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Editorials

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Food Technology vs. Food Engineering as a Professional Entity

THE spectacular development of the food industry during the past twenty-five years or so has had its analogy in the rapid movement of military spearheads whereby advances are made faster than the conquests have been consolidated. In this relatively short period numerous parts of the food industry have broken into the field of "big business." The milk industry alone is in the three billion dollar bracket.

Such a great industrial development needs the stabilizing effects of sound scientific foundation and engineering control to secure the financial support and servicing that are necessary for its life. To an increasing degree, the food industry has recognized this need. It turned to the only source of scientifically-trained knowledge available, namely, the bacteriologists and the chemists, and to a minor degree, the mechanical engineers. Suddenly these laboratory-minded workers were jumped from the areas of grams and millivolts to those of tons and horsepower. They have had to do what chemists did when suddenly they found that they had a great chemical industry on their hands. The industrial needs and demands of big business stimulated the universities to devise formal courses in chemical engineering. These now have developed to professionally and industrially recognized curricula.

The food industry has moved along somewhat parallel lines. Its technically trained men have been drafted mostly from the formal fields of bacteriology, chemistry, and engineering. These men have had to learn by the quick way how to extend their knowledge into the production field. This is technology. Food technology is a field for the executive type of trained food chemist and bacteriologist with many years of practical experience and with a fair knowledge of the principles of chemical engineering.

Most of the leading food technologists now comprise the Institute of Food

Technology, a national organization of about sixteen hundred members. Its constitution states:

> Food Technology is the technological application of science and engineering to the manufacture and handling of foods. Food Technology is primarily based on the fundamentals of chemistry, physics, biology and microbiology, any of which sciences may find expression through an engineering operation. Knowledge of Food Technology enables its possessor to develop new products, processes, and equipment, to select proper raw materials, to understand and control food manufacturing operations, to solve technical problems of food manufacture and distribution, including those involved in plant sanitation, and those affecting the nutritional value and public health safety of foods, and to know the fundamental changes of composition and of physical condition of foodstuffs which may occur during and subsequent to the industrial processing of the foodstuffs.

Chemical engineering is concerned with the application of chemistry and the several branches of engineering to the design, construction, operation, control, and improvement of equipment for carrying out chemical processes on an industrial scale.

Inasmuch as food technology is governed and regulated by well-defined chemical, bacteriological, and physical principles, and has utilized engineering practices that are common in the chemical industry, there has come about a tendency to create the new branch of food engineering as including and extending food technology.

The two fields are similar in many respects. Both are based on chemical and physical principles. They handle foods and chemicals in many similar ways—grinding, heating, crystallizing, drying, etc. Both use steam for heating and electric current for power. Both operate batch processes, and both are increasing in the development of continuous operations. Their equipment often is similar in design and operation, and the plants may incorporate the same principles.

They are also quite dissimilar. The chemist may be a chemical engineer but the chemical engineer must be a chemist, whereas the food technologist must be a biologist and a bacteriologist and a chemist and a sanitarian and a nutritionist (to a greater or less degree), as well as able to utilize and apply engineering principles. Food technology embraces some of the field of engineering but it extends farther. Its raw materials are supervised even during growth and production, then harvesting, transportation to plant, processing, packaging, storage, and distribution, all in a setting that must comply with rigid requirements of sanitation and public acceptance, without impairing such imponderable and unmeasurable properties as appearance, nutritive value, and gustatory appeal. This requires a type of training that is only partially supplied in the engineering curricula. (Sanitary engineering overlaps the field of food technology to a degree.) The difference in point of view is strikingly illustrated in the case of a large manufacturer of plastic sheeting for capping milk bottles: he exercised splendid chemical and technical control in his plant production but allowed the finished sheeting to be rolled across the plant floor and couldn't understand what harm there was in that. The efforts of the milk industry to make the producers of fiber-board for bottle cap manufacturers "sanitary minded" speaks eloquently of the difficulty.

This broader scope of knowledge of the food man requires a type of training that must be geared to the needs of the industry. To essay to meet this need by devising a course in food engineering postulates in the first place a knowledge that does not exist. There is no formulated information on food thermodynamics. The chemistry of foodstuffs is obscured by our more or less hazy understanding of the chemical forces that operate in food whereas the chemistry of most of our chemical processes is far more advanced. The results of our food plant processing must be gauged by such elastic measuring sticks as the senses. The engineer knows his materials and his products because he measures with scientific precision all of his operations and end-products, whereas the food technologist measures much but judges mostly. When we understand the chemistry of foodstuff varieties; when we possess a knowledge of the factors involved in heat treatment; when we can reliably express the properties of the crumb and the texture of meat; when we can measure taste and evaluate appearance (eye appeal): then we shall possess a control of our operations that will permit food products to be handled with the exactitude now accorded chemicals by chemical engineering.

Food technology covers a broader field than that connoted by food engineering. In fact, food engineering is as restricted in its application to food technology as food chemistry is, or food bacteriology is, or physics is. A course in food engineering would have to comply with the conventional curriculum requirements of the accrediting engineering societies. These provide that the foundation courses in the lower classes of engineering be common to all the branches of engineering before specialization begins in the upper classes. Such a curriculum set-up would be necessary for professional recognition of the food engineer in the class with the chemical engineer, the mechanical engineer, the electrical engineer, and the others. This requires so many subjects in a crowded curriculum that the only way to include the other necessary subjects for the food industry is to increase the number of years of formal undergraduate education. This is out.

The time may come when a food plant will engage a relatively large technical staff of specialists from the several fields of biology, chemistry, engineering, physics, etc. However, the work of this staff would have to be directed and coordinated by a food technologist, because only such training (food technology) is broad enough to make each supporting science integrate with the others. The food engineer, highly trained in a conventional engineering curriculum, would have insufficient information about so many factors involved in successful food production that he would be not much more useful than a regular mechanical engineer who gets some food plant experience.

And so it is that we have no present place for food engineering as replacing technology. The food industries must develop and use the food technologist. This must be recognized as a professional entity. As such it must develop its own curriculum, its literature, and its professional organization. The last it has. The others are in the making. They will come more quickly when we see clearly the need. A problem defined is already half solved. So, we are ready for food technology, not food engineering. J. H. S.

The Acid Milks: Their Potential Hazard

FOR many years, milk sanitarians have considered that the fermented milks present no health hazard. This attitude finds its support in the general belief that pathogenic microorganisms will not grow in such acid media as sour milk. This complacency has received a severe jolt on two counts.

For several years now, the compilation of disease outbreaks attributed to milk and its products, published by the U. S. Public Health Service, has carried reports of the (alleged) incrimination of the fermented milks.[1] The latest one cites an outbreak of gastroenteritis caused by *Staphylococcus aureus* in buttermilk which had been placed in insanitary containers.

To those who would be inclined to pass lightly over this bit of news, we point out that a good research paper has just been published on the bacteriology of this very subject.[2] The authors, Wilson and Tanner, review the extensive literature as to the effect of acid milk on the growth of pathogenic microorganisms. The results as reported are often contradictory. There seemed to be a difference between the effects of growth in a milk which had been acidified by the addition of acid as compared with milk in which acid-producers had grown along with the pathogens. So they themselves studied the survival times of *Eberthella typhosa, Salmonella paratyphi, Salmonella schottmülleri, Shigella dysenteriae,* and *Shigella paradysenteriae* Flexner in milks whose pH values ranged from 4.0 to 5.1, and whose percentage acidity ran 0.45 to 1.30. Three types of acidified milks were used as media in each case: (1) sterile skimmed milk plus lactic acid; (2) naturally fermented milks; and (3) milk inoculated with lactic acid-producing bacteria and pathogens. The data clearly show that the first medium usually permitted survival for only a few days; the second medium, much longer; and the third medium, often for as long as sixty-three days plus. Their summary includes the following important points:

"Lactic acid-producing bacteria vary in amount of acid formed in sterile skimmed milk."

The above test microorganisms "are destroyed more rapidly when lactic acid is added to milk than when natural fermentation occurs."

"Pathogenic organisms persist longer when acidity increases gradually. Slower increase in acidity permits development of acid-tolerant strains if they are present."

"Commercial buttermilk has an acidity ranging from 0.6 to 0.95 percent. In naturally fermented milk it is not sufficient to destroy pathogens tested within a reasonable time. In fermented milk with acidity of 0.95 to 1.15 percent (pH 3.9 to 4.2), pathogens survive from one day to seven weeks; with acidity of 0.50 to 0.86 percent (pH 4.3 to 5.0), pathogens persist from two to nine weeks."

These findings are important on three counts. First, they reconcile much data in the literature which seemed contradictory. Second, they point out the obvious procedure for milk sanitarians to follow, namely, to insist on the sanitary handling of the fermented milks by approved methods as used for the regular bottled supply. Third, we must not take any of our control practices for granted or assume that this is harmless and that is not, but should subject all our work to the rigor of scientific investigation and accurate measurement.

These symbiotic effects—we wonder if an analogous condition exists in other dairy products.

J. H. S.

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The Effect of Penicillin on Staphylococci and Streptococci Commonly Associated with Bovine Mastitis

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The general outlook for the control of bovine mastitis has been changed in the last few years by important advances in the chemotherapy of the disease. Kakaras *et al.* (1) have shown the effectiveness of udder instillations with sulfanilamide in oil, and Little and his co-workers (2) and others have demonstrated the value of tyrothricin and gramicidin in destroying streptococcal populations in infected udders.

The remarkable effectiveness of penicillin against hemolytic streptococci of human origin (Lancefield's Group A) suggest that this substance would be effective against the important udder pathogens, *Streptococcus agalactiae* and *Streptococcus mastitidis* (Lancefield's Group B), and *Streptococcus dysagalactiae* (3) and *Streptococcus zooepidemicus* (4) (Lancefield's Group C).

Preliminary observations by the authors (5) have shown that representative strains of Group B and C streptococci are susceptible to 1 Florey unit per ml. of penicillin, and alpha hemolytic Group B streptococcus (Strain # 22) has been adopted for routine use in a rapid method for the assay of penicillin (6). In addition it has been found that a non-pathogenic beta hemolytic Group B streptococcus (Strain # 3) can be substituted for the human Group A (Strain # 203) in the hemolysis inhibition test for determining penicillin potency recently described by Rake *et al.* (7).

Subsequent work has shown that all of the Group B and Group C streptococci so far examined are highly susceptible to penicillin. In addition, experiments have been carried out on the action of penicillin on Group B streptococci, special attention being given to the behavior of low concentrations—1 or 2 Florey units per ml. This concentration range has been studied in view of the possibility that penicillin in the form of sterilized filtrates of cultures of *P. notatum* could be used therapeutically. Such products are reasonably non-toxic, and if found active could be produced and marketed at a relatively low cost.

A number of pathogenic *S. aureus* cultures similar in all respects to those described by Little and Foley (8) and Plastridge *et al.* (9) isolated from milk, and other strains obtained from human lesions have also been examined and found to be highly susceptible.

