to appreciably raise the bacterial population of milk. This suggests one argument sometimes advanced against filtration; namely, that any manure removed from milk by the filter medium is distintegrated and the occluded bacteria washed through the filter by milk put through subsequently. I never can understand this argument because if the milk is not filtered the solid manure particles as well as the bacteria are in the milk anyway. It seems reasonable that some of the bacteria will be retained with the dirt on the filter medium, even if a considerable quantity of milk is put through later.

In hand milking of cows, dry-hand milking should be practiced. Wet-hand milking is a slovenly procedure, at best, and always adds significant numbers of bacteria to the product.

By far the most important factor in producing milk of low bacterial count is clean and properly sterilized utensils —pails, strainer, milking machines, cans and any other equipment with which milk comes in contact. This factor, by and large, is the most difficult to control on the average farm and the producer often gives it less attention than things which are more obvious but of lesser importance. All utensils must be well washed which involves rinsing, followed by the use of a washing compound (not soap) and a stiff brush capable of getting into all the corners and seams of the equipment. A supply of reasonably warm water is essential for satisfactory washing. But even with all the facilities available for proper washing, there is no assurance that a satisfactory job will be done. The most important factor in washing as in so many other operations is the human element. Even with poor facilities a careful, conscientious, operator will secure better results than a hit or miss operator will achieve with the best of facilities. In general, it can be said that the job of washing milk utensils and equipment on the farm is not given the time and attention it deserves. The object is to remove all remnants of protein or fat from the surface of the equipment and to rinse every vestige of these as well as the cleaning compound from that surface. If this is not accomplished, then the heat used in sterilizing may bake these on and gradually build up deposits of milk stone which will harbor bacteria.

Sterilization is a very indefinite term applied to dairy equipment. We very seldom mean it literally but rather mean a treatment which we hope will approach sterility. There are three common methods of sterilizing dairy equipment. First, by means of hot water; second, by means of steam; and third, by the use of chlorine solutions. All are satisfactory if properly used. If heat is employed, time as well as temperature is an important consideration and while there are innumerable ways of applying the heat, it is essential that the whole of the surface to be treated reaches the required temperature and is held there for the required time. Steam cabinets and water boilers large enough to hold all the utensils are, in general, satisfactory. Steam jets, rinsing with scalding water or mere "dunking" in hot water are usually not satisfactory. In using chlorine, the manufacturer's directions should be followed implicitly and it must be continually borne in mind that chlorine solutions are not stable, therefore, should be fresh; they are not effective on poorly washed surfaces; and they are extremely corrosive to metals, therefore the duration of contact should be limited. Many producers use a heat treatment followed by a chlorine rinse preceding the use of the equipment.

After washing and sterilization, the equipment should be placed on a rack protected from dust and flies and allowed to dry. Holding equipment dry between uses is almost as important as proper sterilization, for in the presence of moisture what few bacteria remain will multiply prodigiously in the period between uses of the equipment.

Before equipment is used again, it is advantageous to rinse it with clean water or a weak solution of chlorine followed by clean water. It is also usually to the advantage of the producer to wash and sterilize the cans returned from the milk plant. Or, if this is deemed too laborious, the cans should be at least well rinsed with hot water and placed with other equipment on the racks to dry.

Milking machines are a special problem. There are a number of satisfactory methods of handling these to minimize bacterial contamination. Some authorities prefer a heat treatment for the cups and tubes. Others recognize the use of chlorine and still others have recently been converted to the use of a .4 per cent lye solution. Recent studies by milk dealers and others have shown that the so-called poor pasteurizability of milk is closely related to improper methods of treating milk equipment on the farm and in 80 per cent of the cases the milking machine has been the principal offender. Bacteria commonly inhabiting poorly treated milk containers and equipment are usually of the so-called thermoduric type. That is, they are capable of enduring a greater amount of heat, without being destroyed, than other milk organisms. Some of the larger milk dealers have set up rather elaborate systems of control for poor pasteurizability and are following the leads right back to the farm where they first of all check on the milking machine. I am not familiar with the recommendations of your local health authorities relative to the cleaning and sterilization of milking machines but I do know that the method advocated is not as important as is the daily careful attention to the details of the method, whatever it is.

All the care exercised to prevent bacteria from getting into milk during milking and handling is too little avail in producing low count milk if we do not also control the multiplication rate of the few which will always be present. Bacteria in general prefer temperatures of 90° to 100° F. In this range they are at maximum activity and may double their numbers every 20 or 30 minutes. Fortunately, due to what is sometimes called the germicidal properties of milk, active multiplication does not begin at once after milking and if milk can be promptly cooled to a temperature which is unfavorable for bacterial action, multiplication may be held to almost the zero point. Experience and experiment have shown that a temperature over 55° F. is not at all satisfactory as a check on bacterial growth and if best results are desired the tempertaure should be taken under 50° F.

There are a number of controversial ideas relative to cooling milk. Some advocate cooling mornings milk—some do not, arguing that the time might be better spent in getting the milk to the plant or receiving station. Some favor surface coolers for quick lowering of the temperature—others claim they are a bacterial hazard due to the difficulties of sterilizing. A few suggest stirring the milk when cooled in the can because the temperature is lowered more rapidly—more advise against stirring because of the liability of contaminating the milk from the stirrer. I am not going to take the time to go into these but I would like to make an observation which applies not only to cooling but to sterilization also. It is most surprising to find that so many dairies attempt to produce low bacterial count milk without a thermometer for checking temperatures. They do not know how hot their "scalding" water is or what temperature their steam cabinet reaches. Neither do they know how cold their cooling medium is or how long it takes the milk to reach a satisfactory low temperature. Almost invariably if questioned about the matter, the dairyman says, "Well, we used to have a thermometer but it broke." This always reminds me of the Scotsman who was an enthusiastic golfer but who had to give up the game because he lost his ball.

FREEDOM FROM HUMAN DISEASE ORGANISMS

Milk free from pathogenic organisms may be obtained in either of two ways or by employing both of them together. The first way is to surround the production and handling of milk all the way from the cow to the consumer with sufficient safeguards to prevent contamination of the milk, at any point, with disease organisms. This is a very large order and *has not* been highly successful except in the case of Certified Milk. Here it has been costly and withall not 100 per cent satisfactory. The second way is to pasteurize the milk and take the necessary precautions against contamination following pasteurization. This method *has* been highly successful except in a very, very few cases where the pasteurization process was not properly carried out or where milk was not sufficiently safeguarded after the process was applied. Pasteurized Certified Milk is quite common in our larger markets today and is an example of the use of both methods of insuring a milk safe from a public health standpoint.

More and more health authorities are becoming convinced that the human element, in the first method of insuring safe milk, is not to be trusted and we find that there is a growing tendency especially in the larger markets to require pasteurization of all milk, with the possible exception of certified milk. The percentage of pasteurized milk is increasing in the smaller markets and through the rural areas but the amount of raw milk sold is still high.

A year or two ago, the New York State Department of Health studied their records and found that in the last 20 year period there have occurred 151 verified milk-borne outbreaks of disease in the state. None has occurred in New York City where all the milk supply, except a very small proportion of certified milk, has been pasteurized. In the latter 12 years, 69 outbreaks occurred and all except four were confined to rural towns and villages. In eight of these the source of the infection was not determined but in the other 61 the infection originated at the farm. These figures illustrate the fallacy of the still popular idea that milk is safe if it comes directly from the farm to the consumer.

Fortunately, tuberculosis has been just about eradicated from dairy herds of the United States and it is now merely a question of keeping it out of our herds. Bangs disease is in the process of eradication but it will be some years before it can be put in the same category with T.B. In the meantime, much raw milk from herds not free from Bangs disease will not classify as clean milk, although it can be made clean, in this regard, by pasteurization.

Mastitis in dairy animals, in the great majority of cases, is not a public health hazard but in a few cases it is. Unfortunately, these few cannot easily be distinguished from the many harmless infections. This means that all cases of mastitis are potentially dangerous to public health and when the prevalence of mastitis is considered it is not hard to appreciate the difficulties confronting any dairyman who is attempting to produce and distribute a safe or clean raw milk. While the most satisfactory solution to the problem, at the present time, is pasteurization, we all realize that facilities for pasteurization of *all milk* supplies are not available. Therefore, it will be necessary to rely for some time on surrounding the production of raw milk with all possible precautions to avoid contamination with human disease organisms and hope that these may be effective. In this connection all raw milk dairies should be required to maintain T.B. and Bangs disease free herds and should be required to adopt and follow through a program of mastitis control. In addition, periodic medical examinations of milkers and milk handlers should be obligatory and dairymen should be acquainted with the danger of allowing workers suffering from sore throat, infected sores, boils, etc., to milk cows and handle milk on the farm.

The pasteurizing plant is also not without responsibility in protecting the milk from contamination following pasteurization. Plant workers should be subject to periodic medical examination and disease "carriers" should not be permitted to work in dairy plants. Following the pasteurizing process, which, of course, should be carefully and conscientiously carried out, the milk should be handled as little as possible and with as much protection as possible, until it is in the bottle and sealed. Some health authorities require homogenized milk to be homogenized before pasteurization. This is a logical requirement in that it reduces the possibilities of contamination after the product leaves the pasteurizers. Many health departments require milk and cream to be pasteurized in the same plant in which they are bottled and require bottling to immediately follow pasteurization, for the same reason. In Pennsylvania much attention has been paid recently to plant lay-out, particularly as regards the milk handling room. The Bureau of Milk Sanitation has required all new construction plans to be submitted for approval. Their interest has centered on eliminating all traffic through the milk handling room and protecting this room and its equipment from flies.

Pasteurization has been extremely effective in rendering milk supplies safe from a public health standpoint. Proof of this lies in the fact that there are practically no milk-borne epidemics reported from our larger cities where substantially all the milk is pasteurized; notwithstanding the fact that such milk is older, is shipped long distances and is handled through various plants by many more workers than is the case with milk supplied to towns and villages close to the producing dairies.

In conclusion, it can be said that milk cannot measure up to the four freedoms and be considered clean milk except through the exercise of extreme vigilance on the part of all who have a hand in its production, processing and distribution. The milk supply of the United States is admittedly of higher quality than the supply in any other country of the world, but there is still room for improvement particularly with respect to the proper application of the knowledge at hand. The "know how" is essential, of course, but it does not result in clean milk until it is translated into continuing action.

MODIFIED TROMMSDORFF METHOD

(Continued from page 18)

4. Hammer, B. W. *Dairy Bacteriology.* 2nd Ed., 482 pp. plus xiv, illus. New York: John Wiley and Sons, p. 144 (1938).

5. Peters, I. I. The Role of Leucocytes in the Sediment Formation in Homogenized Milk. *Master's Thesis, Mich. State Col.,* East Lansing (1944).

6. Rullman, W., and Trommsdorff, R. Milchhygienische Untersuchungen. *Arch. f. Hyg.,* 59, 225-265 (1944).

7. Russell, H. L., and Hoffman, C. Effect of Heating upon the Determination of Leucocytes in Milk. *Amer. Jour. Pub. Hyg.,* **18**, 285-291 (1908).

8. Schuppius, R. Die Milchleukozytenprobe nach Trommsdorff. *Arch. f. Hyg.,* **62**, 137-146 (1907).

9. Trout, G. M., and Halloran, C. P. Sediment Test Not a Reliable Guide in the Selection of Milk for Homogenization. *Mich. Agr. Exp. Sta. Quart. Bul.,* **15**(4), 271-274 (1933).

10. Trout, G. M., Scheid, M. V., Peters, I. I., and Mallman, W. L. Influence of Bacteria, Yeast and Leucocyte Distribution in Bottled Homogenized Milk on Sediment Formation. *Ibid.,* **26**, 285-296 (1944).

Integrating Milk and Food Inspection Work

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The integration and correlation of all phases of public health activity is a subject which has been given a great deal of attention and study by specialists in administrative practice over a considerable period of years. Consequently, it is highly appropriate on the part of those engaged in the promotion of environmental sanitation to be actively concerned with the integration of two closely related phases of sanitation, namely milk and food control. Consideration of the word "integration" itself defines our objective quite fittingly since its synonymous meaning is, "to make up or complete as a whole." Sometimes we are prone to think of milk sanitation as one specialized branch of public health and food control another, while as a matter of actual fact the specific knowledge and information possessed by the milk sanitarian readily lends itself to translation and application to the area of food control.

Generalization from Specialization

When the content of any one phase of environmental sanitation is closely analyzed, it is generally apparent that some degree of specialization is necessary, while on the other hand one is also struck with the fact that the broad aims and general principles are practically identical. One pertinent corollary to illustrate this point may be found in another important branch of public health, public health nursing. At one period in its development, the nurse's duties were both circumscribed and specialized. She was either a school nurse, did communicable disease nursing, gave all of her attention to tuberculosis, or devoted the majority of her time to beside care of the sick. Over the years, a change in policy has taken place. The trained public health nurse of today renders a generalized service and possesses an appreciation and understanding of what were at one time considered distinct specialties. Sanitation, it would appear, has been and is now going through a somewhat similar evolution. The former policy of branding a man a food or a milk inspector or a sanitary officer is giving way to a much broader interpretation, one that considers him trained in sanitary science, a public health engineer, or a sanitarian, with all that those terms imply.

If such then is the case, it is entirely fitting that those especially delegated to handle milk sanitation begin to enlarge their sphere of activity to include the supervision of food and food handling. When one examines reports of food-borne illness reported annually by state and territorial health officers to the U. S. Public Health Service, one must certainly be impressed with their implications. These figures are probably well known to most of you, but they bear repetition. In 1942 there were 245 food-borne outbreaks involving over 11,000 cases and 101 deaths. Outbreaks due to infected food overshadowed those due to milk and milk products by over five to one. In addition to the evidence presented by these figures, it is common knowledge that patronage of public eating and drinking places is at an all time high. Eating and drinking is done in all sorts of

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places from the corner hamburger stand to the banquet tables and cocktail lounges of our largest hotels. The problem is there, it is important and challenging, and we cannot afford to ignore it.

WHERE TO START

At this point, I believe I know what many of you are thinking and I have thought the same thing myself. You are saying that that is all very fine, but we have a full time job now just looking after the milk supply. How can we take on added responsibility? That is a valid question in most instances and I have not a ready answer in all cases. I can say that the job of supervising a milk supply does not stop at the dairyman's door. Practically every eating place today uses milk in one form or another. When it leaves the pasteurizing plant, it is good milk, but when it gets to its final point of destination in some restaurants its identity as good milk begins to fade. I propose then that a good starting point in food sanitation is in the investigation of methods and means for handling and dispensing milk and cream in public eating places. I do not mean to insinuate that this is the only starting point, but it is a good one and fits in appropriately with your duties in milk control. I can say this because I have done it. I recall checking milk storage and handling in eating establishments some years ago when my responsibility was primarily milk sanitation. What I found was a revelation and these few examples illustrate how milk is sometimes abused. Cases of milk were found stacked for an undetermined period of time on the floor in a back room without benefit of refrigeration, half pints found stored in the pop cooler with water of questionable quality covering them, uncovered cans of milk in walk-in coolers, milk being poured out of larger containers into glasses for table service with never a thought for individual service, and in one case half pints being filled from quart bottles with used caps being put on by rule of thumb. This same survey led to other findings which not only revealed inadequate storage temperatures and dirty refrigerators, but equally unsatisfactory conditions violating other precepts of good sanitation. From that point on, restaurant supervision became an increasingly important part of that local sanitation program.

While I appreciate that many of you here are already doing both milk and food work, it seems timely in this discussion to show how these two programs may be integrated on the basis of sanitary requirements. If you will take, for example, the recommended "U. S. Public Health Service Milk Ordinance," place it beside the Service's recommended "Ordinance Regulating Eating and Drinking Establishments" and compare them on the basis of applicable items, a marked similarity will be noted, both in specifications and in interpretative meaning. To cite a few examples, consider these:

1. Doors and windows, mainly involving fly control, are treated similarly in both ordinances.
2. Ventilation, the same general requirement of adequacy in both ordinances.
3. Toilet facilities — provisions are almost identical.
4. Lavatory facilities and the necessity for personal cleanliness on the part of all employees are emphasized in both ordinances.
5. Cleaning and bactericidal treatment of containers, utensils and equipment. The same basic principles apply, whether the product handled be food or milk. Obviously, with food the type of soil to be removed is of different character, but the sanitarian who gives advice on this point to the milk plant operator is equally well equipped to do so to the restauranteur.
6. And finally, pasteurization of a specialized type enters the food picture with the advocacy of heat treatment for custard pastry fillings.

As can be seen from this enumeration of only six selected items—and others could be given—the principles that apply to milk sanitation have equal merit and importance in the food handling establishment. This fact alone should serve to give confidence when a food program is inaugurated.

LEADERSHIP NOW NECESSARY

Thus far an attempt has been made to show some of the technical implications involved in the two activities, but there are others which deserve consideration. One of them is the opportunity health departments have for leadership in the food field. Up until the last few years (and I say guardedly, the past ten or fifteen years, because I know of many fine food programs that have been operating for a longer time) much of the food sanitation work was and still is carried out by bureaus and agencies outside of public health who have to consider the economic and marketing phases of food handling. Such responsibility leaves much to be desired from the strictly public health viewpoint. Much stress has been placed upon the esthetics of food plant physical maintenance and appointments while real sanitary values have sometimes been relegated to the background. Staphylococci food-borne outbreaks are a case in point. Enough has not yet been done to stamp them out, but relatively little was done until trained sanitarians tackled the problem. Private water supplies, sewage and waste disposal, and plumbing hazards to food have been seriously overlooked by inspectors whose training and aptitudes were not calculated to consider inherent dangers of this type. Milk sanitarians, on the other hand, have been dealing with these factors for years. A transition from milk to food is not difficult. It would appear that food sanitation is almost in the position milk control was twenty-five or thirty years ago. The standard of milk safety now employed by many communities did not happen overnight but took place because of intelligent guidance and leadership on the part of public health workers. It is fair to assume that similar safeguards can be created to protect food.

I have mentioned the opportunity for leadership in the food field but this need not be confined strictly to the industry itself. The manufacturers of food processing apparatus and equipment can be influenced. This has been demonstrated among the manufacturers of milk plant equipment. Standardization among most major suppliers is an outstanding example of how public health demands can be met and equipment designed to give maximum protection to a product. When a milk company in your area buys a new pasteurizing vat, for example, you know that it will come equipped with a proper type outlet valve. As much cannot be said for the suppliers of food processing and handling equipment. If, therefore, sanitarians insist that restaurants purchase only approved equipment and point out what safeguards must be provided, it will not be long before manufacturers will note the trend and incorporate changes to meet demands. Sanitarians know, for example, that many types of dish-washing machines do not meet specifications for proper sanitization of dishes, but unless those of us who recognize these defects can stimulate the desire on the part of the restaurant proprietor to get a machine that will do an effective job, we shall still have inadequate dishwashers.

FIELDS FOR LEADERSHIP

This is one type of leadership: for improved and more efficiently designed food equipment. This influence can be exerted by the sanitarian yet there are other opportunities for leadership and guidance. Another activity in this category is the opportunity for adult education among both food proprietors and their employees. Particular reference in this connection is made to the organization and operation of classes of instruction for food personnel. Again the experience of the milk sanitarian can be utilized. At frequent intervals those so engaged are invited to speak before milk producer groups, granges, luncheon clubs, and civic organizations where facts are given, not only about the mechanics of milk inspection but equally important the public health necessity for it. A number of outstanding examples could be cited to show that milk sanitarians have been directly instrumental in organizing courses for the instruction of milk producers and pasteurization plant workers. It follows, therefore, that the milk sanitarian has the training and technical information needed for organizing group instruction among those engaged in the food industry, and the opportunity to apply this knowledge must not be overlooked. Facilities are available today for the instruction of food handlers which were almost wholly lacking five or six years ago. Several good films on food sanitation are obtainable, outlines for courses have been worked out, and methods for organizing classes have been developed. When one realizes that relatively little had been done in this field of endeavor prior to 1937 and that now classes are going on in nearly all parts of the country, the value of this activity seems to have been widely accepted and to give promise as a real aid to food control work. It is certainly a valid premise to assert that progress in food sanitation will be in direct proportion to the rapidity with which persons engaged in it can be taught and enlightened.

PUBLIC SUPPORT

While education within the industry is necessary and highly desirable, food control offers an excellent opportunity to sell public health. People generally are interested in the cleanliness of eating and drinking places, perhaps even more so than they are in the conditions surrounding milk production. One reason for this is that their contacts with food establishments are firsthand because they are in and out of them frequently. Most anyone will glibly recite some unpleasant experience about something he found in food or the cloudly lipstick-stained glass he was served at a bar and then end his story by vociferously stating, "Why doesn't somebody get in there and make these places clean up?" I believe it is evident that when interest can be properly stimulated on the part of the public, the sanitarian will find a real ally to champion his cause. Public backing for reforms in milk quality and safety have materially helped to put good programs across. The same enlightened and guided public opinion can do likewise for food.

Finally, it should be emphasized that the milk sanitarian has a real opportunity to make his influence felt in food control. He has the training and technical information at hand, and it is simply a matter of slight adjustment plus a patient approach and a study of problems to begin to accomplish with food what has so ably been done to make milk a safe product. There is a job to be done and ours is the responsibility to do it.

The following brief reports were prepared at the request of the Editor to cover some developments in the dairy industry during 1944.

Developments in the Laboratory Control of Milk

One of the most useful studies reported during the past year has been the survey of milk laboratories in war areas conducted by Black (1). The degree to which Standard Methods are being departed from in official control laboratories should cause real concern. It is unfortunate that in discussing the comparative value of the plate count, direct microscopic count and methylene blue reduction test, the report departs from its previous objective tone.

Alternatives to the plate count in the control of pasteurized milk continue to receive attention. Believing that the results reflect keeping quality more adequately than does the plate count, the Ministry of Health in England (2) have substituted a methylene blue reduction test following preliminary overnight incubation of samples. In Rockford, Ill., Gunderson and Anderson (3) report that the direct microscopic examination of both raw and pasteurized milk and the swab test for determining equipment cleanliness apparently offer definite advantages over the tests previously used (methylene blue for raw milk, plate count and coliform test for pasteurized).

As a result of recommendations made at a recent meeting (4), the forthcoming 9th edition of Standard Methods for the Examination of Dairy Products will include a description of both the "one hour" and "triple reading" resazurin techniques. Furthermore, the inversion of tubes at intervals during incubation in the methylene blue reduction test, which has been advocated for some time, will become the standard procedure. This should remove much of the grounds for recent criticism of this test.

Standardized tablets for the resazurin test (5) are now available on this continent. These furnish a more concentrated dye solution than that in use in Britain.

In Britain there has been a steady flow of papers on various aspects of the resazurin test. Davis and Newland (6) reported that changes were most rapid in samples held before testing under the most aerobic conditions. According to Morris and Edwards (7) high cell counts have little effect upon the results of the "10 minute" test (8), but have more effect in the "one hour" test and in the methylene blue test. Similar findings were reported by Thomas and Bowie (9). The effect of overnight storage of samples at various temperatures was also studied by Morhis and Edwards, but the results were conflicting. Thomas (10) found that the bacterial content of resazurin solution purposely contaminated through unsterile cylinders or by addition of nearly sour milk might reach very large numbers on holding at 40° F. Phillips and Soulides (11) found a very high degree of reproducibility for the routine resazurin test (12), while Thomas and Peregrine (13) reported good agreement between the results of this test and those from the methylene blue test. These workers suggested

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that an official test evolved from the present routine resazurin test be considered for the grading of both "designated" and "undesignated" raw milk, since this test is at least as good an index of the keeping quality as the methylene blue test. Provan and Rowlands (14) found both methylene blue and resazurin tests gave a reliable indication of the keeping quality of pasteurized milks following overnight holding at 18° C.

Morris and Edwards (15) reported a plant where pasteurized milk showed high counts and coliform content while negative to the phosphatase test. Four per cent of producers' milks were found to contain heat-resistant coliforms, while 12 per cent contained thermoduric bacteria in large numbers. Although the resazurin test failed to indicate the latter, in some cases reducing substances formed by bacterial growth before pasteurization resulted in a significant change in color when the test was applied to the pasteurized milk.

A modification of the Frost "little plate" method was described by Bryan and Bortree (16) for the detection of heat-resistant bacteria in milk. The mixture of milk and agar prepared with the raw milk is pasteurized in the laboratory and a second "little plate" prepared. Results reported show good agreement with the plate count following laboratory pasteurization. Prouty, Bendixen and Swenson (17) compared the roll-tube method with the plate count method, while Bell (18) described a rectangular Pyrex culture flask to replace the petri dish. Skinner, Marwin and Honaas (19) found little difference between brilliant green bile broth and formate-ricinoleate broth in the number of false negative samples, but false positives were encountered much more frequently with the latter medium. The value of the Burri slant method in bacteriological control has also been referred to (20).