Materials and Methods

Penicillin in the form of partially purified preparations containing 100-200 Florey units per mg. and filtrates of crude liquor of cultures of *Penicillium notatum* containing from 25 to 80 Florey units per ml. were diluted and used for the various experiments. Brain heart infusion (Difco) was used as a liquid medium and colony counts were made by plating in proteose tryptone agar. Fresh defatted milk pasteurized in the laboratory was used in all milk population experiments. Incubation of cultures was carried out in a 37° C. water bath. All of the streptococcus strains were typed by the method of Lancefield (10) using streptococcus grouping serum (Lederle). Beta hemolytic Group B streptococci cultures, 3, 5, 6, and 7 and alpha hemolytic strain # 22 were isolated in this laboratory from certified milk, and Dr. J. M. Sherman supplied culture Bg 2. Dr. J. M. Murphy kindly supplied Group B alpha hemolytic strains 507 RF, 507 LF, 507 LH, 43 RF, 704 LF, 522 LF, 611 LF, and 692 LF. Hemolytic Group C strains L 72 C, MCF, Clarke and Lung IV were obtained from Dr. J. H. Brown, and Ferret 5, G.P. 1942, Horse 408 and Fox I were supplied by Dr. F. H. Fraser. Strain 342 was isolated from a guinea pig abscess. *Staph. aureus* strains 1–14 and 1–19 were isolated from purulent milk, # 8629 and # 8631 were obtained from Dr. G. H. Chapman, and strain H from the research laboratory of Merck & Company, Inc. Other details are given under the separate experiments.

EXPERIMENTAL

The susceptibility of the various streptococci and staphylococci to partially purified and crude penicillin was compared by seeding 0.1 ml. of 1/10

TABLE 1

SUSCEPTIBILITY OF VARIOUS MASTITIS PRODUCING ORGANISMS TO PENICILLIN

Organism		*Source*	*Bacteriostatic concentration of penicillin in Florey units per ml.*
Streptococcus aureus	FDA	American Type Culture Collection	0.02
	Assay Strain H.	Merck & Co., Inc.	0.02
	8629	Human nasal mucosa	0.15
	8631	Human eye	0.02
	Milk 1-14	Milk	0.15
	Milk 1-19	Milk	0.02
Streptococcus agalactiae (Lancefield's Group B)	507 RF	Milk	0.02
	507 LF	Milk	0.02
	507 LH	Milk	0.02
	43 RF	Milk	0.02
	H704 LF	Milk	0.17
	522 LF	Milk	0.17
	611 LF	Milk	0.17
	692 LF	Milk	0.02
	22	Milk	0.02
Streptococcus mastitidis (Lancefield's Group B)	3	Milk	0.02
	5	Milk	0.02
	6	Milk	0.17
	7	Milk	0.02
	Bg 2	Milk	0.02
Streptococcus dysagalactiae (Lancefield's Group C)	Diernhofer	Milk	0.02
	B 938	Milk	0.02
Staphylococcus zooepidemicus (Lancefield's Group C)	L 72 C	Human	0.017
	MCF	Human	0.02
	Clark	Animal	0.02
	342 M	Animal	0.017
	Animal Lung. IV	Animal	0.02
	Ferret 5	Animal	0.17
	Guinea Pig 1942.	Animal	0.02
	Horse 408	Animal	0.02
	Fox I	Animal	0.02

dilution of 18 hour cultures into 5 ml. amounts of brain heart broth containing dilutions of the penicillin solutions. The penicillin solutions were preliminarily diluted to contain 3 Florey units per ml. and then diluted further according to the harmonic progression 1/50–1/100–1/150. The presence or absence of growth was recorded after 24 hour incubation at 37° C. The results are shown in Table 1.

It is known that penicillin is not only bacteriostatic but also bactericidal (11, 12) and that the logarithm of the number of survivors is a linear function of time at temperatures favorable for the multiplication of the susceptible microorganisms. In two preliminary experiments in which 0.03 and 0.035 million chains of *S. agalactiae* per ml. were added to pasteurized milk containing 1 Florey unit per ml., sterilization was accomplished after 5 hours incubation at 37° C. Experiments were made to study by plating at shorter intervals the rate of decline of Group B and C streptococci. The results are shown in Table 2.

tubes which were incubated at 37° C. A similar pair of tubes containing brain heart infusion broth was set up with the same inocula. Growth was allowed to proceed for 1.5 hours after which time a sample was withdrawn from each tube for the enumeration of the viable streptococci. After taking this sample, 0.10 ml. of 5 units per ml. of penicillin was added to one of the milk and to one of the broth tubes, giving a final concentration of 1.0 Florey unit penicillin per ml. Plate counts were made at intervals on 0.10 ml. samples taken from all the tubes. The results of this experiment are given in Table 3.

It has been shown by Jones (13, 14) that fresh milk contains a bacteriostatic substance—lactinin, which is destroyed within 5 minutes at 100° C. In order to study the separate and combined effects of lactinin and penicillin on the growth of *S. agalactiae* # 22 in milk, the following experiment was conducted. Two tubes containing 5 ml. of milk which had been boiled 5 minutes and two tubes containing 5 ml.

TABLE 2

VIABLE BACTERIA IN MILLIONS PER ML. OF BROTH CONTAINING 1 FLOREY UNIT OF PENICILLIN PER ML. AFTER VARIOUS INTERVALS AT 37° C.

Hours	*Streptococcus Group A 203 MV*	*Streptococcus Group B 22*	*Streptococcus Group C 342 M*	*Staphylococcus aureus FDA*
0	0.032	0.034	0.576	2.14
0.5	0.112	.....	0.540	.....
1.0	0.035	0.26	0.512	.....
1.5	.....	.....	0.131	.....
2.0	0.010	0.24	0.108	29.0
3.0	0.008	0.004	0.092	.....
4.0	.....	0	.....	2.8
5.0	.....	.....	.....	.....
24.0	0	0	0	0.24

The bactericidal activity of penicillin against growing streptococci and staphylococci is clearly shown in Table 2, and the following experiment gives additional data on this action. A sample of milk boiled five minutes was seeded with 80,000 chains of streptococci per ml. Five ml. of this sample were then distributed in two sterile

of milk heated at 60° C. for 20 minutes were inoculated with 0.1 ml. of 1/10 dilution of a 3 hour culture of *S. agalactiae* # 22. An initial population count was made on all tubes and then concentrated penicillin was added to one tube of each pair to give a final concentration of 2 Florey units per ml. of milk.

TABLE 3

ALTERATION IN VIABLE COUNT OF STREPTOCOCCI BY THE ADDITION OF 1 FLOREY UNIT OF PENICILLIN

	Streptococci per ml. in millions			
Hours	*Broth control*	*Broth*	*Milk control*	*Milk*
0	0.080	0.08	0.08	0.08
1.5	0.42	0.34 (1 Florey unit of penicillin added.)	2.3	2.3 (1 Florey unit of penicillin added.)
2.5	0.57	0.26	4.6	2.8
3.0	1.40	0.24	13.8	0.130
4.0	5.8	0.004	41.4	0.009
5.0	23.2	0	....	0

The effect of lactinin alone and in combination with penicillin is shown in Table 4. Incubation was carried out at 37° C. and counts were made at hourly intervals .

It appears from Table 4 that although penicillin (2 Florey units per ml.) rapidly reduces the number of viable streptococci in boiled milk, it is even more effective in milk containing lactinin.

TABLE 4

EFFECT OF LACTININ AND PENICILLIN ON THE VIABLE COUNT OF S. AGALACTIAE IN MILK

	Streptococci per ml. in thousands			
Hours	*Boiled milk*	*Boiled milk plus 2.0 Florey units penicillin*	*Milk heated 60° for 20 minutes*	*Milk heated 60° for 20 minutes plus 2.0 Florey units penicillin*
0	35	35	35	35
1	......	1.50	......	0.70
2	1,280	0.90	800	0
3	......	0.018	......	0
4	20,500	0	14,700	0

DISCUSSION

Previous work has shown that *S. aureus* is susceptible to penicillin and the experiments herein described point out that streptococci of Lancefield's Group B and C, which together with *S. aureus* comprise the three major groups of microorganisms associated with bovine mastitis, are equally susceptible.

Rapidly growing populations of these streptococci in milk and broth are quickly attacked by penicillin (1 Florey unit per ml.) and total killing of viable organisms is accomplished within a matter of hours.

In view of the present observations it is implied that penicillin is an agent of considerable promise and worthy of study in the treatment of bovine mastitis caused by staphylococci and Group B and Group C streptococci. It would appear that penicillin possesses a number of properties which would give it advantages over sulfonamides or the water insoluble tyrothricin or gramicidin. Penicillin is relatively non-toxic and is freely diffusible and water soluble. It is at least as effective as gramicidin against streptococci and far more effective against *S. aureus* (15, 16, 17).

The rapidity with which streptococci

and staphylococci are killed (Tables 2, 3, and 4) suggests that a few treatments would suffice to rid an udder of pathogens. Should repeated exposure be necessary however, it is not unlikely that preparations of reasonable purity could be repeatedly instilled into an udder with a minimum of irritation.

SUMMARY

Experiments are described which show that the most important causes of bovine mastitis, *Staph. aureus*, *Streptococcus agalactiae* and *S. mastitidis* (Lancefield's Group B), and *S. zooepidemicus* and *S. dysagalactiae* (Lancefield's Group C) are highly susceptible to small amounts (1–2 Florey units) of penicillin. It is suggested that penicillin offers promise in the treatment of the conditions due to the presence of these organisms.

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A Swab-Slant Test for Equipment Sanitation and Its Correlation with a Standard Method

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Unquestionably, the lack of a simple method for demonstrating the sanitary condition of equipment is responsible for the fact that such equipment continues to rank as the most prolific source of microbic contaminants in dairy products. The operator charged with the task of sanitizing has no way of observing or measuring the efficiency of the procedure he follows. He is satisfied that his equipment looks clean and he fails to realize the critical difference between physical cleanness and sanitation, as expressed by freedom from bacteria. The former is important; but the latter is the final criterion of effective sanitation. Most workers in dairy plants have seen samples taken for bacteriological analyses and have observed the typed report of results and of the tests. To only a few has the procedure much meaning. Others look upon it as something very complicated and without much practical significance. As such, the usual plating method has only limited educational value and fails to inspire the worker responsible for the output of products of high sanitary quality. He needs to be made "microbe conscious."

Attempts to do this for well over a quarter of a century have failed primarily because methods have been too complicated to be used widely or interpreted fully. "Seeing is believing" is a dictum that applies truly to the problem of sanitation of dairy equipment and eating utensils. There is dire need for a simple visual method that would convince dairy workers of the need for greater care in cleaning and sterilizing.

The problem of simplification of bacteriological methods has been considered by many workers. The Burri slant (2) originally proposed in 1928 is now considered a standard technique for estimating numbers of organisms in liquid substances. The method of smearing loop-measured amounts of material on a culture medium in tubes or petri plates is so simple that it may be performed by any careful user and wherever desired.

In 1942 Hasson (6) proposed an emergency method for estimating bacterial populations. Suitable dilutions of liquids to be tested are poured on and drained from a satisfactory culture medium solidified on one inner surface of 2 oz. square screw capped bottles. After incubation in an inverted position discrete colonies develop. These may be counted. Both the Burri and Hasson technique are designed primarily for the testing of liquids. However, with slight modification they can be adapted to testing the sanitation of surfaces.

In 1943 Gunderson and Anderson (4) reported that a swab test is most practical, economical, and efficient for regular checks on the sterility of plant equipment. They suggested smearing the contaminated swab directly on the surface of nutrient agar in petri plates instead of the usual rinsing in sterile water and the subsequent plating of the contaminated water. They describe this sanitation test as being "stream-lined and well adapted to emergency wartime conditions." Again in 1944 Gunderson and Anderson (5) reported beneficial results from the inclusion of the swab test in a milk control program.