REFERENCES

1. Black, L. A. *Pub. Health Rep.*, **58**, 1605–1623, 1641–1656, 1681–1689 (1943).
2. Ministry of Health (England). The treated milk (prescribed tests) order, March 28, 1944.
3. Gunderson, N. O., and Anderson, C. W. *J. Milk Tech.*, 7, 73–77 (1944).
4. American Public Health Ass'n. Meeting of Standard Methods Committee on Milk and Milk Products, New York, Oct. 4, 1944.
5. Johns, C. K. *Amer. J. Pub. Health*, **34**, 955–956 (1944).
6. Davis, J. G., and Newland, L. G. *Dairy Ind.*, 9, 339–344 (1944).
7. Morris, C. S., and Edwards, M. *Ibid.*, **9**, 92–96 (1944).
8. Ministry of Agriculture and Fisheries (England). Form No. C.150/T.P.Y., July, 1942.
9. Thomas, S. B., and Bowie, D. A. *Dairy Ind.*, **9**, 335–338 (1944).
10. Thomas, B. F. *Proc. Soc. Agric. Bact.* (Abstr.), 46–49 (1943).
11. Phillips, G. M., and Soulides, D. *Ibid.*, 50–52 (1943).
12. Ministry of Agriculture and Fisheries (England). Form No. C.158/T.P.Y., 1942.
13. Thomas, S. B., and Peregrine, A. *Dairy Ind.*, **9**, 634–639 (1944).
14. Provan, A. L., and Rowlands, A. *Ibid.*, **8**, 693–699 (1943).
15. Morris, C. S., and Edwards, M. *Dairy Ind.*, **8**, 550–554 (1943).
16. Bryan, C. S., and Bortree, A. L. *J. Milk Tech.*, **7**, 251–254 (1944).
17. Prouty, C. C., Dendixen, H. A., and Swenson, S. P. *Ibid.*, **7**, 5–16, 1944.
18. Bell, G. *Food Ind.*, 16, 797–798 (1944).
19. Skinner, C. E., Marvin, R., and Honaas, O. *J. Milk Tech.*, 7, 200–205 (1944).
20. Johns, C. K. *Food in Canada*, **4**(3), 17–18 (1944).

C. K. JOHNS

The Frozen Desserts Situation

The frozen dessert field is rather large to cover in a few words but a resume of some of the more recent developments may be given briefly.

Problems of Industry

Reduced quotas of milk products that could be used together with shortages of available milk supplies and other ingredients such as sugar has limited production at a time when the demand was greatly increased due to war time conditions. This has presented a real problem to the ice cream industry which has been solved in part by the very extensive use of sherbets which have been forced upon the public since the sale of sherbets as such has not greatly increased. Another way in which the gallonage has been increased is by the use of greater amounts of flavoring materials. Most laws allow sufficient dilution of ice cream with fruits up to as high as 20 per cent. The use of such high proportions of fruit may actually improve fruit ice creams if consideration is given to the extra sugar in the fruits and the dilution of stabilizer by the fruit. Flavoring syrups such as malt, chocolate and malt chocolate is also used to increase the gallonage. Ribbon or variegated ice creams has also given variety as well as increased the gallonage of bulk ice creams.

There has been a very great reduction in the number of varieties of ice cream made and distributed with a greater saving both to manufacturer and retailer.

Ice Milk

Ice milk had been legalized in some states even before the war. Its use has increased in those states during the present emergency. Those states that have legalized the sale of ice milk have had a hard time in controlling these products. There is always the tendency on the part of the unscrupulous dealer to substitute ice milk for ice cream on the unsuspecting public especially when the demand is so great. Controlling the quality of ice cream is hard enough under normal conditions. When you add ice milk to an already undermanned and overworked food enforcing agency, the results are far from satisfactory.

Fillers for Ice Cream

The subject of fillers is one that has always given trouble to the ice cream industry. During these times there is a noticeable trend to substitute fillers for milk products in ice cream to its detriment. Fillers such as the cereal starches especially, corn starch and soya bean flour are the ones most commonly used. The public has always been suspicious that commercial ice cream contained fillers. It has been a long hard fight to remove the starch from ice cream and gain the confidence of the public. It would be a very great mistake to permit the addition of any form of filler to ice cream and thereby lose all the ground that has been won over a long period of years. This fact should be recognized by the industry as well as control officials.

Methods for Determining Quality

Ice cream and frozen desserts in general present not only more but a greater variety of problems to control officials due to their complexity. All the problems common to milk, cream, butter, dry, condensed and evaporated milks are present and in addition those of fruits, nuts, stabilizers, sweeteners, flavoring extracts and colors. Added to these is the control of overrun, total solids and milk solids.

A very great forward step in helping to control the sanitary quality of these products was taken when the American Public Health Association published standard methods for the microbiological analysis of all the ingredients used in the manufacture of frozen desserts. In addition methods have been worked out or are being worked out for the chemical and physical analysis of frozen desserts. Methods for determining sediment and overrun are the principal physical methods completed so far. Chemical methods for the determination of the presence of stabilizers, coloring matter, milk fat and the like are available as well as standardized sampling procedures. All these are steps in the right direction.

NEW SCORE CARD

California has issued a new score card for a milk products plant which has been designed to reflect the sanitary conditions of the plant, the cleanliness of the employees, to divorce the inspector's pet ideas and personality from its application; and, finally, one which would serve as an intelligent guide to the plant operator. It has a total of 350 scoring points, 201 points or 57.4 per cent to buildings and equipment and 149 points or 42.6 per cent to methods with a score of 80 per cent required for passing.

UTILIZING LABORATORY FACILITIES

One very important development has been the greater use of laboratory facilities to control the milk fat, milk solids and total solids. With these items so scarce and unobtainable, the manufacturer conserved them by scientific control. Let us hope that this continues since it has demonstrated its value in a more uniform and economical poduct.

APPRENTICESHIP TRAINING

Some consideration is being given to apprenticeship training of key men in the dairy manufacturing industry such as has been practiced in Europe for years. Most of the Acts are patterned after the Wisconsin Act framed some years ago and which has been in successful operation. War time scarcity of trained and experienced men has given impetus to the movement. Many provinces of Canada have passed the Act and last year there were 325 who received diplomas from these classes. If such training should become universal, the next logical step would be licensing all key workers in the milk industry.

VACREATION OF ICE CREAM MIX

Vacreation which originated in New Zealand primarily for butter was introduced into this country in September 1938 for the same purpose. Later, March 1939, it was used successfully for ice cream mix. Vacreation, briefly, consists of instant flash pasteurization and steam distillation in a machine having three vacuum chambers through which the mix falls in droplets through expanded steam. The vacuum is progressively increased from the first (11 to 6½") to the second (15 to 20") and finally to the third high vacuum chamber thereby lowering the temperature in each succeeding chamber from 190 to 200° F., to 161 to 179° F. and finally to 100° F. respectively. It is claimed that an ice cream of superior flavor, texture and with fewer bacteria is produced by this method of pasteurizing the mix than by the vat-pasteurizing method.

F. W. FABIAN

Dairy-Farm Operations

Everyone intimately familiar with the details of milk control activities knows that the difficulties of maintaining a satisfactory degree of compliance with prescribed dairy farm conditions, and the practice of prescribed milking and milk-handling methods, have increased markedly during the past several years. A wider prevalence of heat-resistant organisms has been encountered during the winter months; and there has been a trend toward higher temperatures of milk when delivered to receiving platforms, and correspondingly higher average bacterial content of the prepasteurized milk, during periods of hot weather.

The stock excuse offered for failure to maintain prescribed milk quality is shortage of dairy farm labor, inability to obtain necessary equipment and supplies, and the difficulty of, or time required for, having needed repairs of equipment competently made. There can be little doubt that the war-created shortages, together with the increased production resulting from War Food Administration requests and the parity subsidy, have been and are causative factors in the difficulties experienced by milk sanitarians. There is, however, another factor—a corollary of the induction and migration of dairy farm personnel—which is exerting a pronounced effect upon the manner and effectiveness with which milk is handled and utensils are treated on the farm. This factor is the marked change in the age and physical vigor of those who perform the milking and utensil-washing operations.

It was recently possible to obtain the name and age of every person resident upon 312 dairy farms in a mid-west state. An analysis of the data obtained yielded some very interesting results:

These farms were occupied by 1,242 individuals, ranging in age from infancy to 92 years. There were 648 males and 594 females. Sixty-three (20.2 per cent) of the farms were operated by tenants.

The age distribution of the occupants of these 312 dairy farms is of interest:

	Male			*Female*			*Total*			
Age group	*Number*	*Percent*	*State percent 1940*	*Number*	*Percent*	*State percent 1940*	*Number*	*Percent*	*State percent 1940*	*U.S. Farm percent 1940*
1–9	136	21.0	16.1	107	18.0	17.8	243	19.6	16.9	20.4
10–19	129	19.9	19.8	106	17.8	19.9	235	18.9	19.9	22.3
20–29	77	11.9	15.6	90	15.1	14.3	167	13.4	15.0	15.2
30–39	83	12.8	12.1	81	13.6	12.8	164	13.2	12.4	11.8
40–49	72	11.1	12.3	80	13.5	13.5	152	12.3	12.8	10.9
50–59	79	12.2	11.4	83	14.0	11.1	162	13.0	11.3	9.3
60–69	50	7.7	7.9	33	5.5	6.7	83	6.7	7.3	6.4
70+	22	3.4	4.7	14	2.4	3.9	36	2.9	4.4	3.7
	648			594			1,242			

U. S. Census age-grouping makes impossible comparisons of the percentages of these farm populations in the age-group 18–38, in 1940 and 1944. It will be noted from the foregoing tabulation, however, that there have been more or less marked reductions in the percentages of males in the 20–29 and 40–49 age-groups.

A more significant age-distribution table of the 1,242 individuals on these 312 dairy farms is presented below. Children not more than twelve years old, even if they do help in the milking and wash-up operations, surely can not be expected to have clear concepts and understandings of milk hygiene and sanitation; those in the 13–17 age-group might be expected to be of some help in the routine dairy operations; those in the age-group 18–45 are eligible for induction into the Armed Services or for industrial employment; and those over 45 need bifocal glasses to see clearly.

Nearly 30 per cent of the occupants of these farms are over 45 years of age.

The foregoing tabulations, although they indicate to some extent the disturbance which has taken place in the age distribution of dairy farm personnel, do not emphasize the important effect of this shift. It is generally agreed that, at or about the age of forty-five years, the eyes of most individuals require bifocals for effective vision at the reading range. The determination of effective cleaning of milking pails, strainers, and milking machine parts—and even a cursory observation of the amount and nature of the extraneous material on used strainer discs—requires vision as good as is required for reading.

It is not implied that middle-aged dairy farm personnel do not, as a rule, own and use bifocals. It is well known, however, that spectacles are not usually worn for general farm work, including milking and milk-house activities. Any milk sanitarian who is over forty-five years old can readily satisfy himself of the general effect of the non-use of bifocals, by attempting to conduct effective inspections without wearing his own bifocals.

The analysis of the ages of the personnel on the 312 dairy farms surveyed makes it clear that both age and the concomitant impairment of vision may be, and probably are, quite important factors in the current milk control difficulties.

Five of the farms were being operated by a lone individual, who, in four of the five instances, was over 65 years old.

Fifty-nine of the farms were being operated by two persons, usually husband and wife. On 41 (69.5 per cent) of these farms both persons were 45 years of age, or older. On 16 (27.1 per cent) both persons were 60 or more.

Sixty-eight of the farms were occupied by three persons. On 10 (14.7 per cent) everyone was 16 or younger, or 45 or older.

	Male		*Female*		*Total*	
Age Groups	*No.*	*Percent*	*No.*	*Percent*	*No.*	*Percent*
1–12	177	27.3	141	23.7	318	25.6
13–17	66	10.2	51	8.6	117	9.4
18–45	220	33.9	239	40.2	459	37.0
46–60	116	17.9	120	20.2	236	19.0
61–75	60	9.2	37	6.2	97	7.8
75+	9	1.4	6	1.0	15	1.2
	648		594		1,242	

On farms occupied by more than three persons it was very rarely that all were 16 or younger, or 45 or older; and data as to which individual or individuals milked and washed the milking utensils was not obtained during the survey. It was found, however, that on 65 of the 312 farms (20.5 per cent) everyone was either 16 or younger, or 45 or older. Impairment of vision, or lack of a sense of responsibility, so that uncleaned areas on milking utensils, or an incipient formation of encrustation, are not seen or are ignored, on one-fifth of the farms of any milk-shed, have potentialities with respect to milk quality which can not be denied.

There is another feature of this disturbance in the age distribution of dairy farm personnel which may—and probably does—affect the quality of the milk produced. Those engaged in milk production, whose ages range from 12 to about 30, have probably been exposed or subjected to a certain degree of 4-H Club instruction in milk handling, as well as the milk sanitarian's admonitions. In many cases the older persons now engaged in milk production activities had retired from active participation in the milking operations, but have had to assume the functions relinquished by those who were called into the Armed Services, or who migrated to industrial war work centers. These older individuals have not had the benefit of school or club instruction in the hygiene and sanitation of milk production and handling, and when they resume the milking chores they all too frequently practice the methods which were orthodox when they produced milk years ago.

What is the moral of these findings and deductions, if true and justified, respectively?

It would appear that educational programs of fieldmen and milk control officials should be modified so as to reach those who have had to re-engage in milk production after years of retirement; and that an organized effort should be made to impress upon older milk producers that failures in the washing operation can not be detected without the aid which age-impaired vision requires.

Equipment and Platform Tests

Metals for the manufacture of milk plant equipment have been somewhat less critical during 1944. However, lack of labor and other manufacturing facilities have resulted in limiting the amount of finished equipment produced. Pasteurizers have been available for replacements although deliveries have been necessarily slow. A dealer recently has been promised nine months delivery on a high-temperature, short-time pasteurizer for replacement.

War conditions naturally have precluded any extensive new developments. Although some health officials have considered the advisability of requiring that all products entering into the manufacture of cheese or that cheese itself be pasteurized as a result of the typhoid outbreaks reported as traced to cheese during the year, they were told that it would be impossible to get the necessary new equipment for this purpose within any reasonable length of time. Aging of unpasteurized cheese has been permitted as an alternate safeguard.

It appears that more new can washers and bottle washers have been installed as replacements this year than during 1943. There have been some developments in can washers particularly along the line of making them applicable to the use of acid detergents.

Although a Committee of the Association urged the War Food Administration and War Production Board to authorize a return to the umbrella type milk can cover, no action has been reported to date. Although the change to the Victory type cover saved some metal and labor, it is considered to be very insanitary by milk sanitarians and the use of these covers in conjunction with many old ones of the umbrella type is said to have caused much loss of time to plant personnel.

The first new developments have come in the electrical field. A precise electronic milk level control device is being marketed. A number of milk dealers have installed new so-called "Electro" water conditioners. Water for boilers is passed between a carbon tubular cathode and a German silver anode. The electrical charge given the water is said to be the same as that of the piping and boiler and results in the deposition of a soft easily removable sludge instead of a hard scale. Also in this field electrical resistance recording thermometers of reported good sensitivity and reliability have been made available for pasteurizers.

Steps have been taken to test in plant installations improvements in the flow diversion valve with a view to making it simpler and more reliable. Experimental work also has been done with a view to making it possible to check the holding time of a high-temperature, short-time pasteurizer by sending a wave of hotter milk through it and timing the interval between the recorded rise in temperature at the beginning and end of the holding tube.

In the field of platform testing, there has been very little development. However, there has been every reason to extend the use of platform testing because of the tendency for sanitary conditions on dairy farms to deteriorate under war conditions. Abele in Chicago found that the methylene blue test as performed in accordance with the milk ordinance and code recommended by the United States Public Health Service passed as satisfactory a high percentage of samples of raw milk for pasteurization with bacterial counts in the millions. He points out that this can be overcome by inverting the tubes each hour. This change is contemplated in the standard pocedure.

There has been an increased use of the resazurin test on receiving platforms with quite satisfactory results. Those interested in extending the use of the direct microscopic test for raw milk for pasteurization will be interested to know that reports indicate that microscopes will be available for relatively prompt delivery.

W. D. TIEDEMAN

Public Health Developments

In spite of the handicaps under which the dairy and milk industry have been working during the past year, it still has been possible to maintain sanitation standards at a reasonably safe level. At least I know of no evidence that the public health, by and large, has suffered seriously as a result of the adverse conditions. This, in itself, is an interesting "development."

In New York State, for example, the rate for infant deaths from diarrheal diseases, in which the quality of milk supplies is likely to be an important factor, was slightly lower, for the first 10 months of 1944 than for the corresponding period in 1943. It was a little higher, however, than for the same period in 1940.

Up to the time of writing (December 11), in New York State, exclusive of New York City, we have not recorded a milk-borne outbreak during the year. If our good fortune continues for another three weeks, 1944 will be the first in 27 years in which we have recorded no such outbreaks. Two has been the smallest number in any previous year. While this is encouraging, we recognize the not too-remote possibility that, due to the hectic conditions under which health officers and other physicians have been working, small outbreaks of streptococci infection or gastroenteritis could have been overlooked. Information concerning milk-borne outbreaks in the country as a whole is, of course, not yet available.

The occurrence, during the year, in the United States and Canada, of several serious outbreaks of typhoid fever traced to cheese has brought the subject of cheese-borne infection into the limelight. During the year California has amended its Agricultural Code, and the Province of Alberta and New York State have enacted regulations requiring that cheese either be "pasteurized" or aged for stipulated periods. Under all three enactments the cheese may be labeled "Pasteurized" if made from pasteurized milk, skim milk, or cream. In the New York State regulations, which apply only to Cheddar and Cheddar type cheeses, pasteurization of the cheese itself also is recognized. Sixty days is the minimum aging period prescribed in California and New York State, while in Alberta it is 90 days. Regulatory action is pending in Indiana and New York City and, probably, elsewhere.

Another recent amendment of the New York State Sanitary Code in relation to streptococcal infection stems chiefly from observations in connection with milk-borne outbreaks and reflects a relatively new conception of this class of infections. In the past scarlet fever and streptococcus (septic) sore throat have been listed, in the Code, as two diseases, with more stringent requirements as to isolation of cases of scarlet fever. The two are now combined in one term "Streptococcal sore throat (including scarlet fever)," with uniform isolation requirements.

Another amendment, enacted at the same time, relates to shipment of milk from farms on which there are cases of certain communicable diseases. The regulations, as amended, permit milk to be shipped or delivered if (and only if) it is determined that it will be pasteurized or equivalently heated before delivery to the consumer and if the case is properly isolated and the milk not brought into the house.

There probably have been other equally important developments of which I might have learned if I had been given a little more time.

PAUL B. BROOKS, M.D.

Education in the Dairy Industry

A canvass of state control or advisory agencies and educational institutions indicates well sustained educational activity in milk sanitation through short courses, institutes and seminars. Both the personnel of control agencies and various groups in the industry have been served. While some states indicate suspension or reduction of effort in this field because of personnel reduction during the present emergency, this deficiency seems to be fully offset by other agencies that have intensified group instruction activities as a means of helping to overcome difficulties arising out of the absorption of untrained personnel into the industry, and for partial replacement of field personnel of official supervisory agencies.

Reports from 38 states show no educational activity for 13 states, and a wide range of educational effort in 25 states. Reports from 19 of 35 educational institutions contacted show that 19 have conducted short period, intensive instruction for various groups. The information regarding these activities is summarized in the following table.

SUMMARY OF MILK SANITATION SHORT-COURSE ACTIVITIES, 1944

Short Courses Conducted by	Total Courses	Attendance				Duration			No. of Courses for		
										Industry	
		Total	Max.	Min.	Av.	Max.	Min.	Av.	Supervisory Person.	Sanit.	Mfg. Tech.
State Supervisory Agencies	154	9003	500	6	62	1 M.	2 hr.	3 D.	36	118	
Educational Institutions	105	7980	342	12	76	1 M.	½ D.	2 D.	10	72	23

The U. S. Public Health Service conducted or participated with state agencies in the conduct of seven seminars included in the above tabulation which served 470 persons and 13 states, and the District of Columbia.

Significant items worthy of special comment include courses conducted at various points throughout certain states to reach local groups, a higher level course to develop leaders for courses on the local level, courses in food sanitation conducted by the U. S. Public Health Service, the trend toward coverage of problems of milk sanitation and food handling in the same course, and evidence of interest in short-time, high-temperature pasteurization.

New York, Wisconsin, Iowa, Michigan, Georgia, and Mississippi are instances of taking the instruction out to local groups. The extent of coordination of effort between state official agencies and educational institutions is pronounced in New York, Wisconsin, Iowa and Michigan. Wisconsin is significant for the group effort participated in by the State Department of Agriculture, the State Department of Health, and the University of Wisconsin. Iowa and Georgia reached local groups to notable extent with sessions ranging from two hours to one day. In Georgia these local lectures embraced food handling as well as milk sanitation. While most short courses have followed the usual patterns, a departure is noted in the five-day inservice training course conducted by the School of Public Health at the University of Michigan. This course was designed for the more experienced milk control officials as an aid in developing leaders for the conduct of courses on the local community level. It is noted that four of the courses conducted by educational institutions emphasized or were confined to short-time, high-temperature pasteurization. The location ranged from Connecticut in the east to Oregon in the west.

The same personnel of the Public Health Service that were formerly engaged in milk sanitation only, have conducted 6 seminars in food handling, serving 12 states and attended by 421 persons; and 2 seminars in milk and food handling sanitation, serving 2 states and attended by 101 persons, including military personnel. This combination of course content suggests the possibility of marking the beginning of a new trend in this type of educational activity, consistent with the tendency to combine sanitary supervision of food handling with milk control activity. Activities in this field, particularly by local health departments, have been seriously hampered by lack of readily available visual education aids specifically suited to the purpose. The Public Health Service announcement of posters and sound strips prepared for use in restaurant sanitation education, available for purchase by local agencies is most gratifying, stimulates the hope that such material may soon be available in subjects of milk sanitation, and may well constitute the most important single incident of the year with respect to developments in the field of education concerned with milk sanitation.

H. E. MILLER

Trends in Dairy Plant Engineering

The processing of dairy products has become an operation which involves much machinery and equipment of an engineering nature. Intelligent operators recognize that the proper selection, arrangement, care, and operation of this machinery is essential for successful operation of the dairy business.

THE PLANT DESIGN

Much progress has been made in plant layout and fitting the plant to the job. Flexibility of design is of great importance. More and more, plants are being built with equipment which can be utilized for processing more than one type of product. For example, vats are puhchased which can be used for either heating or cooling and with agitators so arranged that either high or low viscosity fluids, as for example either milk or ice cream mix, can be processed.

Plate-type heat exchangers which can be used for a variety of heating and cooling jobs are also popular.

A second important trend in modern plants is toward more compact design—for example, plate type heat exchanger equipment is being selected in many cases because it occupies so much less space, oftentimes as much as only one-half to one-third of the space required by other types of equipment.

Efforts are also being made to reduce the length and number of sanitary pipes and fittings by proper arrangement of equipment.

Making the plant easier to keep clean and sanitary is also one of the trends in plant design. This is being accomplished by attention to adequate lighting, impervious, well drained floors, tile walls, use of air conditioning, use of non-corrosive metals, and improved paint or metalized finishes on equipment. The use of stainless steel equipment is of real help in this connection.

Many plants are minimizing their clean-up problem by elimination of unnecessary piping, and by the use of handy washing racks and tanks made to fit the job.

MAINTENANCE OF THE EQUIPMENT

From the standpoint of use and maintenance of the equipment in the dairy plant, much can be done to improve its life and performance.

Especially during war time with its heavier demands, the equipment is being used up at a rapid rate and it is necessary for the milk plant operator to take the best possible care of his equipment through proper operation, maintenance, and reconditioning.

READ THE MANUFACTURER'S INSTRUCTIONS

Every piece of equipment, to give best results, must be operated according to the manufacturer's instructions. Particularly on specialized equipment such as Continuous Ice Cream Freezers and Refrigeration Machines, these instructions are highly specialized, and damage is likely to result if they are not followed. It is a good plan to check instructions over with operators, and especially new operators, at occasional intervals. During the present emergency it is doubly important to make certain that instructions are available and that they are followed.

Direct responsibility for the maintenance and operation of dairy equipment must be placed on some one individual. Divided responsibility results in confusion and inferior results. Operators should be taught to have pride in the machines they operate—it pays large dividends.

LUBRICATION

Lubrication of dairy equipment is a subject which needs re-emphasis, as it is often neglected in otherwise well-operated plants. The presence of moisture and corrosive gases around dairy equipment intensifies the problem of lubrication. A regular lubrication schedule with proper charts for every machine is a real help. Special lubricants which resist moisture and corrosion are available for dairy plant use.