Except for that of the Burri technique, the methods reviewed were unknown to the writers when they developed the method hereafter described, to determine the effectiveness of various new germicidal agents for sanitizing dairy equipment. It proved effective, simple, and reliable. It could be used also for checking sanitation in food handling and beverage dispensing industries.

THE SWAB-SLANT TEST

The swabs should be small and uniform. They may be prepared on single or double wooden applicators, 0.05 gm. of good quality absorbent cotton being sufficient for each swab. Two applicator swabs are preferable for cans and similar utensils to permit considerable pressure without breakage. Stainless steel wire applicators would be ideal if they could be obtained. These swabs may be packaged and sterilized in non-cumbersome form in glassine bags, such as used by plant breeders to prevent cross pollination. The 6½" x 2½" bag, folded twice lengthwise, provides three compartments each capable of holding three to four swabs or a total of nine to twelve per bag. This tube arrangement makes it possible to withdraw one swab without disturbing the others. The package is capped with a smaller bag or the bottom half of the same sized bag, which may be folded to prevent contamination and provides a neat package that autoclaves effectively. It furnishes a simple aseptic means for carrying many swabs, and is a decided improvement over the customary cumbersome cases of test tubes used by many.

Sterile water for saturating swabs before use on dry surfaces may be conveniently provided in small screw-capped vials of 40 ml. capacity. Under careful use one vial provides sufficient sterile water to moisten 20 or more swabs without significant contamination. Reasonably pure tap or well water may be used instead of sterile water, in which case check swab-slant tests on the water should be made. This also provides a generally appreciated bacterial test on the water supply in use. Deductions due to growths on water checks should be applied to equipment tests in which such water was used. A uniform system of swabbing must be followed for each type of equipment.

The next part of the test is where the most important simplification enters. Instead of taking the contaminated swab to a laboratory for the usual plate culturing, it is smeared, in the presence of the operator, over a suitable medium previously slanted in oval test tubes, similar to those used by Meyers and Pence (9). This tube provides a large surface of medium on which culture developments may be readily seen, colonies counted or growths classified. Also, oval tubes pack compactly and thus simplify the transportation problem, usually a factor that curtails adequate analyses at sources distant from the control laboratory.

The tryptone-glucose-extract-milk agar medium described in *Standard Methods of Milk Analysis,* reinforced by an additional 0.5 to 1 percent of agar, is highly satisfactory. Special or differential media may be substituted for specific determinations. Only 4.5 mls. of medium per tube are required to produce a shallow slant approximately 5 inches long; therefore the test is economical on the medium. Free moisture on the medium should be eliminated by drying about five days at 25° C., or more quickly by inverting the tubes so that the cotton plugs absorb the small amount of moisture. The small swab favors the re-swab type of inoculation of slants in shallow oval tubes. The most effective inoculation is obtained by rotating the contaminated swab while it is being smeared from top to bottom and again back to the top; i.e. a double application and a uniform procedure for all samples.

To be most instructive the prepared slant cultures should be left in the plant in the care of some reliable person. They may be most readily observed lying flat on a black table top but are safest in a suitable drawer, such as the large centre one in most office desks. At average room temperature culture development usually is complete within two days. Results may be expressed with reasonable accuracy up to a maximum of 300 colonies per tube. Above this, they are estimates and express only roughly, relative conditions of sanitation. As from all swab samplings, the results are intended as indicators more than as accurate determinations. They provide comparisons only, but with experience arbitrary, though adequate, classes such as good, fair, and poor may be established for each specific type of utensil. Usually a few "good" results provide the basis for comparison and it is notable how quickly the eyes of practical operators focus on these. Such persons usually remark, "All should be like those." Some follow this by, "Next time, all will be."

When tests are complete, the glassware returned to the laboratory may be made ready for repeated use.

Thus the "swab-slant" test provides still another simplification by making unnecessary the usual none-too-effective nor interpretive written reports. The test is a self reporting type or a "seeing is believing" one for the practical operator, primarily because the complete test is performed with simplicity in his presence. Consequently, poor results stimulate determination and action for subsequent improvement.

The oval test tube containers for the culture medium present several advantages over the ordinary petri dishes as proposed by Gunderson and Anderson (5) for the swab test. They are less cumbersome for transportation, easier to handle, and less vulnerable to contamination. Still other containers yet may be found equally or more effective. Recently Hasson (6) reported that his square 2 oz. bottle slants, originally proposed for testing liquids, have proven very useful and adaptable for inoculations directly from swab samplings of equipment surfaces. However, these bottles have the disadvantage of being heavier and more bulky than the oval test tubes. Nevertheless, their tightly sealing screw caps are an advantage over the cotton plugged tubes by preventing drying of the culture medium and therefore favoring extended storage periods in readiness for use. The writers lately have obtained good results by substituting flat 1 oz. screw capped bottles, of the trade name "Prince of Wales", for the oval test tube. Although these bottles may not provide the ideal, the capped type of medium container offers promise in making the swab-slant test widely acceptable for testing sanitation of equipment, and, in fact, for determining the approximate microbial content of liquids.

Naturally, stocks of swabs, sterile water and slants must be prepared in an adequately equipped laboratory. These materials, if made available to careful practical operators, with instructions or demonstrations for making tests, should provide a simple means by which persons responsible for sanitizing utensils and equipment may learn for themselves how effectively they are performing their job. It is quite probable that the requirements for this test might be extended even to dairy farms. Here it would be highly beneficial. A progressive company that would institute the use of this test among its milk or cream producers unquestionably would benefit through the improved quality of products received. The "microbe consciousness" so instilled might initiate a revival for improved sanitation throughout the whole dairy industry.

CORRELATION WITH A STANDARD SANITATION TEST

Any new test proposed to supplement standard procedures requires proof of its reliability. This was undertaken by a statistical correlation study of the data from swab-slant tests and free-rinse tests of the sterility of milk containers. One hundred and ninety-two milk and cream cans, sanitized and ready for return to patrons, were tested first by the swab-slant method and then by the free-rinse quantitative plate technique. This procedure provided comparative data from the same cans.

The method of swabbing the cans was that previously described by Jamieson and Chen (8)—the "line system" instead of a definite area. A rotating swab was drawn across the bottom of the can, around the wall at three predetermined levels, up the shoulder and out of the neck; then across the diameter of the lid and finally around its circumference. The contaminated swab was smeared over the test tube slant of medium. Following this procedure 100 mls. of sterile water were added to the can for the free-rinse test. Each can was shaken endwise 10 times on each quarter turn of the can. A sterile pipette was used to withdraw approximately 30 mls. of this rinse water for quantitative plating which was carried out within 2 hours of sampling. Both the slants and the plates were incubated at 25°C., for 48 hours. Counting was done on a Quebec colony illuminator.

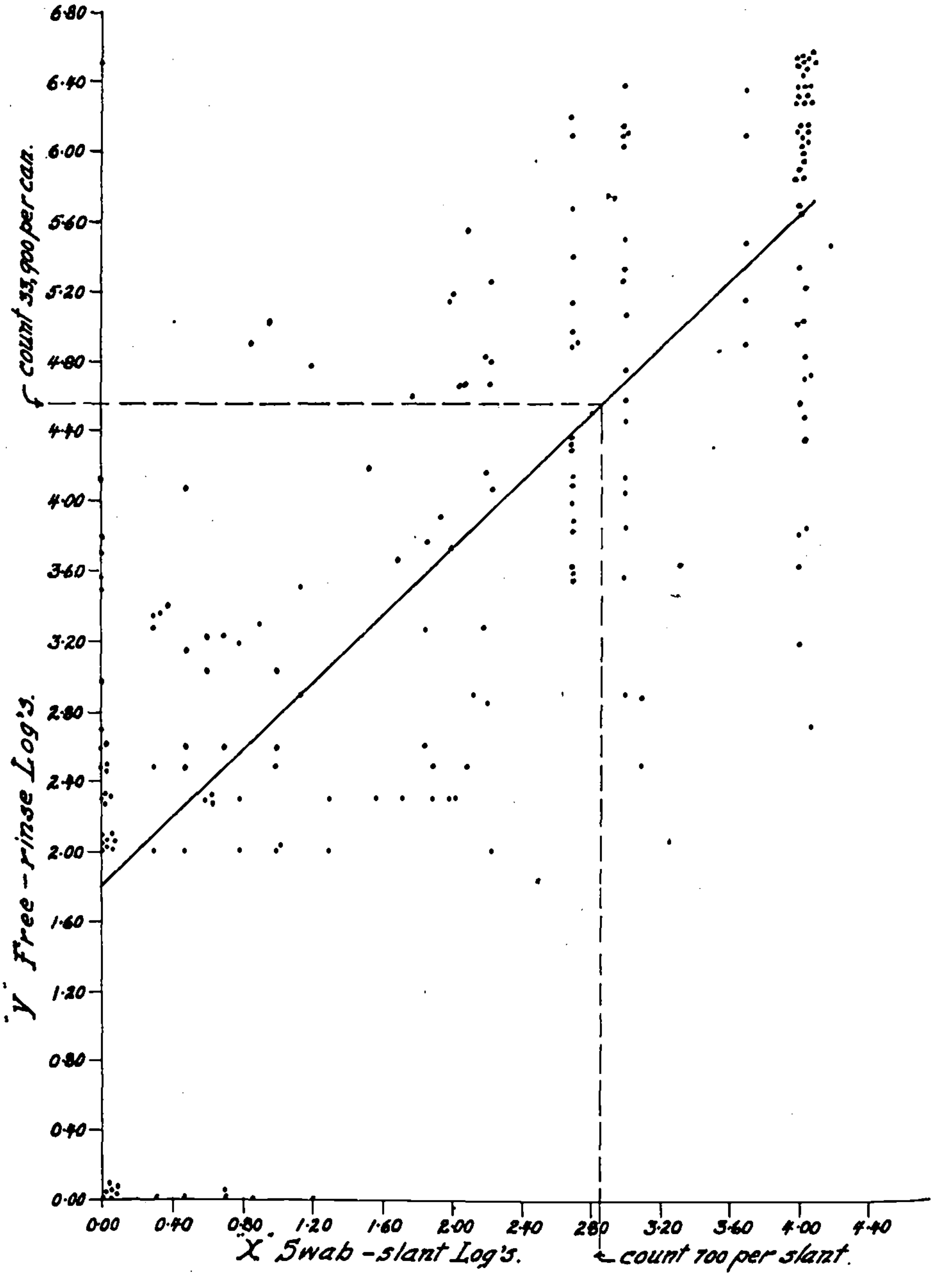
In order to evaluate tube slant results, actual counts up to 300 were used, and above this estimates were expressed on the arbitrary basis as follows: about 500, about 1,000, about 10,000, in each case the number being used as if it had been an actual count. In the free-rinse method estimates up to 3,000,000 per can were based on actual counts. Tests that gave uncountable colonies in the highest dilution plated were considered arbitrarily to have a count of 3,150,000.

For the statistical calculations, counts were converted to logarithms. The distribution of these is shown in the regression graph. Using the procedure described by Goulden (3) the correlation coefficient was determined for the logarithms of counts by the swab-slant and the free-rinsing-plating techniques. This value $r = 0.7712$. This is highly significant giving a value of $t = 16.71$ for which the 1 percent point is 2.60. A t value of 2.60 means that such a correlation could occur by chance variation in 1 case out of 100. Since the t value obtained in these results is 16.71 it is evident that there is a significant correlation between the two methods.