CLEANING OF EQUIPMENT

Much damage is done to dairy equipment through improper cleaning methods. Acid or alkali solutions of excessive strength cause corrosion. So also does the allowing of moisture to remain on stainless steel surfaces in a closed area, as on homogenizer plungers which are left in contact with wet packing.

Many plants find that it is desirable to use rubber or synthetic mats on which to lay pump rotors and small, finely-finished parts during clean-up so they will not become dented or scratched.

Use of proper wrenches instead of a hammer on fittings is also a point which needs emphasizing.

Of great importance is the matter of remedying small troubles before they become serious. Therefore, a regular inspection of equipment to locate any small defects is well worth while.

In summarizing, it appears that there is a definite interest in better handling of the machinery and equipment in dairy plants, and that proper plant design coupled with good plant maintenance will pay real dividends in the modern dairy plant.

ARTHUR W. FARRALL

Bovine Mastitis Problem

Great strides have been made, during the past year, in veterinary medicine by veterinarians, and by the many people of allied professions and vocations in the clarification of our understanding of the bovine mastitis problem. The value of these advances in our knowledge are not generally understood and for this reason they are not properly applied to the bovine mastitis problem. Experimentation now in proress and the investigations that are being initiated from time to time will reveal new facts and aids that will guide our efforts in the future, but at this time it is pertinent to take stock of the facts as we now know them.

Mastitis is a very general term which refers to any inflammation of the udder irrespective of the cause and severity of the condition. It is no more specific than a headache being a pain in the human head. True, this is very descriptive to the person who is suffering from the ailment, but it does not reveal the cause of the trouble.

Clinicians indicate the severity of the disease irrespective of cause, by applying the name *acute mastitis* to that inflammation of the udder which results in swelling of the udder or any part thereof, the production of abnormal milk either with or without congestion, and for the septicemia or bacteremia which develops subsequent to some pyogenic udder infections. Many dairymen and others have been misled to believe that acute mastitis constitutes the entire mastitis problem, and that a remission of the clinical symptoms constitutes recovery from the disease. Unfortunately this is not true because the major portion of the mastitis of cattle is present in the *chronic* form—where usually physical signs of the disease are not evident—but is subject to subsequent "flare-ups" into the acute form.

Udder troubles may be classified as *non-infectious* and *infectious mastitis* from the standpoint of cause. Such non-infectious factors as chilling, bruising, and injury of the udder or teats, rough handling of the udder during hand or machine milking, and the adverse effects, in some cows, of irregular or incomplete milking may cause mastitis of an acute or chronic nature depending upon the severity of the non-infectious agents or condition. In a general way non-infectious mastitis should be considered as "injury" mastitis. Further, the damaging effects of non-infectious mastitis may predispose the udder to infection by bacteria, especially *Streptococcus agalactiae,* and most commonly causes the udder infection of a chronic type; but at times the streptococci and usually infection by staphylococci, coliform bacteria, and others produce acute mastitis. It is possible to eradicate *Str. agalactiae* mastitis from the herd and to maintain the herd free from this infection.

The cause of the inflammation must be removed to insure recovery from mastitis, therefore it is quite evident that udder infusion treatments are of value only in the case of infectious mastitis. Even here the selection of the proper medicinal agent is dependent upon the type of infection present. Research workers are constantly studying new products for the treatment of infectious mastitis and are making their results available for use in dealing with udder infections.

The available scientific data, substantiated by field trial, indicates that mastitis prevention and control must include:

1. Good sanitary milking procedures.
2. Good sanitary herd management procedures.
3. Early and accurate diagnosis.
4. Proper treatment.

C. S. BRYAN

Progress in the Sanitary and Technological Aspects of the Cheese Industry

In the years prior to the war, Federal Food and Drug inspectors acting under the then new Fedeal Food, Drug and Cosmetic Act began to seize certain interstate shipments of cheese containing extraneous material, such as rodent hairs, manure particles, etc., that were indicative of unsanitary conditions. Various state agricultural departments and the industry had recognized the need for action in correcting this situation and the activities of the Food and Drug Administration focused attention on the urgency for corrective measures. As a result, the industry promptly took unified action to assure the consumer that cheese was a clean wholesome food.

Several years ago, a committee representing the Wisconsin Milk Producers, the Wisconsin Cheesemakers Association, the University of Wisconsin, the State Department of Agriculture of Wisconsin, and the National Cheese Institute drew up acceptable minimum sanitary requirements for cheese factories and recommended their official adoption by Wisconsin and other cheese producing states.* The cheese producing areas throughout the country have favorably accepted these suggestions as a forward step in producing clean cheese from clean milk.

* Copies of these requirements may be obtained from Dr. E. W. Gaumnitz, Executive Secretary, National Cheese Institute, 110 North Franklin St., Chicago, Ill.

Membership of the National Cheese Institute covers the country's cheese producing areas. The Research Committee of the Institute is concerned with the sanitary and technological aspects of the industry. This committee is appointed from the technical staffs of the Institute's membership. Research projects are of mutual interest to the entire industry. Persons interested in cheese research are invited to participate in the monthly discussions of the Research Committee held at the offices of the National Cheese Institute in Chicago. During the past year a number of scientists from various parts of the country have attended these meetings.

In addition to projects conducted by its own members, the Research Committee of the National Cheese Institute is sponsoring industrial fellowships at Cornell University and the University of Wisconsin. Several projects have been completed and results published in scientific journals or trade papers. As an example, an article on "Testing for Extraneous Matter in Cheese" was recently published in the Journal of Dairy Science, Vol. 27, p. 881, 1944, by Raymond Miersch and Walter V. Price of the University of Wisconsin. In addition to obtaining much practical information on tests for extraneous matter, the work of these authors has furnished the basis for further quality improvement in cheese manufacture. Other projects which are well under way are long time projects which may require several years for completion.

Insect control is essential in reducing extraneous material in cheese. Control of flies in cheese factories is perhaps more difficult than in other dairy plant operations due to favorable breeding conditions on farms and on the premises of cheese factories.

The National Cheese Institute supports a fellowship on insect control under the direction of Dr. Ed Searls, University of Wisconsin (on leave with the Army Service Command). Dr. Searls has furnished information of great value to the industry and over two million copies of a booklet based on his findings have been distributed to cheese factory producers. Preliminary work with new products such as DDT indicates that as soon as these products are generally available, insect control on the farm and in the cheese factory will be much simpler and more effective than in the past. All of this work contributes greatly to the general improvement of cheese quality.

For several years, the Research Committee of the National Cheese Institute has felt that the question of pasteurization of milk for cheesemaking was one of the more important poblems confronting the industry. Fine aged cheese has been a raw milk product. Cheese made from pasteurized milk cures more slowly than raw milk cheese and does not customarily develop as much flavor. Scientists have not as yet found the answer to this problem. Because of a lack of information on many aspects of pasteurization, fellowships were set up at Cornell University and at the University of Wisconsin to study the effect of various heat treatments of milk on the curing of cheese and on the survival of pathogenic bacteria in cheese.

Rapid progress has been made on these projects and work on the survival of pathogenic bacteria in cheese has been timely due to the focusing of attention on several recent typhoid outbreaks which have been attributed to cheese.

California and New York have passed regulations in 1944 requiring that cheddar cheese be made either from pasteurized milk or that the cheese itself be pasteurized, or if made from raw milk that the cheese be held 60 days before sale to the consumer. It is significant that recent cheese-borne outbreaks have been attributed to cheese less than one month old.

A survey of storage facilities has shown that it would be impossible for the industry to find sufficient storage space to hold all raw milk cheese longer than 60 days under present conditions. A 60-day holding period appears to give adequate protection from a public health standpoint.

The industry is deeply concerned with the matter of adequate public health protection and feels that it would be advantageous to all concerned if the various states would adopt uniform regulations. Cheese is so widely distributed that compliance with regulations by the industry will be made much easier if state requirements are uniform.

Although restricted by wartime conditions such as a shortage of skilled cheese makers and necessary use of old equipment, the quality improvement program continues to go forward. With a large percentage of total cheese production going to our fighting forces and to government agencies, the fact that under wartime conditions such a large percentage of cheese has graded No. 1 speaks well for the skill and sanitary procedures practiced by the Nation's cheese makers.

E. H. FREIDEL AND
M. W. YALE

U. S. PUBLIC HEALTH SERVICE

WASHINGTON 14

November 24, 1944.

To All State Health Officers:

The report of the Committee on Interstate and Foreign Quarantine, which was approved at the 42nd Annual Conference of State and Territorial Health Officers in Washington, March 21–22, 1944, contained the following recommendation:

"It is recommended that the Public Health Service study seriously the certification of milk and milk products sold for interstate shipment by somewhat the same procedure as is now in effect for the certification of shellfish, and report back to the Committee on Interstate and Foreign Quarantine."

In connection with the certification of shellfish sources, the Public Health Service issues periodically lists of dealers, by name and State number, certified by State health departments whose shellfish sanitation control measures are endorsed by the Public Health Service as complying with its minimum standards. Careful consideration has been given to the application of a similar procedure to the certification of milk sources, and the following plan is proposed for your comment.

The Public Health Service would undertake the publication and periodic revision of lists of milk shippers who, having surpluses to dispose of, have applied to the State for listing, and whose producing farms and receiving stations have within the preceding 12 months been inspected, sampled, and certified as having achieved the required compliance rating by the State health or other milk control agency, whose rating procedure has been checked and approved by the Public Health Service.

The shellfish certification procedure has met with general support because both producing and consuming States have accepted the shellfish sanitation standards of the Public Health Service. In the field of milk production, however, there is less unanimity of agreement on standards of sanitation. There are some 11 States, including California and the Northeastern group, in which the milk ordinance recommended by the Public Health Service has not been adopted either locally or as State regulations. The Public Health Service is actively cooperating with the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS in an effort to devise standards that would be universally acceptable. With such standards available, a single list of certified shippers would fulfill the needs of all areas, including those with milk shortages and those with surpluses. In the meantime, in the absence of universally accepted standards, it is believed that practically all States would be adequately served by two or three lists, as follows:

List 1 would include milk shippers certified as having a compliance rating of 90 per cent or more on the basis of the Public Health Service Milk Ordinance provisions (P. H. Bul. 220) and rating procedure (Repr. 1970). In normal times this list would probably be large enough to supply the needs of all standard milk ordinance areas experiencing shortages; but under present wartime conditions it is likely to be grossly inadequate, as few standard ordinance areas now have surpluses, while most milk sheds with surpluses are not operating under these standards.

List 2 would include either (a) shippers certified as having a compliance rating of between 80 and 90 per cent on the basis of the Public Health Service Milk Ordinance, or (b) shippers certified as having a compliance rating of 90 per cent or more on the basis of the Northeastern States Emergency Sanitation Standards for Raw Milk for Pasteurization (*J. Milk Technology,* Sept.-Oct. 1944, pp. 270–5), when rated by a procedure similar to that of the Public Health Service. Please indicate whether alternative (a) or (b) would be of greater use to you as list 2. Until normal conditions are reestablished possibly both would be desirable, making three lists in all.

The receiving stations of shippers on all lists would be required to have a compliance rating of 90 per cent or more on the basis of the Public Health Service Milk Ordinance standards. The present plan contemplates the certification of shippers of raw milk for pasteurization only. If the demand justifies, the procedure could later be expanded to include pasteurized milk dealers. Discussion of other details may be left until agreement has been reached on the major issues.

One advantage of such lists would lie in furnishing immediate information on acceptable milk sources which may be tapped to relieve local shortages. They would also tend to eliminate trade barriers and duplication of inspection. If this plan of cooperation is to be of practical value, however, it must have the active support of both receiving communities and shipping States. The former must be willing to accept shipments from certified dealers, and the latter must accept the responsibility of inspection, examination, and certification of milk sources. Your frank comments are therefore solicited. Responses from State Health Officers will be summarized for the information of their Committee on Interstate and Foreign Quarantine.

Sincerely yours,

THOMAS PARRAN,

Surgeon General.

New Books and Other Publications

Definitions and Standards for Food. Service and Regulatory Announcements. Food and Drug Administration. Federal Security Agency. Washington, D. C., May 25, 1944.

This publication contains the definitions and standards for food which were promulgated before June 1, 1943, under the Federal Food, Drug, and Cosmetic Act, as they appear in the Code of Federal Regulations (21 CFR Cum. Supp.), as amended by the order on enriched flour promulgated July 1, 1943. The appendix contains the only definition and standard that has been promulgated since that date and an amendment to the general regulations. The preface contains some of the relevant sections of the Act and general regulations.

The Chemistry and Technology of Food and Food Products. Prepared by a group of specialists under the editorship of Morris B. Jacobs, Ph.D., Senior Chemist, Department of Health, City of New York. Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, N. Y. Set of 2 volumes. Volume I—xviii+952 pages, 79 illustrations and 218 tables—Reviewed in this JOURNAL, Vol. 7, p. 296 (1944). Volume II—xx+890 pages, with 166 illustrations and 84 tables. Price for individual volumes, $10.50. Set $19.00.

This volume constitutes the second volume of the set, and completes the issue.

The editors, authors, and publishers have made a substantial contribution to the food industry by assembling information over a wide field. Inevitably in such an undertaking that lies between an elementary and an advanced treatment of the various subjects, there arises some divergence of opinion as to what to include or omit. For example, this reviewer regrets that the principle involved in "leavening" (applicable to baking, ice cream, lard, confectionery, etc.) was not considered broad enough to treat in this section on unit operations whereas particular emphasis is given to operations in the confectionery industry.

Some statements may not be generally accepted, such as "The tube or tubes (in pasteurization equipment) are usually made from block tin, . . ." (p. 68). "The holding method . . . (milk pasteurization) . . . and immediately cooling it thereafter to at least 50° F." (p. 624). "Coresline" (p. 240) should be "Gorseline" and the reference page is 169, not 189. "Scoles" also is misspelled (p. 241); the reference is "Scales."

The index covers 56 pages and is well arranged. The two volumes constitute the most comprehensive treatment of the subject of food that we know of. It is an excellent treatise, and should be in the working libraries of every food technologist and food control officer as well as in those of food industrialists who contact many phases of the food industry.

Methods of Sanitizing Eating and Drinking Utensils *

This article reports present desirable practices in cleansing eating and drinking utensils, including operation, supervision, and tests. It is illustrated by seven figures showing different types of machines, and it carries thirteen references to the current literature.

* By John Andrews, *Public Health Reports*, Volume 59, Number 34, August 25, 1944.

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Secretary, B. E. Horrall, Dairy Department, Purdue University, Lafayette, Indiana.
Assistant Secretary, W. K. Moseley, Moseley Laboratory, 315 North DeQuincy St., Indianapolis, Indiana.

KANSAS ASSOCIATION OF MILK SANITARIANS

President, Dr. E. F. Kubin......McPherson, Kan.
Vice-President, Dr. L. W. Rowles....Topeka, Kan.
Secretary-Treasurer, Tom Larsen, Kansas State Board of Health, Topeka, Kan.
Directors, (1) J. R. Mingle, Deputy State Dairy Commissioner, Oakley, Kan.; (2) Howard Weindel, Milk Sanitarian, Lawrence, Kan.

MASSACHUSETTS MILK INSPECTORS' ASSOCIATION

President, Thomas J. Travers...........Worcester
Vice-President, Francis M. Hogan.........Beverly
Secretary-Treasurer, Robert E. Bemis...Cambridge

METROPOLITAN DAIRY TECHNOLOGY SOCIETY

President, F. L. Seymour-Jones..New York, N. Y.
Vice-President, Harry Scharer...New York, N. Y.
Secretary-Treasurer, H. E. Roberts, New Brunswick, N. J.
Sergeant-at-Arms, S. H. Harrison, New York, N. Y.

MISSOURI ASSOCIATION OF MILK SANITARIANS

President, C. W. Drumgold, St. Louis City Health Dept., St. Louis, Mo.
Vice-President, J. K. Smith, Jackson County Health Dept., Independence, Mo.
Secretary-Treasurer, Glenn M. Young, State Board of Health, Jefferson City, Mo.

PACIFIC NORTHWEST ASSOCIATION OF DAIRY AND MILK INSPECTORS

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

PHILADELPHIA DAIRY TECHNOLOGY SOCIETY

President, Dr. Thomas Kelly, Scott-Powell Dairies, Philadelphia.
Vice-President, Jay D. Girard, Breuninger Dairies, Philadelphia.
Secretary-Treasurer, Mrs. Helen A. Sutton, Sylvan Seal Milk, Inc., Philadelphia.
Assistant Secretary-Treasurer, W. S. Holmes, Philadelphia Dairy Council, Philadelphia.

TEXAS ASSOCIATION OF MILK SANITARIANS

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

WEST VIRGINIA ASSOCIATION OF MILK SANITARIANS

Chairman, Donald K. Summers, Charleston 1, W. Va.
Secretary-Treasurer, J. B. Baker, Department of Health, Charleston, W. Va.

Association News

ANNUAL MEETING, October 18–20, 1945
Deshler Wallick Hotel, Columbus, Ohio

Associated Illinois Milk Sanitarians

The Associated Illinois Milk Sanitarians during the year 1944 gained 56 new members, making a total of 140 members. We lost two members through death, viz., Oliver C. Hutter on December 7, 1943, and William D. Dotterer on September 25, 1944. Both men were charter members and Dotterer had been a member of the Executive Board from the time of organization.

The increased membership has provided the Association with an increase in operating funds as indicated by the Treasurer's Report. A spring conference was held in collaboration with the Illinois Public Health Association in Chicago, attended by 150.

P. EDWARD RILEY,
Secretary-Treasurer.

New York State Association of Milk Sanitarians

At a recent meeting of the Executive Committee of this Association, Rochester, N. Y., was selected as the place for the next annual meeting. The tentative dates are September 26, 27 and 28, 1945.

W. D. TIEDEMAN,
Secretary-Treasurer.

Philadelphia Dairy Technology Society

Ninety-two members of the Philadelphia Dairy Technology Society and their friends met at Holland's in Philadelphia, Tuesday evening, October 31st, to enjoy a good dinner and listen to a talk by Dr. P. H. Tracy, Professor of Dairy Manufactures at the University of Illinois, on "Probable Phases of Development in the Post-War Dairy Industry."

Dr. Tracy stressed the fact that dairy leaders should plan now for tomorrow, by noting what other business leaders are thinking and doing, the economic, political and social conditions as they will probably exist in the immediate future, the nature of wants that will satisfy the post-war buyer, a research program to improve present products and develop new items, and studies for improving operating methods and reducing costs.

The point was brought out that the cost of milk production should be lowered and that this could be accomplished by using proper culling, breeding, and feeding methods, increasing the skill and managerial ability of the dairy farmer, and control of disease, particularly mastitis, in dairy cattle.

In the interest of reducing processing costs and building a sound future for the dairy industry, Dr. Tracy listed the following general points:

1. Are your cows supplying the milk for your plants relatively free from disease?
2. Is there a coordinated program for control of disease among dairy cattle in your milk shed?
3. Is the average yearly fat production per cow in the herds supplying your plants equal to that of the average cow in D.H.I.A., i.e., 341 pounds?
4. Is there a coordinated program for raisthe level of production and the efficiency of operation for dairy farmers in your milk shed?
5. Is there a unified program on the part of regulatory officials and plant procurement men to make sure that the quality of milk entering your plant is of the high standard that post-war world will demand?
6. Can you accurately account for at least 99 percent of the fat entering your plant?
7. Do you know not only what your plant losses are, but where they occur?
8. Is your equipment arranged so as to require the minimum handling of milk and the utilization of a minimum amount of labor?
9. Are you using machinery of antiquated design and construction—a practice that may be costing you much from the standpoint of inferior quality, extra labor, and plant losses?
10. Are your employees properly trained in the art and skill of their profession?
11. Are all your procedures standardized and printed in booklet or mimeographed form for distribution to your workers?
12. Are your employees happy in their work?
13. Do you provide healthful, pleasant, and attractive working conditions for both men and women employees?
14. Do you have a recreational and social program for the employees and their families?
15. Are all parts of your plant well lighted, properly ventilated, and properly heated?
16. Have you made cost studies of all your operations at stated intervals for analysis by someone competent to advise you as to their significance?
17. Do you keep abreast of times by studying new methods of processing, new types of packages, the development of new products, and new methods of merchandising, or do you spend your efforts in trying to defend present and past practices which may or may not be suitable for your present and future market?
18. Do you have a periodic check up made on the quality of all your products together with those of your competitors to determine your rating?

The next meeting of the Philadelphia Dairy Technology Society will be held in January, 1945.

HELEN A. SUTTON,
Secretary.

Weindel Succeeds Larsen

Mr. Tom Larsen, who has been with the Milk Division of the State Board of Health for seven years and has been Chief Milk Sanitarian for the past three years, has accepted a position with Borden Creameries in Kansas City, Missouri. He will be in charge of quality control and act as director of their laboratory.

Mr. Howard M. Weindel has been appointed to fill the post vacated by Mr. Larsen. Before coming here, he was sanitary officer with the Douglas County Health Unit at Lawrence, Kansas, for 3½ years.

Wisconsin Dairy Manufacturers' Conference

The program of the annual Wisconsin Dairy Manufacturers' Conference which is scheduled for Thursday and Friday, April 12 and 13, 1945, will conduct discussions on:

Dairy industry corporation taxes

- Aspects of high temperature and vat pasteurization
- Getting the butter industry on its feet
- The non-fat milk solids problem
- Should advantages of war time controls be retained
- Powdered ice cream mix
- Farm costs, farm management economy, and the price of milk
- Surplus war materials of probable interest to the dairy industry
- Grading problems in the industry
- Returning veterans training plans and legal prerogatives
- Cheese industry problems

Inquiries about the Conference should be directed to Professor H. C. Jackson, Department of Dairy Industry, University of Wisconsin, Madison 6, Wisconsin.

REPORT OF THE NORTHERN NEW ENGLAND MILK COMMITTEE

To The Honorable Commissioners of Agriculture of Maine, New Hampshire, Vermont and Massachusetts:

Gentlemen:

The committee appointed by you August 1, 1944, to study the problem of rejected milk at country plants submits the following report:

REASON FOR STUDY

Substantial amounts of milk were rejected during the early summer months of 1944 as the milk was being delivered at country receiving stations. These rejections were made in the form of "STOP NOTICES" by inspectors of the Boston Health Department pursuant to a regulation that required the cooling of night's milk to 50° F. and morning milk to 50° F. if delivered to country receiving plants after 10 A.M. war time. Regulations also require the continued rejection of the milk until each producer, whose milk had been excluded, had signed an "AFFIDAVIT" in which he agreed to cool his milk in accordance with the prescribed regulations.

COMMITTEE HEARINGS AND INVESTIGATIONS

The committee met at Hotel Manger in Boston on August 31, 1944, for its organization meeting. A hearing was held on September 12 at which the regulatory agencies were present. Dealer representatives appeared before the committee on September 26. A sub-committe investigated conditions at country receiving plants and interviewed plant managers, producers, and truck drivers. Subsequent meetings were held to discuss findings and to write the report.

STATEMENT OF COUNTRY CONDITIONS

In response to a government request for the production of more milk and an assurance by the government for a market, producers increased their production for the Boston market approximately 11.5 per cent over the previous year. As an example in one producing area, the volume of milk had increased 30.8 per cent over a period of approximately two years. In this same area the number of trucks hauling milk from farms to receiving stations had been reduced in number from 54 to 39. Fifteen trucks were taken out of service as a war economy to save manpower, equipment, and supplies. As a result of increased production and fewer trucks, the remaining trucks were loaded heavier and there were more stops by the average truck to collect milk from farms. Many of the trucks being old made slower deliveries resulting in congestion and delay in unloading milk at the plant. Moreover, early collections, in many cases, could not be made due to a shortage of farm labor.

In general, the facilities for producing, trucking, receiving, and cooling milk in the country have not kept pace with the annual increase in production that has occurred. This has caused and will continue to cause more milk to be rejected unless remedied. The cooling facilities are inadequate on some farms and in some plants. Present arrangements for unloading milk and the washing and return of empty cans are bottlenecks in some of the plants. These conditions do not permit the handling of milk under proper temperature control.

QUALITY OF PRODUCERS MILK

The committee recognizes the general improvement in the quality of milk that has taken place over a period of years. This has benefitted producers by an increase in the consumption of milk and improvement in returns to them. The committee is in agreement that nothing should be done that would impair milk quality. Both regulatory officials and milk dealers are agreed that the bacteria counts of producer's milk have in general been good this year.

LAWS AND REGULATIONS

Massachusetts law requires that all milk be cooled to 50° F. or below within two hours after milking. Present regulations, under which milk for the Massachusetts market is now being produced, provide that morning milk that is delivered to country plants before 10 A.M. wartime need not be cooled. Boston Health Department regulations require bacteria counts to be made monthly of producers' raw milk as delivered at receiving stations. Such counts shall not exceed 400,000 per ml. and after laboratory pasteurization of the milk sample, the count shall not exceed 20,000 per ml.