In order to obtain the free-rinse count as predicted by the swab-slant method the regression equation ($y = 1.8526 + 0.9441x$) was calculated and the regression line was plotted as shown in the graph. From this regression equation the logarithm of a swab-slant determination may be related to the logarithm of the corresponding free-rinse count. In interpreting the correlation coefficient of 0.7712, it is well to realize that variability in the logarithms of the free-rinse counts independent of the logarithms of the swab-slant count is approximately only 59 percent ($0.7712^2 \times 100$). For this reason a swab-slant count cannot be used as an accurate prediction of the corresponding free-rinse count. The data serves merely to show that there is a general relation between counts by the two methods.

Actually, on the swab-slants the cultural growth ceases to be discrete colonies at approximately 700 per tube. This would seem to be the maximum allowable for an arbitrary class of "fair" with respect to sanitation of milk or cream cans. The logarithm

Regression Graph



of 700 is 2.85 which on the regression graph corresponds to a logarithm of 4.53 or a count of 33,900 by the free-rinse technique. This is a reasonably close relation to the count of 32,000 stipulated by the American Public Health Association (1) as a satisfactory bacterial limit for 8-gallon cans. Therefore this simple and practical test of equipment sanitation appears sufficiently reliable to justify its use in the dairy industry.

SUMMARY

A new procedure for demonstrating the sanitation of equipment is outlined. It is a "swab-slant test" in which swabbings from surfaces are smeared directly on a culture medium slanted in oval test tubes or flat capped bottles. The complete test including the growth of the "tell-tale" cultures may be performed in the presence of those charged with sanitizing duties. "Seeing-is-believing results" inspire operators to improve sanitation. This simple, practical test presents unusual possibilities for extensive application in dairying as well as in other food handling and beverage dispensing industries.

The reliability of the test is substantiated by a statistical correlation study of data from swab-slant tests and free-rinse-plating tests on the sterility of milk and cream cans. A significant correlation between the two methods was found to exist.

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The Babcock Fat Test on Homogenized Milk

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ACCORDING to the literature on the subject, investigators are not unanimous in their opinions concerning the accuracy of the ordinary Babcock test for the fat determination on homogenized milk. C. J. Babcock (1) states that fat tests range from 0.05 to 0.15 percent lower, with an average of 0.1 percent lower on milk after homogenization. Halloran, Trout, and Gould (7) state that homogenization appears to have no effect on the Babcock test. Tracy (5) writes that "in general, no difficulty was encountered in securing tests that were comparable to the results obtained on unhomogenized samples."

According to Doan (2), "It has been reported that the Babcock test of homogenized milk gives lower readings, but several studies have shown that the difference is negligible and well within the normal limits of error. Better results are obtained by using slightly weaker acid (sp. gr. 1.81–1.815) or by using 1 ml. less than the usual 17.5 ml. and adding the acid slowly with agitation between portions." Trout (6) states, "The fat content of homogenized milk may be easily and reliably determined by the modified Babcock Method." The method referred to makes use of acid standardized to 1.82 sp. gr.

In the December 1944 issue of *Food*, a house organ issued by Mojonnier Bros. Co. of Chicago, there appears an article which describes tests in which the results of the Babcock test on homogenized milk are uniformly higher than those obtained with the ether extraction method. The Babcock test on homogenized milk varied from + 0.04 to + 0.17 higher than the results obtained with Mojonnier equipment. Lampert (3) reporting on the accuracy of the Babcock test on milk, showed that the Babcock test will average about 0.04 higher than the results obtained by the ether extraction method. It would appear that the same relationship holds for homogenized milk. The few tests reported here also show that the Babcock fat tests average about 0.04 percent higher than those obtained by the ether extraction method (Mojonnier).

Reports were made to the California State Dairy Service Laboratory that various laboratories were obtaining lower tests on homogenized milk than on the unhomogenized product. Since this was not in accordance with most of the results reported in the literature, a limited investigation was made in order to obtain first hand information. Through the cooperation of O. A. Ghiggoile, Chief of the Dairy Service Bureau and E. R. Eichner and H. C. McCausland, Market Milk Specialists, a number of samples of milk were obtained representing lots of milk before and after homogenization. As shown in the tabulations, some lots were not preserved; others were preserved either with mercuric chloride tablets or with formalin. The preserved samples contained either two drops of formalin per ounce of sample or a No. 2 Ideal preservative tablet was added to 8 ounces of sample. In every instance, the samples were shipped to the laboratory under refrigeration and in completely filled bottles.

Duplicate portions of each sample

were tested by the ordinary Babcock procedure; by two slight modifications of this method; by the Pennsylvania Test (4), by the Minnesota Test (8), and by the ether extraction method, using Mojonnier equipment. The modifications of the Babcock method referred to consisted in the first case (Modified Babcock Test No. 1) of adding less acid (16.5–17 ml.) to the sample and adding it in three portions, mixing well after each addition. After the first centrifuging, the test bottle was shaken and then shaken again after the first and second additions of hot water. Practically all of the tests made by this method on homogenized milk had pale fat columns which contained sediment plugs. During the tempering time, the fat column dropped through the sediment plug, so that in some cases the sediment reached the top of the fat column, making it difficult to read. Inasmuch as no advantage was obtained by this procedure, further tests were run by a second modification (Modified Babcock Test No. 2). This consisted of adding the normal amount of acid at one time, shaking the test bottle after the first centrifuging, and then shaking again after the addition of hot water.

The Pennsylvania test uses a weaker acid than the usual Babcock test acid, and also requires the addition of ammonia and butyl alcohol to the test bottle. It was found that this test cannot be used on milk preserved with formaldehyde since the hardened curd is not dissolved. As shown in the table, the results were not satisfactory and the test is not recommended for use on homogenized milk, even if not preserved.

The manufacturers of the reagents for the Minnesota Test recommend its use for testing homogenized milk. Samples preserved with mercuric chloride reacted with the reagent so that a black precipitate, probably finely divided mercury, was formed. This material entered the fat column, but in a number of cases the fat column dropped through this material, leaving it adhering to the neck of the test bottle. Although the fat tests appeared excellent, the results were lower than those obtained with the other procedures and the use of the Minnesota test was not continued.

It was thought that homogenized milk might not drain from the pipette as well as normal milk, so some tests were run in which the samples were weighed into the test bottle. Weighings were made to the nearest milligram on an analytical balance. It was found that the same amount of normal or homogenized milk was delivered by the pipette, the greatest difference was 0.02 gram. In each case, enough milk was added to bring the sample up to 18 grams, since the pipette delivered a trifle less than this amount. The small amount of milk added was insufficient to make any difference in the test.

Samples of unpreserved milk and acid were shaken for about two minutes on a mechanical shaker, while samples preserved with formaldehyde were shaken for five minutes. The shaking is advisable in order to obtain uniformly good tests.

It has been noted in this laboratory that the presence of mercuric chloride preservative favors the separation of a small amount of fat from the milk. The separated fat has the appearance of small particles of curd floating on the surface, or in some cases only an oily layer is apparent. Warming the sample increases the amount of fat separation. If the sample is held for a check test, the repeated cooling and warming markedly increases the fat separation and a progressive lowering in the fat test usually occurs. A few of the samples which were preserved with mercuric chloride showed some fat separation and were discarded.

Formaldehyde is regarded here as the most desirable preservative for composite test samples of normal milk. Since it hardens the curd, care must

TABLE I

FAT TEST ON UNPRESERVED SAMPLES

	Ether Extraction		*Regular Babcock*		*Modified Babcock Test No. 1*		*Pennsylvania Test*	
Sample	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*
5714–5718	3.46–3.48	3.44–3.44	3.50–3.50	3.45–3.50	3.55–3.50	3.45–3.50	3.65–3.65	3.55–3.60
5715–5719	3.43–3.46	3.44–3.46	3.50–3.50	3.50–3.50	3.55–3.50	3.50–3.50	3.60–3.70	3.55–3.50
5716–5720	3.42–3.39	3.44–3.46	3.50–3.55	3.45–3.50	3.40–3.50	3.50–3.45	3.65–3.70	3.55–3.55
5717–5721	3.48–3.48	3.48–3.49	3.45–3.50	3.50–3.50	3.50–3.45	3.50–3.45	3.70–3.70	3.60–3.65
Average	3.45	3.46	3.50	3.49	3.49	3.48	3.67	3.57

A = Milk before homogenization
B = Milk after homogenization (pressure not reported)

be taken to mix the sample well with the acid and to shake the mixture for about five minutes in order that all of the curd is dissolved in the acid. As shown in the tables, samples of homogenized milk preserved with formaldehyde give lower tests than those unpreserved or preserved with mercuric chloride.

All fat tests reported are the results of duplicate tests which were run in accurately calibrated test bottles. Only fat columns which were clean and free of sediment were reported. The results of the work are summarized in the tables. Table I shows that with unpreserved samples, the ordinary Babcock test will give results comparable to those obtained by the ether extraction method. Table II shows that homogenized milk preserved with formalin will give low fat recovery by the Babcock test, although the test on the unhomogenized control will check with the ether extraction method. Table III shows that when mercuric chloride is used as a preservative, the Babcock test will give a reliable fat test, provided the sample is in good condition.

CONCLUSIONS

1. Comparative fat tests by different procedures have been made on milk,

TABLE II

FAT TESTS ON SAMPLES PRESERVED WITH FORMALIN

	Ether Extraction		*Regular Babcock*		*Modified Babcock Test No. 1*		*Modified Babcock Test No. 2*	
Sample	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*
5777	3.54	3.57	3.60	3.40	3.55	3.40	3.60	3.40
5778	3.52	3.58	3.55	3.40	3.60	3.40	3.60	3.40
5779	3.64	3.62	3.65	3.40	3.60	3.50	3.65	3.40
5780	3.64	3.62	3.70	3.50	3.70	3.45	3.70	3.40
5781	3.60	3.59	3.65	3.45	3.70	3.45	3.70	3.40
5782	3.60	3.60	3.70	3.50	3.70	3.50	3.70	3.40
5783	3.53	3.58	3.55	3.50	3.60	3.40	3.65	3.40
5784	3.57	3.56	3.55	3.50	3.60	3.50	3.65	3.40
Average	3.58	3.59	3.62	3.46	3.63	3.45	3.66	3.40

A = Before homogenization
B = After homogenization (pressure not reported)

TABLE III

TESTS ON MILK PRESERVED WITH MERCURIC CHLORIDE

Sample	*Ether Extraction*		*Regular Babcock*		*Modified Babcock No. 2*		*Pennsylvania Test*		*Minnesota Test*	
	A	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*
182	3.47, 3.48	(*)	3.50, 3.45	3.40	3.50	3.42	3.60	3.60	3.35	3.20
183(1)				3.42	3.45	3.42				
184	3.37, 3.44	3.49	3.50, 3.45	3.45	3.55	3.50	3.60	3.62	3.20	3.25
185(2)		3.51		3.50	3.50	3.50				
186	3.50, 3.51	3.52	3.50, 3.50	3.50	3.50	3.50	3.60	3.65	3.40	3.30
183(3)		3.53		3.50	3.55	3.55				
	(**)		(**)		(**)					
465	3.61, 3.61	3.60	3.70, 3.70	3.60	3.71, 3.72	..	..	..	..	..
466	3.65, 3.69	3.59	3.66, 3.70	3.60	3.70, 3.70					
467		(1)		(1)						
	(**)		(**)							
468	3.56, 3.54	3.53	3.51, 3.51	3.50	3.57, 3.60	3.55				
469	3.51, 3.51	3.51	3.52, 3.51	3.50	(**)					
470		(3)		(3)	3.50, 3.60	3.55(3)	..	..	..	..
	(**)		(**)		(**)					
471	3.56, 3.58	..	3.50, 3.50	..	3.50, 3.55	..	..	..	..	..
472	3.58, 3.60		3.57, 3.56		3.60, 3.63					
473										
	(**)		(**)							
474	3.45, 3.46	3.46	3.53, 3.51	3.45	3.50, 3.53	3.50				
475	3.48, 3.46	3.45	3.45, 3.50	3.45	(**)	3.52(2)	..	..	..	..
476		(2)		(2)	3.50, 3.48					
8349	3.53, 3.53	3.52	3.45	3.50	3.42, 3.50	..	..	..	..	..
8350		3.48	3.42	3.50	3.45, 3.45					
		(1)		(1)	(1)					
8351	3.53, 3.51	3.52	3.50	3.45	3.50, 3.52					
8352		3.47	3.44	3.40	3.45, 3.45(2)	..	..	..	..	..
		(2)		(2)						
8353	3.52, 3.56	3.53	3.50	3.45	3.50	3.45				
8354(1)		3.57	3.55	3.50	3.46	3.45	..	..	..	..
8355		3.54	3.56	3.52	3.55	3.50				
8356(1)	3.56, 3.57	3.56	3.50	3.55	3.53	3.50	..	..	..	..
8357	3.60, 3.57	3.55	3.55	3.50	3.45	3.50	..	..	..	..
8358(2)		3.53	3.55	3.52	3.50					
8359	3.56, 3.56	3.50	3.52	3.50	3.48	3.50				
8360(1)		3.51	3.60	3.45	3.55	3.50	..	..	..	..
8362	3.42, 3.48	3.45	3.40	3.50	3.35	3.50				
8363(1)		3.48	3.42	3.52	3.40	3.50	..	..	..	..

A = Before homogenization
B = After homogenization
(**) = No preservative in sample
(*) = Fat separation
(1) = 2500 lb. pressure
(2) = 1500 lb. pressure
(3) = 3500 lb. pressure

before and after homogenization at different pressures.

2. The regular Babcock procedure was found to give accurate results on homogenized milk.

3. Homogenized milk preserved with formaldehyde gives a lower Babcock test than the unpreserved sample.

4. Mercuric chloride may be used as a preservative but care must be taken not to test samples which show "oiling off" or fat separation.

5. Neither the Pennsylvania test nor the Minnesota test are recommended for testing homogenized milk.

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A Time and Equipment Comparison Between the Methylene-Blue and Direct Microscopic Tests

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Although milk sanitarians, bacteriologists, and other dairy specialists have discussed the advantages and disadvantages of the several methods for testing pre-pasteurized milk, many market milk areas which plan to substitute another procedure for the methylene-blue test are unable to decide which method would be most practicable for their particular area. When a health department or dairy plant decides to inaugurate a better testing program, two important questions arise: (1) How much additional equipment will be needed; and (2) How many additional hours of laboratory and clerical services are necessary?

This discussion relates the experience of a milk-shed of approximately 150,000 population in changing from the methylene-blue reductase test to the direct microscopic or Breed test. Assuming that the agency planning a similar change already has the basic equipment and personnel to collect the samples, make the methylene-blue tests, wash and sterilize the containers, and report the results, the time and equipment comparison between the tests is as follows:

Equipment

The methylene-blue test equipment which will not be needed for the direct microscopic test is a constant-temperature water bath, and the pipettes or burette used for delivering measured amounts of dye. Additional equipment and its approximate cost may be listed as:

Article	*Number*	*Approx. Cost*
Microscope	1	$75–250
Pipettes or	per 100	$65
Wire Loop	1	$5
Guide plate, Microslides, and Staining Dishes		$5

Laboratory Services

As the laboratory technician does not devote all of his or her time to the methylene-blue test after the start of the incubation period, the man-hours of work for both tests are computed only on the actual time allotted to the test. In order to make the evaluation as applicable as possible, the time per 100 samples examined will be used as the basis for comparison.

	Methylene-blue	*Direct microscopic clump count*
Hours per 100 high-quality milk samples	1¼	6
Hours per 100 low-quality milk samples	1	11 (including the classification of organisms)

Even though Standard Methods require many more field examinations for low-count milk than for high-count milk, the tedious counting of the organisms in the latter fields almost doubles the amount of time needed for quality milk.

Clerical Help

As in the laboratory, the amount of additional work required by the clerical staff will be determined largely by the quality of the milk sampled. Assuming that each test, whether methylene-blue or direct microscopic, is reported to the dairy producer and a copy of the compiled report sent to the milk plant, it is apparent that for grading purposes the averages of low-count milk samples examined by the direct microscopic method are computed more quickly than high-count samples. The use of a logarithmic, instead of an arithmetic, average is the procedure which increases the time factor; for as the quality of the milk decreases, the clerk must refer more frequently to a logarithm table.

In this particular milk-shed, all bacteria counts under 200,000 are reported by postal card, but when the counts exceed the maximum, a report form letter is mailed—including the probable reason for the excessive count and methods for its correction. Therefore, in the following table there is a difference of about 2 hours per 100 direct microscopic examinations between low-count samples reported by postal card and high-count samples reported by letter. If all reports are to be sent by letter, the time will approach the maximum regardless of quality.

	Methylene-blue	*Direct Microscopic*
Hours computing averages and reporting results by postal card per 100 high-quality samples	1½	2½
Hours computing averages and reporting results by letter per 100 low-quality samples	3¼	4½

SUMMARY

With the essential equipment and personnel for testing pre-pasteurized milk by the methylene-blue test, the minimum additional equipment cost required for direct microscopic examination would be approximately $85. Depending upon the quality of the milk the laboratory time would increase from 4½ to 10 hours, and the clerical services from 1 to 3 hours, per 100 samples examined.

Can a Differential Germ Test with a Leucocyte Count Be Used in the Control of Mastitis?

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AND

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Recent reports indicate that bovine mastitis in this country is on the increase, a situation which seems to merit consideration.

It is also known that the severity of mastitis present in a given dairy herd depends largely on the kind, number, and virulence of the prevailing bacteria, as well as the resistance of the udder tissue of the host.

Likewise, the term mastitis is generally used to include the (a) early latent (hidden) and carrier forms of this disease, as well as advanced and easily recognized (b) acute inflammatory, and (c) chronic types.

With this information at hand, it seems reasonable to assume that the early recognition and accurate diagnosis of bovine mastitis needs to be approached not only by the use of conventional clinical observations and chemical tests, but from a bacteriological standpoint as well. The term mastitis should be used to cover latent forms of the disease as well as active inflammations.

The effect of human carriers in the transmission of human disease is well recognized. Similar principles apply in the case of animal to animal, or animal to human relationships.

This approach, however, is rather difficult without the aid of a clinical and differential laboratory germ test. Until comparatively recent years the identification and classification of udder streptococci has been unsatisfactory. It is now possible, however, to differentiate between the various species isolated from cases of mastitis. The practical nature of these tests has progressed farther than is generally realized.

In view of the fact that saprophytic streptococci may be isolated in an appreciable number of cases, particularly in improperly collected samples, their recognition is necessary in making a correct diagnosis for segregation purposes.

It is this laboratory "differential germ test" consisting of (1) direct microscopic examination for streptococci, (2) leucocyte count, and (3) differential plating, which is made on properly collected, incubated milk samples that forms the main theme of this discussion.

Specific Milk Regulations

It is interesting that nearly all of the official milk ordinances and codes specifically provide that no milk shall be used from dairy animals that are known to be affected with an infectious disease.

This perhaps is convincing evidence that the question of infectious bovine mastitis needs to be reviewed as to a possible solution for its control.

Incidentally any action taken in this regard must have the support and sanction of local health departments, milk processors, veterinarians, and owners of dairy animals.

THE CONTROL OF MASTITIS

As to a concerted program for the control of mastitis, it appears that the following suggestions can perhaps be profitably re-emphasized at this time:

1. AS LONG AS WE HAVE COWS WE WILL HAVE MORE OR LESS MASTITIS (udder inflammation).

2. By accepting this important basic premise, much of the confusion regarding this disease may possibly be avoided.

3. Up to now, a goodly share of the mastitis control work unfortunately has been carried on by fieldmen without the aid and guidance of a veterinarian, and without access to a laboratory "differential germ test", which will be referred to later.

4. Experience shows that we are coming to recognize more and more that bovine mastitis may have a definite effect on the flavor, nutritive value, and keeping quality of raw and pasteurized milk and milk products.

5. This disease, also under certain circumstances, may be a potential source for the dissemination of certain gastroenteric disturbances to man, especially where milk is consumed raw.

6. Bovine mastitis is reported to be on the increase in this country. This is of economic importance to milk producers.

7. With milk production a big business in this country, dairy herds need to be protected against mastitis through early laboratory detection for the veterinarian in (1) preventing, (2) controlling, and (3) treating this disease in its incipiency. It is in this stage that the greatest good can be accomplished by the use of udder infusions.

EFFECT OF MASTITIS ON MILK QUALITY

The milk from cows with advanced chronic or acute mastitis is often characterized by the following highly objectionable features:

1. A salty off taste.
2. An offensive odor.
3. An altered appearance and color.
4. Many flakes, pus cells and mucous.
5. Blood cells and especially blood serum.
6. A decrease in butter fat and volume.
7. Very large numbers of streptococci, staphylococci and other bacteria.

The fact that such milk is mixed with other milk makes it no less objectionable. The end results of such inferior milk may be listed as follows:

1. Results in a distaste for milk and discourages its use.
2. Gives to babies and youngsters an inferior quality of their best body building food.
3. May spoil large batches of milk causing a loss to plant owners.
4. Causes an inferior quality of pasteurized milk and milk products—powdered and evaporated milk, butter, cheese, cottage cheese, etc.
5. May cause staphylococcus food poisoning, septic sore throat and scarlet fever (if human strains are present).
6. Causes milk to be rejected at the platform.
7. Causes a large economic loss to the herd owner as a result of lower production and loss of animals.

CLASSIFICATION OF BOVINE MASTITIS

Before describing these tests it is essential to consider the following suggested classification of mastitis:

1. BOVINE MASTITIS IS A GENERAL TERM used in designating any inflammatory condition of the udder.

2. Four main classes of mastitis are involved: (a) Contagious *Streptococcus agalactiae* mastitis, (b) Non-contagious mastitis caused by other streptococci, (c) Non-contagious staphylococcal mastitis, and (d) Non-contagious coliform mastitis. In rare instances (b), (c), and (d) may appear to be contagious.

A. STREPTOCOCCUS AGALACTIAE MASTITIS: (a) about 75 percent of the prevailing mastitis is caused by this germ; (b) it is contagious and spreads from infected to healthy cows; (c) recovery is rare when infection becomes established in the udder.

B. MASTITIS CAUSED BY OTHER STREPTOCOCCI: (a) they cause a milder type of mastitis, presumably due to injury of one kind or another, (b) about 25 percent of these infections with proper supervision clear up within a year.