CONCLUSIONS AND RECOMMENDATIONS

Producers

1. Producers have produced more milk in many instances during the flush season than they could cool properly on the farm. The producer should either produce a fairly uniform volume of milk throughout the year for which he has the equipment to handle properly or he should provide the equipment necessary to handle the production during the flush season.
2. The producers should cooperate with truck drivers to effect deliveries to the plants as early in the day as possible.
3. In rare instances it may be advisable for some producers at the beginning of collection routes to hold over a portion of the morning milk for collection the following day so that truck drivers can maintain a schedule of early deliveries at the plant.
4. Producers should be more fully informed by an educational program how cooling affects quality; how better quality increases sales and affects health and how sales make more Class 1 milk and results in a better price to producers.

Truckers and Trucking

1. Truck drivers should establish and maintain as uniformly as possible a schedule of the time of collection of milk at the farm and of delivery to the plant.
2. Trucks should arrive at properly spaced intervals to facilitate proper handling of milk in the plant and to avoid warming while waiting to be unloaded.
3. Government agencies should authorize the use of additional trucks when necessary.
4. Cans of milk should be collected from cooling tanks whenever possible. Where this is impractical and it is necessary to leave milk at the roadside for collection, the cans should be properly protected from the elements. The type of protection that should be provided will depend on the season and the length of exposure.
5. The compensation for trucking milk from farms to country plants should be in proportion to the services rendered.
6. Truck drivers should not collect milk that they know is in violation of temperature requirements.
7. Truck drivers should provide insulated truck bodies or cover all cans of milk with a suitable cover in transit from farms to plants. Cooled night milk should be separated on the truck from uncooled morning milk and the latter iced in transit.

Plant Handling

1. While the committee recognizes the difficulty of securing plant equipment, it recommends that additional and more efficient equipment be installed in many of the plants to receive and cool the greater volume of milk produced during the flush season in compliance with present regulations.
2. Plant operators should provide additional help during the flush months and especially during the rush hours of each day so that milk may be unloaded with as little delay as possible and so that warming of milk does not occur while awaiting delivery.
3. As a further aid in securing compliance with temperature regulations, we recommend that plant managers cooperate by taking temperatures of each producer's milk and report high temperatures, if found, to producers. In cases where high temperatures are found, the plant managers should cooperate with producers and truckers in order to effect compliance with all regulations.

Regulatory Officials

1. Many dairy farms and dairy plants are under the supervision of more than one health agency. Emphasis is often placed on items that have a very indirect bearing, if any, on public health, cleanliness and quality. The cost of unnecessary multiple inspections over the milk shed is considerable. Divergent and even conflicting requirements are common. When requirements apparently intended to accomplish the same purpose differ widely, there is sure to be discord, lack of respect for such a system of enforcement, and little, if any, cooperation on the part of those who are being regulated. Many difficulties, resulting in milk rejections, can be traced to a lack of regularity or a lack of uniformity in enforcement.
2. We, therefore, recommend a uniform standard code of sanitary requirements and uniform application of that code covering the production and care of milk on the farm, for its transportation and acceptance at country plants, and for its processing and delivery to market. Each municipality would then control the supply within its borders. Essential public health requirements would be divorced from economic controls and outworn restrictions and encumbrances removed from the regulations.

Respectfully submitted

(Signed) H. C. MOORE
(Durham, N. H.) *Chairman*
(Signed) E. H. BANCROFT
(Barre, Vt.)
(Signed) MILTON C. ALLEN
(Boston, Mass.)
(Signed) MAX GARELICK
(Franklin, Mass.)
(Signed) C. P. OSGOOD
(Augusta, Maine)
(Signed) H. E. BROMOR
(Montpelier, Vt.) *Secretary*

Nov. 28, 1944.

New Members

ACTIVE

Adrounie, Capt. V. Harry, Sn.C. 0513157, Bacteriologist and Sanitarian, Army of the United States, AAF Reg. Sta. Hospital, LAAF., Lincoln 1, Neb.

Adams, J. V., State Board of Health, New Albany, Ind.

Barton, John L., Sanitarian, Indiana State Board of Health, 210 Lowell Ave., Charlestown, Ind.

Deal, C. C., Chief of Milk Division, Department of Health, Portland, Oregon

Fisher, L. M., Sanitary Engineer, U.S.P. H.S., Custom House, Chicago, Ill.

Frederickson, Dr. L. E., Dairy Sanitarian, Box 243, St. Louis, Mo.

Gillespie, Ned, Public Health Sanitarian, 304 E. 7th St., Portland, Ind.

Hooven, C. A., Milk Sanitarian, City Health Department, Marshalltown, Iowa.

Hussong, Prof. Ralph V., Prof. of Dairy Bacteriology, University of Illinois, Urbana, Ill.

Law, Otto T., Public Health Sanitarian, Indiana State Board of Health, 1098 W. Michigan St., Indianapolis 7, Ind.

Murphy, William J., Dairy Commissioner, Capitol Bldg., Bismarck, N. Dak.

Pegg, Capt. Charles Elmer, Jr., Station Veterinarian, Station Hospital T.A.A.F., Tuskegee, Ala.

Price, C. C., Public Health Sanitarian, State Board of Health, 516 E. 48th St., Indianapolis, Ind.

Quest, A. E., Jr., Sanitarian, McKinney-Collin County Health Unit, City Hall, McKinney, Tex.

Quist, Elmer B., Sanitarian, State Dept. of Health, 122 State Capitol, Salt Lake City 1, Utah.

Roessler, E. F., Dairy Plant Inspector, State Health Department, 420 N. William St., South Bend, Ind.

Schrock, C. E., Dairy Chemist and Bacteriologist, State Board of Health, 1098 W. Michigan St., Indianapolis 7, Ind.

Stevens, Howard R., Public Health Sanitarian (Dairy), State Board of Health, 150 E. Spring St., New Albany, Ind.

Tansey, J. A., Dairy Farm Inspector, City Health Dept., 113 N. St. Peter St., South Bend 17, Ind.

Taylor, Clarence L., Director, Food and Dairy Division, City Board of Health, 620 E. 42nd St., Indianapolis, Ind.

ASSOCIATE

*Abraham, J. R., Genl. Mgr., City Dairy, Ltd., Winnipeg, Manitoba, Canada.

*Agnew, J. S., Partner-Owner, Jersey Farms, Ltd., 2256 Broadway, Vancouver, B. C.

*Ames, Richard P., Dairy Inspector, State Department of Agriculture, 350 Central Ave., Oshkosh, Wis.

*Arrasmith, James F., Comico Products Corp., 727 N. Henry St., Alexandria, Va.

*Attoe, Arnold B., Dairy Technician, Galloway-West Co., 279 Fifth St., Fond du Lac, Wis.

*Baron, Morris, Bacteriologist, Capitol Dairy Co., 4326 S. Wabash Ave., Chicago 15, Ill.

*Boving, Steve, 812 W. Huron St. Pontiac, Mich.

*Bradt, C. Curtis, Plant Superintendent, Silverwood Dairies, Ltd., 588 Dupont St., Toronto 4, Ontario.

*Brooks, Marvin N., Production Mgr., Meadow Gold Prod. Corp., 105–27 192nd St., Hollis 6, N. Y.

*Brown, E. W., President, Puritan Dairy Products Co., Pittsburg, Kansas.

*Caldwell, G. K., 643 N. Madison Ave., Hastings, Mich.

*Cornelius, Philip A., General Manager, Skagit County Dairymen's Assn., Burlington, Wash.

*Couffer, R. W., Machinery-Hardware Division, Chicago Flexible Shaft Co., 5600 W. Roosevelt Rd., Chicago, Ill.

*Coughlin, John, 15725 Evergreen St., East Detroit, Mich.

*Cree, Norman F., Sidney Wanzer & Sons, Inc., 130 W. Garfield Blvd., Chicago, Ill.

*DeBusman, Arthur W., Milk Sanitarian, Eau Claire City-County Health Dept., Safety Bldg., Eau Claire, Wis.

*Dionne, Dr. Bertrand, Brunswick Hospital, 26–28 Cumberland St., Brunswick, Me.

*Drosihn, R. P., The Borden Company, Denton, Tex.

*Eddy, William G., Supt. of Production, Whatcom County Dairymen's Assn., Bellingham, Wash.

*Friar, Edward J., 295 Hampton Ave., S. E., Grand Rapids, Mich.

*Hanson, F. E., Dairy Research, Chris Hansen's Laboratory, 2253 N. 71st St., Wauwatosa 13, Wis.

*Hunnicutt, Walter D., Natl. Dairy Products Corp., 230 Park Ave., New York 17, N. Y.

*Jankowski, Frank, Lake City, Mich.

*Kingry, Ernest G., Plant Supt., Beatrice Creamery Co., P. O. Box 1996, Wichita 1, Kansas.

*Koehler, Russell, 1046 E. Main St., Owosso, Mich.

*Koger, French, Jr., Dairy Inspector, Dade County Health Dept., 5629 S. W. 7th St., Miami, Fla.

*Lee, Charles W., Service Mgr., Universal Milking Machine Co., R. R. No. 2, S. Grand Ave., Waukesha, Wis.

*Leeder, Joseph G., The Telling-Belle Ver-

non Company, 3740 Carnegie Ave., Cleveland 15, Ohio.
*Linneboe, J. B., Bacteriologist, Alberta Department of Agriculture, Terrace Bldg., Edmonton, Alberta, Canada.
*Matthews, William E., Supt., Williams-McWilliams Dairy, 323 S. W. 20th St., Fort Lauderdale, Fla.
*McIntyre, A. E., 820 West Genesee St., Saginaw, Mich.
*Miller, Harry E., School of Public Health, University of Michigan, Ann Arbor, Mich.
*Mortimore, Charles, Bad Axe, Mich.
*Neuman, Paul J., Supt., Steffen Ice and Ice Cream Co., P. O. Box 2199, Wichita, Kansas.
*Nossov, Capt. Morris A., Veterinary Corps, AAF Reg. Station Hospital, LAAF, Lincoln 1, Neb.
*Pegram, C. W., Chief, Dairy Division, State Department of Agriculture, Raleigh, N. C.
*Pope, R. C., The Pope Testing Laboratories, Box 903, Dallas 1, Tex.
*Puls, Dallas J., Cheese Grader, State Department of Agriculture, Richland Center, Wis.
*Quirch, Eduardo, Milk Company of Cuba, Inc., Calle 18, No. 306 Vedado, Havana, Cuba.
*Riley, Thomas B., Health Department, 1111 Highland Ave., Oak Park, Ill.
*Ross, W. C., Secy.-Treas., Standard Cap & Seal Corp., 629 Grove St., Jersey City 2, N. J.
*Seaver, William H., Officer-in-Charge, Water Analysis Laboratory, U. S. Army, 9 Scribner Ave., Staten Island 1, N. Y.
*Stoy, Charles O., Senior Sanitary Officer, Dade County Health Dept., 778 N. W. 42nd St., Miami 37, Fla.
*Stratton, D. E., N. Y. District Sales Manager, Aluminum Cooking Utensil Co., Room 2700, 330 W. 42nd St., New York City.
*Welsh, M. Palmer, District Fieldman, Pet Milk Co., 400 Washington Bldg., Madison 3, Wis.
*White, Dr. J. H., County Health Officer, Box 509, Columbus, Miss. (Lowndes County Health Dept.).
*Wiedenhaft, Ben, Territory Manager, The Fairmont Creamery Co., Green Bay, Wis.
*Williams, Henry O., Partner-Owner, Rose Lawn Dairy, 302 Callahan St., Muskogee, Okla.
*Willingham, Juddie J., Associate Technical Director, Meadolake Foods, Inc., Sherman, Tex.