C. STAPHYLOCOCCUS MASTITIS: (a) it may be acute or chronic, (b) acute cases are quite rare, (c) 25 percent of the chronically infected animals may clear up within a year, (d) gastro-enterotoxic strains of staphylococci may cause food poisoning through both raw or pasteurized milk. The toxin is not destroyed by heating.

D. COLIFORM MASTITIS: (a) it is not very common, (b) in the acute form it is often fatal.

Milk from old advanced cases of mastitis is usually abnormal and unfit for use. A large percentage of the milk from mild or beginning cases is entirely normal in appearance and safe to use, if pasteurized.

In summary, it may be said (a) that MASTITIS WILL ALWAYS BE WITH US, (b) because of the greater prevalence of *Str. agalactiae* mastitis, and because this disease can be controlled and eventually eliminated by the use of suitable diagnostic tests and herd management, *Str. agalactiae* infected cows are the ones to be considered first, and (c) with proper producer cooperation, the loss of cows from mastitis can be curbed, and the production and quality of milk increased.

THE LEUCOCYTE COUNT

When properly interpreted in terms of stage of lactation and with a carefully compiled clinical history of each cow under study, it seems that a microscopic leucocyte count of milk has practical application.

For example, in normal healthy cows the number of leucocytes present in the milk may vary from 1,000 to 500,000 per ml. depending upon the age, and other individual animal characteristics.

On the other hand, when the udder becomes infected and the history of lactation is known, repeated tests have shown that a leucocyte count of the milk varies with the severity and stage of infection. The count also may fluctuate depending on the particular type of organism present.

Thus it can be seen that the leucocytes in milk can perhaps be likened to the leucocytes in the blood of man, which vary in number according to a fairly definite pattern depending upon whether the body is mildly or severely attacked by bacteria. Physicians use this correlation in making a diagnosis in certain conditions.

THE DIFFERENTIAL GERM TEST

1. It is all-important to determine the presence of mastitis organisms in the milk as early as possible. This perhaps may be termed a "new approach" to this disease.

2. A satisfactory approach to this angle of the problem is to apply a laboratory "differential germ test" to the milk to determine what type of organisms are present. This test has been used experimentally on a number of dairy herds in the Rockford milk shed now for over a year with encouraging results.

3. These tests include in sequence:

   A. Incubation of properly collected composite samples (with brom cresol purple) from individual cows.

   B. Note reaction to Hotis test.

   C. Microscopic examination of stained slide preparations [1] for streptococcus chains and leucocyte count. The leucocyte count is recorded as falling into one of four classes: (1) 500,000 per ml. of less; (2) $> 500{,}000$ to $< 1{,}000{,}000$; (3) 1,000,000 to 7,500,000; (4) over 7,500,000.

   D. Transplanting a small loopful of milk from samples containing (1) streptococci, and (2) leucocytes over one million per ml., to modified Edward's medium.[2]

E. Examination of these plates after incubation, for beta and gamma colonies and the subsequent classification of animals.

F. As an accessory test the differentiation of certain saprophytic streptococci from *Str. agalactiae,* by the inability of the former to produce ammonia in arginine broth, is very useful. Polyvalent and type specific antisera for slide agglutination tests can also be used for identifying mastitis streptococci.[2] The above tests usually require 48 hours. Although further tests to identify completely the isolated organisms are very desirable and useful when it is possible to make them, they are not believed to be absolutely essential for the successful control of *Streptococcus agalactiae* infection by segregation.

4. Each cow tested is classified according to one of the following grouping:

Group 1. *Negative.* Animals in this group give milk which contains 1,000,000 or less leucoytes per ml. and is free from *Str. agalactiae.* Occasionally saprophytic streptococci are present.

Group 2. *Positive.* Animals in this group have leucocyte counts over 1,000,000 and are free from *Str. agalactiae;* their milk usually contains either streptococci other than *Str. agalactiae,* or staphylococci.

Group 3a. *Positive.* Animals in this group have leucocyte counts of 500,000 or less and *Str. agalactiae* present.

Group 3b. *Positive.* Animals in this group have leucocyte counts over 500,000 and *Str. agalactiae* present.

5. Following testing, the milk producer is instructed (a) to segregate all Group 3 animals, or place them at the end of the milking line, (b) to call a veterinarian for a clinical examination and treatment when necessary, and (c) to carry out certain sanitary procedures described later.

6. If a milk producer does not choose to cooperate, the supply of milk, if considered necessary, can be excluded from the market. The difficulties involved in obtaining a sufficient degree of essential voluntary cooperation from herd owners not primarily engaged in the production of milk are considerable, but can usually be overcome.

7. A certain percentage of animals (5–15 percent approx.) will, in some herds, be affected with non-contagious mastitis which is presumed to result from largely uncontrollable (by segregation) and constantly recurring factors such as injuries of one type or another, trauma, etc. Control of this phase of mastitis would seem to depend largely upon the degree of care and attention given the animals by the owner, as well as the proper operation of milking machines, fast milking, etc.

8. The beneficial effect of fast milking and its relationship to the control of mastitis needs to be carefully evaluated. It may possibly have a larger bearing upon the problem than present information indicates.

PRELIMINARY SURVEY

A preliminary survey to determine the extent of infection in the local area has been made and the following results obtained:

Total herds	49
Total cows	956
Group 1	538—56.3%
Group 2	89— 9.3%
Group 3a	69— 7.2%
Group 3b	260—27.2%
Str. agalactiae infected herds	37—76.0%
Str. agalactiae free herds	12—24.0%

NECESSARY FARM PROCEDURES

It is necessary that certain farm practices be adopted if contagious mastitis is to be controlled and the udders kept in a healthy condition.

1. Before starting to milk, wash the hands thoroughly.
2. No "wet" milking since this spreads the infection.
3. Milking on the floor also spreads infection.
4. Dip teat cups in clean water, then in 200 ppm. of warm chlorine solution before milking each cow.
5. One minute before applying teat cups wash udder with warm (130° F. water containing 200 ppm. chlorine solution, and use strip cup on each quarter. This induces rapid let down of milk, reduces the number of bacteria, and reveals abnormal milk.
6. Directly after milking dip ends of teats in chlorine solution.

HERD MANAGEMENT

1. Adequate stall space with clean dry bedding should be provided.
2. Herd replacements should be raised on the farm if possible. Most of the herds found free of *S. agalactiae* infection in initial tests are self-contained herds. Self-contained herds free from infection can be maintained free.
3. Calves and bred heifers are safest to buy since they are usually but not always free of infection.
4. Calves should not be given mastitis milk and should be prevented from sucking each other.
5. Mature milking cows and "dry" cows are frequently infected and should be tested before adding to the herd.

PRACTICAL APPLICATION OF TESTS

It may appear that the use of a Differential Germ Test with leucocyte count requires too much time, personnel, and unobtainable laboratory facilities, which is true in some cases, but these factors should be weighed in terms of the huge annual loss resulting from this disease.

A WORD OR CAUTION

Any program for the control of bovine mastitis, however, should (a) begin gradually, (b) be regarded as long range in character, and (c) be carried on only with the full cooperation of the milk producers and cattle raisers. An effective control program will require considerable patience and time in the education of the herd owner.

It should be remembered that the purpose and emphasis of the program is directed toward the control of contagious (*S. agalactiae*) mastitis, since it has been shown to be the most prevalent and causes the greatest economic loss.

STARTING THE PROGRAM

1. As a beginning, sufficient funds are needed for a technically trained field man with travel expenses to initiate the program. The estimated cost would be $3,000 to $4,000 annually for a milk shed with 300 to 400 producers. Bacteriological laboratory facilities are also necessary.
2. The field man, a veterinarian if obtainable, can combine educational field work with demonstrations of necessary control methods and also collect milk samples.
3. If treatment is desired the results of laboratory examinations will be referred to the producer's own veterinarian, who will make subsequent clinical examinations before treatment. They may also be given to the county veterinarian if this is desired.
4. After proper training herd owners can bring in recheck samples at 3 or 4 month intervals, thereby greatly facilitating this phase of the work.
5. Herds free from *S. agalactiae* infection will need as a routine procedure only semi-annual or possibly annual tests.
6. Cooperation of the herd owner is essential.

CONCLUSIONS

1. An attempt has been made to present some of our present knowledge regarding the early recognition and control of infectious bovine mastitis, which is reported to be on the increase in this country.

2. It appears that the number of leucocytes in milk follows a definite pattern of variation, which is directly related to stage of lactation, disease, and age of the dairy animals under study. This information may be used in the early recognition of and recovery from udder disease, providing the leucocyte count is properly interpreted in terms of the interfering factors involved.

3. Certain laboratory procedures called a "differential germ test" when applied to properly collected milk samples may be considered essential in the control of infectious mastitis.

4. It is recognized that good herd management and sanitation practices must be carried out in conjunction with the laboratory examinations.

5. Laboratory procedures have been discussed, which perhaps can supplant our present unsatisfactory approach to infectious bovine mastitis by means of chemical tests in the hands of those not familiar with the very complex clinical picture involved in this all-important disease in dairy herds.

6. It is rather evident that unanimity of opinion has not been achieved regarding the role played by *Streptococcus agalactiae* in all phases of mastitis control. For this reason, it should be emphasized that the local objective has been to determine the practical field results which may reasonably be expected to follow, when a certain definite specified procedure is consistently carried out over an adequate period of time. How can the effectiveness and value of a mastitis program be measured in a better way than through actual field results obtained?

7. The results obtained up to the present time justify further efforts in this direction.

ACKNOWLEDGMENT

This paper would not be complete without sincere acknowledgment of the original investigative research of such men as Plastridge and associates, Little, Breed, Hucker, Bryan, Turner, Peterson, and others, which has stimulated public interest to do something about mastitis in the Rockford milk shed.

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Prospective Developments in Dairy and Milk Plant Equipment*

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It is exceedingly difficult for one connected with engineering and production in any line of manufacture to give a talk on the subject of future or prospective developments in dairy equipment after the advertising men and stylists have been using so much printer's ink to tell the world that everything is going to be new, startling, and different after the war. One would think that aviation, plastics, and electronics were going to sweep the country and completely change our habits and materials to which we are accustomed. While outstanding advances have been made under the pressure of speeded-up mass production of war materials in these three fields, I can heartily agree with a recent national speaker that the immediate post-war applications of some of these advances will not break upon us like a dazzling new world immediately after the war, but will be in a surer, economically sound, logical step-by-step pace, since industry and the public will be paying the bill directly for any mistakes, and not the government. I affirm my absolute confidence in the constructive expansion of the dairy industry and civilian consumption of its products after the war, and that our own dairy equipment industry will contribute heavily, as it has in the past, in this advance through the production of equipment to produce improved quality dairy products with greater sanitation, ease, and efficiency.

* Delivered at the 32nd Annual Convention of the International Association of Milk Sanitarians, November 3, 1944.

The war and the attitude of the Armed Forces toward dairy products has greatly increased their consumption. Practically every man in a camp in the United States has received a half-pint of milk daily, even at the Camp Hale Ski Camp at the top of the Rockies in Colorado. Increasing preference for milk and milk drinks as compared to non-food beverages has been recorded at post exchanges and canteens. Ice cream has generally been reasonably available and abundant to servicemen, in quantities they had never consumed before. Overseas, our boys are getting an increasing amount of powdered whole milk, which is reconstituted into fluid milk for drinking. Even the island of Attu, in the Aleutians, has its equipment for reconstituting milk powder into fluid milk. Powdered ice cream mix has been made available in prodigious quantities, and the destroyer which took General MacArthur to Leyte two weeks ago, had its ice cream freezing equipment on board, which made possible the picture of General MacArthur enjoying a chocolate ice cream soda on board ship.

PLASTICS

We expect to see an increasing use of plastics in various applications in dairy equipment. Already, plastic gaskets have replaced the old, insanitary type of soft flax and asbestos gasket and packing. Plastics will find increasing use for those pieces which lend themselves to multiple production, like special agitator and scraper blades, handles, etc. On the limited current production of military cars and motor vehicles, it is most interesting to note how plastic trim substituted for metal trim has reduced noise and rattles commonly experienced with metal trim. You have no doubt seen the plastic polysterene acid dipper which replaces the easily broken glass acid dipper in dairy laboratory use.

ELECTRONICS

Here again, while electronics have played an outstanding role in war communications and controls, only limited knowledge of many developments are known to date due to war restrictions, and adaptations to our dairy equipment industry will necessarily have to follow careful experimentation and plant trial. We feel that the various electronic control devices developed during the war are going to make possible better and more accurate control of the processing of dairy products at many steps from the receiving room to the customer's doorstep. Improved controls are responsible for the present day degree of acceptance of the speed-up of milk-processing by short time pasteurizers.

Some experimental work indicates most promising post war developments in such control equipment, including the flow diversion valve.

We know definitely that there will be increasing use of electronics in the dairy products packaging field, with increasing accuracy of weights and saving of manpower. A simple application of electronics to an important dairy plant control problem with resulting improvement in sanitation has been accomplished in the case of electronic-type liquid level controls for receiving vats, storage tanks, and all types of similar dairy products containers.

STYLING

The definite trend in styling of dairy equipment, as well as all industrial equipment, is in the direction of more thorough study to obtain styling lines on the equipment which combine some worthwhile functional purpose. In other words, styling lines and shapes must satisfy sanitation, accessibility for cleaning and maintenance, as well as the most efficient performance of the machine. As some of our leading industrial designers have said, form must follow function.

In recent years there has been a trend to "show plants" and a policy of inviting the public to inspect dairy products plants in daily operation. We feel certain that this movement in the field of good housekeeping will continue and will accelerate the trend for attractive appearance as well as function in the design of post war dairy equipment.

IMPROVED PLANT EFFICIENCY

The interest in acid cleaners in can washers and the use of polyphosphates in bottle and can washers to control the formation of scale on both the equipment and the cans or bottles has served to direct attention to a simple and effective answer to the hard water problem, namely, the zeolite water softener. There is no question but that a very worthwhile improvement in the final cleanliness of milk cans particularly, can be effected by the use of zero hardness water from one of these softeners placed on the pipeline feeding fresh water to a can washer. Freedom from scaling of the washer and improved operation of valves and jets will also be secured. Many plants are already considering separate hot water lines fed from a water softener which will insure water for washing up operations in the plant that will be free of the sticky lime curd formed by ordinary washing compounds when used with untreated hard water.

RUBBER

Out of the welter of confusion caused by the gradual reduction in the use of natural rubber in rubber products, and final substitution of synthetic rubber (principally Buna S), we feel sure that we shall eventually have rubber compositions which are more resistant to fat and cold flow (for compression). A very serious problem has been posed to our dairy equipment industry in the necessity of finding new cements for adhering the synthetic gaskets to the stainless steel heat exchanger plates. Several manufacturers will offer plates post-war with the gaskets vulcanized in place.

SQUARE GLASS MILK BOTTLES

The square milk bottle seems assured of a definite and advancing position in the delivery of fluid milk and cream. It is equally strong, cheaper (in that it makes more trips), easier to handle in the home, and effects space-saving economies in the plant, on the route, and in the home, refrigerator. The future of the 2-quart bottle seems uncertain but pointing in the direction of a rectangular bottle of the style that has been used in demonstration installations in New York City.

STAINLESS STEEL

The Conservation Section of WPB Limitation Order L-292 has limited the use of stainless steel and copper-bearing alloys to "Contact and Corrosion Points." There is considerable certainty that as soon as we have celebrated V-E Day, all such conservation provisions will be relaxed. I predict an increasing use of stainless steel outer covering of equipment, resulting from wartime experience in the problem of clean-up and maintenance of painted steel surfaces. I expect our equipment to make increasing use of stainless steel for parts now made of other less easily cleaned and corrosion-resistant alloys.

WARTIME DEVELOPMENTS

Actual developments or changes in dairy equipment during wartime have naturally been very limited and confined largely to items spurred by war conservation demands and material changes and shortages. With appreciable numbers of engineers entering the Armed Services, it has been a real strain to keep up with the problems of these material changes and shortages arising from wartime conditions. Our engineering staffs have been carrying the double burden of production of war materials and the essential dairy equipment required to replace worn-out units as covered by the War Food Administration priority ratings. It should be appreciated that for the past year, our industry has been producing dairy equipment under Quota Schedule I of WPB order L-292 based on a rate equal to the average production during 1939–40 and 41. Butter has, as we all appreciate, been one of the shortest dairy products on the market, and still there have been reports of extensive spoilage in government stocks. This has stimulated the previous U.S.D.A. Program for Cream Improvement, and as a result, two types of cream station cooling units have been developed and at least one will be placed in production immediately after V-E Day. Under wartime developments, the future welfare of the butter industry is dependent on the improvement and quality of butter, and the development of new butter products such as the cheese spread now used by the Armed Forces. Along this line, a post-war development will be the offering of continuous churns made to the usual sanitation standards of the fluid milk industry.

CONTINUOUS PROCESSING

The extreme shortage of experienced plant help in dairy products plants has stimulated thinking in terms of improved continuous handling of containers and products to conserve labor and minimize mistakes and shutdowns, due to the human element, by a wider use of various types of conveyors in the future. It is our studied opinion that automatic wrappers and cartoning machines to minimize contact of human hands with the product are certain future developments. Success of the short time pasteurizers with attendant conservation of floor space and plant time and labor has been responsible for serious consideration of continuous processing of other dairy products such as ice cream mix without aging.

Post war conditions are certain to be highly competitive and any improvements which can be developed to reduce the cost of processing dairy products will be thoroughly explored.

MILK CANS

The sanitarians have justifiably demanded the earliest possible return to umbrella type covers, and I feel sure that this is assured on V-E Day. Having participated in the industry battle for steel for the manufacture of milk cans in 1941 and 42, I can assure you it was a struggle to secure the barest minimum required to keep our work crews together. The industry has been extremely fortunate in having the backing of the U. S. Dept. of Agriculture and the War Food Administration in insisting to the War Production Board on the essentiality of steel for milk cans to handle the product from farms to plants, necessitated by the increased production of milk and switching of patrons from gathered cream to whole milk. A saving of 4 pounds or some 17 percent of the average weight of a milk can, by substituting a type B cover for the umbrella cover was ordered by the War Production Board to conserve steel, in a period when practically all civilian industries were denied any steel whatsoever on account of the heavy demands of the Armed Services.

In conclusion, I should like to pay tribute to the dairy plant operator who has kept his plant running long hours with limited and often inexperienced help and equipment, often inadequate for his increased production, in order that dairy products could be provided for all our armed forces and for most of our needs on the home front. The job has been difficult and it has only been through your understanding and thorough cooperation as milk sanitarians that it could be carried out.

When the job in Europe and the Pacific is done, I know all of us here at home will continue to move forward toward a goal of highest quality at minimum cost. Until then, we shall do the best we know how with "the means at our command."

Comments on How to Handle the Mastitis Problem*

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Cows that produce market milk must be healthy (especially free from udder infection) clean, and stabled in sanitary quarters if the milk produced is to be safe and of reasonably high quality. The presence of infectious mastitis in the lactating cows and the lack of application of proper and adequate sanitary procedures in handling the milk result in bacterial contamination of the milk. The dairyman must know something about the cause of mastitis, and he must know that there are several types of mastitis if he is to understand and apply the herd management procedures that are necessary in solving the mastitis problem in his herd.

What Is Mastitis?

Mastitis is any inflammation of the udder. This can be the physiological swelling or congestion at "freshening." The swelling resulting from udder and teat injuries, or the pathological change in the udder tissue as the result of activity of disease-producing bacteria. In so far as the condition of the cow is concerned, the mastitis can be classified as acute or chronic.

Acute and Chronic Mastitis

Acute mastitis may be divided into acute local mastitis and acute systemic mastitis. In the acute local mastitis, the symptoms of swelling, pain, and the production of milk of abnormal physical appearance are confined to the udder. The cow is eating well, and has a good appearance except for the udder changes. The acute systemic mastitis is characterized by a visible sick cow in addition to the symptoms in the udder. The acute local mastitis may progress in severity to develop into the destructive and highly fatal acute systemic mastitis.

Chronic mastitis is usually characterized by the absence of any painful swelling of the udder and by the production of a decreased amount of milk of normal physical appearance. Therefore, a cow may be infected for periods varying from a few weeks to several years before having an acute attack, and before the owner may become aware of the presence of the disease. The chronic mastitis may "flare-up" and become either acute local or acute systemic in nature. If death of the cow does not occur and treatment is instituted, the acute condition may abate and chronic mastitis persist. This change from chronic to acute mastitis and *vice versa* may occur irrespective of the cause of the disease.

Non-infectious and Infectious Mastitis

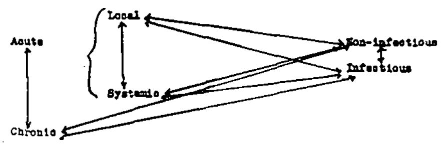
Udder troubles may be classified as non-infectious and infectious mastitis from the standpoint of cause. Such non-infectious factors as chilling, bruising, and injury of the udder or teats, rough handling of the udder during hand or machine milking, and the adverse effects, in some cows, of irregular or incomplete milking may cause mastitis of an acute or chronic nature depending upon the severity of the non-infectious agent or condition.

* Presented at the Thirty-second Annual Meeting of the International Association of Milk Sanitarians, Chicago, November 2–4, 1944.

Further, the damaging effects of non-infectious mastitis may predispose the udder to infection by bacteria.

The streptococcus group of bacteria most commonly causes the udder infection of a chronic type, but at times the streptococci and usually infection by *Staphylococcus aureus* and/or *Escherichia coli* and other bacteria produces an acute mastitis. The accompanying diagram is presented to indicate (by arrows) the interrelationship in mastitis between "the cause" and "the effect on the cow and her udder":

The condition of the cow and/or udder *Cause of Mastitis*



DETERMINING THE CAUSE OF MASTITIS

The physical examination of the udder and milk are valuable in determining the clinical condition of the cow and her udder. This information is important when a final decision must be made concerning the disposition and treatment of the individual case of mastitis. However, bacteriological procedures must be applied to properly collected milk samples to make the specific diagnosis of infection—if the infectious bacteria are present—or to exclude infection and, therefore, suggest that the cause of the trouble is non-infectious in nature. In my opinion, the veterinarian and dairyman must know the cause of the mastitis before they can intelligently apply preventive procedures or specific curative udder infusion treatments.

INFECTIOUS MASTITIS IS A MAJOR DAIRY HERD PROBLEM

All evidence points to this being a major dairy problem both from the economic and hygienic standpoints.