CHANGES IN ADDRESS

Bellin, Walter P., from Thiensville, Wis., to T/Sgt. 36293863, H&S Co., 1393d Engr. Const. Bn., APO 709, c/o Postmaster, San Francisco, Cal.
Bergy, Malcolm, from S.M.A. Corp., Mason, Mich., to Wyeth, Inc., Mason, Mich.
*Booth, L. E., from Sheridan Road, Chicago, to 4638 W. Clarendon Ave., Chicago, Ill.
*Buechel, John N., from Lincoln, Neb., to Roberts Dairy, Omaha, Neb.
Burkhardt, Sgt. R. C., from Huntsville, Ala., to Medical Det. V.S., c/o Dairy Distributors, Inc., Watertown, Wis.
Butterworth, T. H., from New Orleans, La., to c/o New Medical Bldg., University of North Carolina, Chapel Hill, N. C.
*Chrisman, C. F., from Jackson Heights, N. Y., to Fulton, N. Y.
Collins, Dr. M. A., from Boston, Mass., to Sheffield Farms Company, Inc., Dryden, N. Y.
Colt, Kenneth H., from 224 Brightridge Ave., E. Providence, R. I., to 143 Walnut St., E. Providence, R. I.
Courtney, Pvt. J. L., from Oklahoma City, Okla, to Mr. J. L. Courtney, East Village No. 2, R. 221, Oak Ridge, Tenn.
Curtis, Dr. L. R., from Salt Lake City, Utah, to 700 Vine St., Murray, Utah (Hi-Land Dairymen's Association.)
*Duzansky, John, from 1412 N. LaVergne Ave., Chicago, to 1938 Augusta Blvd., Chicago, Ill.
*Eldred, R. E., 3931 S. Leavitt St., Chicago 9, to National Cheese Department, Great A&P Tea Co., 211 W. Wacker Drive, Chicago 6, Ill.
Elliker, Prof. P. R., from Lafayette, Ind., to First Lt. P. R. Elliker, Camp Detrick, Frederick, Md.
*Engimann, Arthur J., from 21 E. Van Buren St., Joliet, Ill., to 312 Richard St., Joliet, Ill.
Farrar, Robert L., from Monroe, Wis., to Purity Cheese Co., Mayville, Wis.
Flake, J. C., from Lansing, Mich., to Acting Chief Milk Sanitation Section, State Health Department, 3239 Spain St., New Orleans 17, La.
*Foter, Dr. M. J., from Greenville, Ill., to Wm. S. Merrell Co., Lockland Sta., Cincinnati, Ohio.
Frederickson, D. L. E., from St. Louis, Mo., to Box 243, Highland, Ill.
*Guske, Fred W., from 605 S. Adams St., Green Bay, Wis., to 1014 E. Walnut St., Green Bay, Wis.
*Hanger, P. N., from 2125 Yale Blvd., Springfield, Ill., to 2425 E. 7th St., Springfield, Ill.
Hawkins, J. V., from Pasco, Wash., to 911 W. 5th St., Austin, Tex.
Held, Milton E., from Des Moines, Iowa, to U.S.P.H.S., Lincoln, Neb.
Herrera, Alfonso, from Bronx, N. Y., to Carrera 13 A. No. 32–67, Bagota, Colom-

bia, South America, C/Pasteurizadora San Luis.
*Jacobsen, D. H., from Ill. Producers Creameries, Chicago, Ill., to Cherry-Burrell Corp., 427 W. Randolph St., Chicago, Ill.
Kinnison, C. B., from 2103 West State St., Grand Island, Neb., to 812 W. 16th St., Grand Island, Neb.
Krueger, Paul F., from Chicago Board of Health, Chicago, Ill., to SPUDS, 715–725 W. 15th St., Chicago 7, Ill.
Layson, S. V., from Washington, D. C., to Illinois Creamery Supply Co., 715 S. Damen Ave., Chicago, Ill.
Layson, S. V., from Chicago, Ill., to 1101 South 7th St., Springfield, Ill.
*Luchterhand, C. K., from Dolgeville, Wis., to 223 Alden Drive, Madison, Wis.
Lyons, Robert, from Flint, Mich., to Box 246, Grand Blanc, Mich.
Marcussen, W. H., from 110 Hudson St., New York City, to 350 Madison Ave., New York City (The Borden Co.).
Moyer, First Lt. Clifford, is now Lt. Clifford Moyer, 0-174671, 1325 S.U., Hq. Section, Indiantown Gap Military Reservation, Pennsylvania.
*Nusbaum, Dave, from Madison, Wis., to The Wheeler Corp., Box 455, Green Bay, Wis.
Painter, W. E., from Sappington, Mo., to c/o Golden State Co., Ltd., Gridley, Cal.
Peterson, Capt. Oliver H., from Fort Riley, Kansas, to 7th Service Command Medical Laboratory, Fort Omaha 11, Neb.
Richards, W. F., from S.M.A., Mason, Mich., to Wyeth, Inc., Mason, Mich.
*Scott, Monier H., from Weston, Mich., to Babson Bros. Co., Chicago, Ill.
*Shell, Kenneth L., from 620 N. 8th St., Milwaukee, Wis., to 722 N. 13th St., Milwaukee, Wis.
Stebnitz, V. C., from Chicago, Ill., to Skokie Board of Health, Skokie, Ill.
*Veenstra, John, from Battle Creek, Mich., to Health Department, Ann Arbor, Mich.
*Wainess, (Lt.) Harold, from Camp Adair, Ore., to Asst. Sanitarian (R), U.S.P.H.S., State Board of Health, Portland, Ore. (apparently out of Army, so no title).
Woodman, M. J., from 1806 Maple Ave., Evanston, Ill., to 1123 Noyes St., Evanston, Ill.

* Associate Member.

Jennings Leaves Iowa

James R. Jennings, well known in Milk and Food Control circles for many years, is leaving the Iowa State Department of Health to join his brother in Phoenix, senior member of the leading law firm of the state and who is engaged in many business enterprises in the southwest.

Jennings has had a long and varied career in public health. For six years he was State Dairy Commissioner of Arizona. From Arizona he went to Portland, Oregon, where he was senior milk sanitarian for the City Health Department. After two years there, he went to Louisville, Kentucky, where he reorganized the milk control program for the City Health Department. Many of us will remember him as our host at the convention in Louisville in 1937.

Leaving Louisville he went with a Chicago firm for two years doing educational work in the milk control field.

For the past five and one-half years he has been with the Iowa State Department of Health and has organized the Iowa Association of Milk Sanitarians and affiliated it with the International Association.

His new address is Title and Trust Building, Phoenix, Arizona.

FLAVOR IN ITS RELATION TO DAIRY PRODUCTS

(Continued from page 23)

The sweetness of fructose was reduced by all the acids except hydrochloric and citric acids where no change in sweetness could be noted.

All the sugars acted to reduce the saltiness of sodium chloride.

All the sugars reduced the sourness of the acids but to varying degrees. Lactic, malic, and tartaric acids were outstanding in this respect.

The effect of sodium chloride and sugars upon the sourness of acids could not be correlated with changes in phosphate buffer titrations or with changes in pH.

REFERENCE

1. Fabian, F. W., and Blum, H. B. Relative Taste Potency of Some Basic Food Constituents and Their Competitive and Compensatory Action. *Food Research*, **8**, 179–193 (1943).

Third letter, published in the November-December, 1944, issue, page 367: Invite the inspector to come on a certain day, and have the place prepared. Play up to the inspector's vanity by asking his opinion on some subject that interests him, and keep him talking to flatter him and keep him from seeing too much. Try to divert his attention to other matters than the sanitary conditions of your place—to gain time for the hired man to clean up.

FOURTH LETTER

Sunny Acres, September 15, 1937.

Dear Nephew:

It has been almost six weeks since I last wrote you, and nearly two weeks since I received your reply. I am disconcerted by your report that your elaborate arrangements to ascertain and anticipate the movements of the dairy inspector in your district have failed so dismally. They must be developing more astute inspectors than operated during my time as a milk producer; or, you are plagued with a particularly clever one. His procedure of driving into your next neighbor's farm during the morning milking operation, and then visiting that day none of the farms warned of his presence, indicates that he is sharp like a fox; and I can understand that it bids fear to demoralize completely the elements of the reporting system you developed. But, do not be discouraged; maybe it was merely a coincidence. Or, perhaps someone became overconfident, and talked out of school.

But, the statement that your inspector will not accept small gifts, is not interested in fishing or hunting, and declines to become involved in the chatter of your herdsman—unless it pertains to milk sanitation, seems to set this man apart from all other dairy inspectors I have ever known. However, this latter trait suggests one point of possible vulnerability—his Achilles' heel, as it were—and that is the subject of this letter—Lesson No. 5.

You imply that this inspector—you have never named him in your letters—can be interested only in discussions pertaining to milk sanitation. Very well, discuss that subject with him! I understand and appreciate the fact that you keep your dairy farm in good condition most of the time, and—at least thus far—have had no quality difficulties (Lucky fellow!). Nevertheless, it seems to me that you should be preparing for the moment or day when you may be in trouble. To that end your efforts should be directed at discrediting the judgment of the inspector. You see, when the judgment of an individual has been discredited, his charges or statements against you lost some or all of their weight or force.

There are numbers of ways in which a dairy inspector's judgment or views may be discredited, but in this lesson I shall confine the discussion to one general procedure.

Involve him, if you can, in discussions of moot points in the milk ordinance or regulations he enforces, or in some particular phase or feature of milk sanitation—no matter how trivial—and note any unorthodox views he may express. The instant you catch a hint of a view or position in conflict with the accepted interpretation of the ordinance or rules under which you produce milk (I told you in a preceding lesson that you must know the ordinance), or an attitude which curtails a local farm operation practice of long standing, draw him out and make him enlarge upon it.

Then, at the first opportunity, relate these views to your neighbors, the farm leaders, and the fieldman of the distributor to whom you sell your milk, or to the fieldman of the co-op of which you are no doubt a member. If you can create the impression that the inspector was seriously in error—at least, that his position is opposed to those of the community, and of those whose views MUST be right, because their positions make their opinions correct—you will have succeeded in demonstrating that he is not infallible; that is, that he can also be in error on other matters connected with the enforcement of the ordinance.

At the same time, you should seize upon any instances of viewpoint or recommended practice, particularly in milk sanitation, in which your fieldman or co-op agent differs from your inspector, never failing to credit the fieldman or agent with correctness in such differing views. In this manner you will ultimately be able to drive a wedge between the fieldman or agent and the inspector, who, if they always work together in harmony can require you to do anything they agree upon. If you can bring the recommendation of either into question by the other, however, there will usually elapse an interval during which you need do nothing, while the differing individuals argue the question or refer it to their superiors.

Another similar way to discredit the inspector, should he chide you or your employees for failure to perform an operation as prescribed, is to claim that the procedure you have been following is a *practical* one, recommended by the fieldman or co-op agent. That is

(Continued on page 62)

Dr. Jones Says—*

We've been hearing a lot, here the past few years, about "long range" programs: health and what not. Folks have come to realize (some of 'em have, anyway) that what's accomplished in the long run may be more important than the things that give immediate results but are only temporary. Getting an epidemic under control, for instance: it's necessary and, sometimes, spectacular; but preventing epidemics from occurring—that's the big thing. But it takes time. And it can't be done by health officers and other doctors working alone. The people themselves—what we call "the public"—they've got to understand what it's all about and do their part.

That's why I figure that the most important part of the job of every health department is to get the people they're responsible for informed on this health stuff. And you can't expect many of 'em to come and get it. You've got to take it to 'em and in such form that they can't get away from it. Like giving a hypodermic: you've got to get it under their skin. When they once realize that they're the ones that're going to be benefited (not the health officer) then you get their support.

A good illustration: I heard the story awhile ago—the way they've cleaned out ragweed up in what they call the "Central Adirondacks"—the section up around Old Forge, the Fulton Chain and so on. Several years ago the Health Department made a survey to find out whether there was any section of the State free enough from ragweed to warrant a systematic effort to get rid of it entirely. They found out that up in this Adirondack area there was only a little of it: mostly scattered along the highways.

Well, sir, there's an organization up there: the Central Adirondack Association, I believe they call it. They saw the point right away and they went to work. Today anybody that finds a sprig of ragweed—they'd probably organize a posse to go after it.

The upshot of the matter is: they've got people coming there from all over to get away from ragweed. Business last year, so a fellow from up there was telling me, was the best it'd been in years. And it started from their seeing that applying a health measure was to their interest.

Vaccination, treatment of public water supplies, pasteurization of milk, control of stray dogs and all the rest—the same principle applies. When the people affected understand why it's to their interest, then you can look for results.

PAUL B. BROOKS, M.D.

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* *Health News*, New York State Department of Health, Albany, June 19, 1944.

FOURTH LETTER

(Continued from page 61)

virtually certain to generate suspicion and coolness between them. I believe it to be unnecessary to warn you that in this game of playing the inspector against the fieldman you must guard against misquoting either too grossly, else your hand will be exposed.

The early fruit is being harvested, and I cannot spare the time to write in greater detail now; but I hope to be able to write you again in a few weeks. I hope you will inform me, in the meantime, concerning the application of one or another of the suggestions in this series of lessons, and give me an idea of the character of your inspector. Unless your reports grow more favorable, it appears that I shall have to come East to take a hand personally in this campaign.

Aunt Matilda and I are both well.

UNCLE BOB.