1. Many research workers have reported that quarters infected with streptococci produce 22 percent less butterfat than the streptococcus-free quarters. Since many cows are infected in all four quarters a similar decrease in milk and butterfat production may be expected and has been observed. In many cases of acute mastitis the milk producing ability of the cow is entirely destroyed. This makes it necessary to maintain an excessive number of cows to furnish a given amount of milk. Such a procedure becomes expensive from the standpoint of money invested and time and feed consumed in maintaining the excess cows.

2. The easy spread of streptococcic mastitis causes an increase in herd wastage. The animals that "go bad" because of the infection must be eliminated, even at a great loss of money. In addition, the infection spreads and reduces the production of the cows concerned, and the elimination at a loss must extend to any recently infected animals.

3. It has already been pointed out that streptococcic mastitis affected cows may produce a milk containing less fat and less milk sugar (lactose) than normal. Owing to these deficiencies such milk is inferior in nutritive quality as well as in bacteriological quality.

4. In studies conducted at Michigan State College and other stations it was found that milk from infected cows was inferior in quality as determined by flavor, chloride content, leucocyte content, sediment test, bacteria count, and methylene blue test. Ninety percent of the milk samples from infected cows in one herd were criticized as having a salty flavor, while only 14 percent of milk samples from a streptococcus-free herd were so criticized. The animals in the mastitis-free herd giving a salty milk are near the end of their lactation period when such changes may normally occur. Only 50 percent of the streptococcus-

infected cows produce a Class 1 milk (good) as judged by the methylene blue test, as compared with 98.5 percent of the non-infected cows. In like manner, 68.5 percent of the infected cows produce milk with a bacteria count of more than 1,000 per cubic centimeter as compared with 5.8 percent of the non-infected cows. The milk obtained from normal udders has 50 to 500 bacteria per cubic centimeter, and the number should not exceed 1,000 if low-count milk is to be produced. Were it not for the dilution of such abnormal milks with normal milk, more would be heard from consumers about these deficiencies.

5. Infected milk should not be consumed in the raw state because of the possibility of human infection. This may take the form of epidemics of septic sore throat, if a streptococcus of human origin is involved, or isolated cases of human infection when certain bovine as well as some human streptococci are concerned. Enterotoxin producing staphylococci have been the cause of some infectious mastitis and subsequent food poisoning among the consumers of such milk. Reports of such disease outbreaks are familiar to all of us.

ARE THE UDDER INFUSION TREATMENTS THE ANSWER TO OUR PROBLEM?

Many dairymen misunderstand the use of the udder infusions in the treatment and control of bovine mastitis or inflammation of the cow's udder, since they assume incorrectly that all cows with udder trouble should be treated with these materials. Udder infusions are effective only against infection and are of no value where the cause is non-infectious in nature. In fact, the use of udder infusion in such cases may aggravate the trouble.

If the cause should be non-infectious, such 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—the treatment of necessity lies in correcting the underlying cause of the trouble.

On the other hand, *the judicious use of the udder infusions in treating infectious mastitis must necessarily be accompanied by sanitary milking procedures and farm sanitation if the occurrence of infection is to be prevented; otherwise, the recovered case becomes re-exposed and reinfection may occur.*

Several pertinent facts which the dairyman must understand, before he has his veterinarian treat any cow, to insure success of a mastitis control program are:

1. A testing procedure must be used to determine that the udder infection is present. This examination should be used to check results after treatment.

2. Best results are obtained by the treatment of early cases, before the development of extensive tissue changes in the udder. The veterinarian will select the cases for treatment by a careful physical examination of the udder; cows in the advanced stages of the disease are not treated. They should be removed from the herd for slaughter, so that they will not serve as foci from which the infection can spread through the herd.

3. It appears inadvisable to treat cows exhibiting acute systemic symptoms because these symptoms are usually intensified by infusing the udder during the acute attack. The cow may be treated after the acute stage of the disease has subsided if on examination she is found to be a favorable subject for treatment.

4. The milk production of treated cows may not be changed greatly or it may be reduced 90 percent from the normal milk flow. In 90 percent of the cows treated during the lactation period, the drop in milk production is less than 50 percent. The period of reduction of production varies from one day to several weeks. Therefore,

it seems advisable to treat cows near the end of lactation or during the dry period.

5. The physical appearance of the milk produced may be changed upon treatment; this may vary from a few flakes to a "gargety" milk. These changes may be evident for a period varying from one milking to about ten days. The milk should not be used for human food during the period it is of abnormal physical appearance, even though there is no evidence available to indicate that it presents any danger to humans.

6. This treatment does not confer any immunity to any animal that becomes free from the infectious bacteria. Therefore, it is most essential that the herd be placed on a control program based on the application of sanitary measures to prevent reexposure of the recovered cases.

Cooperation in Handling the Mastitis Problem

In my opinion, the mastitis problem can be successfully handled only through the veterinarian and client relationship (because of the many causative factors, varying conditions of management and milking existing on each farm, and the selection and proper use of udder infusion treatments) in cooperation with and receiving very essential aid (along educational lines and detection of the affected herd or cow) from all health and control agencies, milk plant operators and the farm and scientific press.

The report of C. S. Leete, at the 20th Annual conference of the N. Y. State Association of Milk Sanitarians in 1942, presents to us the value of these cooperative efforts in inaugurating and carrying to a successful conclusion an investigation of a milk borne outbreak of streptococcal fever. To locate the one cow responsible for the disease outbreak, within a period of seven days, three sorting tests were applied to 331 herds, comprising 6,069 cows; they were: (1) direct microscopic examination of milk from 2,029 cans, (2) clinical examination of 1,931 animals in 73 herds where abnormal milk was found upon microscopic examination, and (3) bacteriological examination for Lancefield group A streptococci, of 150 samples of abnormal milk submitted by the veterinarians.

These same agencies can and should cooperate where the motivating force is mainly economic in nature rather than activated by an outbreak of milk-borne disease. To increase the accuracy of detecting the herds with udder infection, I recommend that a representative milk sample of each farm supply be incubated at 37° C. for a period of 12 to 24 hours in the presence of a differential preservative (0.1 cc. of preservative is added, to 5 cc. of milk sample; the preservative consists of 200 cc. of distilled water, 0.75 gm. sodium azide, 2.25 gms. brom-cresol-purple, and 10 gms. of dextrose.) and then examined under the microscope for long-chained streptococci and to determine the number of leucocytes present. A positive finding will be obtained by this procedure if as few as one in 18 lactating cows is infected. The microscopic examination of milk samples prior to incubation will detect up to 10 percent of the herds affected with infectious mastitis, depending upon the conditions of farm cooling of the milk. In addition, the operator must recognize that herd milk collected at the platform may contain contaminating streptococci that have gained entrance to the milk during its production and handling; in actual practice this does not often interfere with location of the herd with infectious mastitis. The results of this check-up made by the milk sanitarian will begin the work of the veterinarian and his client in dealing with the disease in the individual herd. The continued checking of the herd milk, by the sanitarian, and the aid he can give in the examination of incubated milk samples from each cow will be appreciated by the dairyman and veterinarian. The finding of abnormal milk and milk of low quality should set the cooperative machinery in motion to locate the affected cow and to deal with her, thus, making it possible for the farmer to carry on his dairy enterprise successfully, for the plant operator to process and deliver a safe milk of highest quality, and for the public health official to know that the quality and safety of the milk is assured.

Report of Committee on Frozen Desserts

F. W. FABIAN, *Chairman*

Michigan State College, East Lansing, Michigan

EVERYWHERE one hears the same story, inexperienced labor when it is obtainable at all, inadequate and wornout equipment, shortage of raw materials and an unprecedented demand for frozen desserts of all kinds. The one cheerful note throughout is the fine spirit of cooperation and the determination to carry on. As one travels throughout the country visiting the various ice cream plants, one hears great plans for the future. A new plant here, alterations there, new and modern equipment almost everywhere. The ice cream man is one of the greatest "changers" in American industry. He is continually tearing down and building bigger and better plants; always altering or changing this or that in the plant. This restlessness is one of the reasons why the ice cream industry is so progressive.

In fact, the ice cream industry frequently is more alive to the sanitary problems confronting them than many boards of health. It is not uncommon to find local boards of health that have no regulations governing frozen desserts. If perchance they do have them, they are usually outmoded and poorly enforced by a sanitary inspector who does not know what it is all about. The manufacture of frozen desserts is more complicated than the manufacture of butter or cheese or the mechanical handling of milk. There are many more ingredients used and there is more machinery involved. Consequently, there is a greater chance for contamination of the product.

POSTWAR PLANNING

Industry is making great plans for the future—bigger, better, and more efficient plants. What plans are the official control agencies making to assist them in making their product more sanitary, nutritious, and wholesome? Are you keeping abreast of the latest developments in machinery and laboratory control methods? Many regulations require that all installations be given the official okay of the regulatory agency in control. Are you capable of passing judgment on these new installations?

Here are a few ways by which you can help industry and at the same time do a real service to the community which you serve.

1. Simplify, codify, and unify the multiplicity of rules and regulations governing the production of milk, cream, and butter. Where and whenever possible, have reciprocity between cities and states. This is even more essential for ice cream manufacture than for market milk, since the dairy products used in ice cream manufacture frequently come from points widely separated. There is no fundamental reason why this cannot and should not be done.

2. Set up the necessary machinery for licensing dairy plant operators especially those who are directly responsible for the safety of the product such as those who operate the pasteurizing equipment. They should be required to pass a comprehensive examination on dairy machinery and sanitation. Schools should be conducted yearly to keep them abreast of

the latest developments and their licenses should be placed on a yearly renewal basis preceded by an examination. It would increase greatly the quality of the personnel of dairy plants and insure a high type individual in responsible places.

3. The INTERNATIONAL ASSOCIATION OF MILK SANITARIANS should standardize dairy plant procedures insofar as possible by collecting and evaluating all the methods available. This will be an invaluable service to the sanitary inspector. An excellent start has been made by the Committee on Sanitary Procedure on dairy equipment. This work should be continued and extended to other phases of the dairy industry.

Truly there is a tremendous amount of work to be done in preparation for the postwar period which is badly needed if we are even to keep up, to say nothing of keeping ahead of industry.

Following are the reports of other members of the Committee. Each has discussed some phase of the frozen dessert problem which has confronted him. It is hoped that these reports will be helpful to others with similar problems.

Grading and Inspection Service

W. C. CAMERON

Chief, Dairy Products, Canadian Department of Agriculture, Ottawa, Canada

In March 1943, it was felt advisable by the Dairy Products Board to change the method of control with respect to restrictions placed on the ice cream industry in 1942. Control of the amount of ice cream and sherbet sold during any quarter was replaced by limiting the volume of ice cream and sherbet mix that could be made during any quarter of the year commencing 1st April 1943 to the volume made during the corresponding quarter of the year commencing 1st April 1941 (Order No. 51). No restrictions were placed on the amount of ice cream or sherbet mix used either as mix or ice cream by the Armed Forces when in camps that are provisioned by the Department of National Defense or to patients in military and civilian hospitals.

Subsequent to the passing of the above order, it was found that some manufacturers of ice cream were adding either milk powder or fluid milk and cream to the previously prepared mix. This was being done at time of freezing. Usually the addition of these milk products was associated with the manufacture of fruit ice cream where difficulty was experienced in meeting the minimum milk fat requirements. Under wartime regulations no ice cream may contain less than 9.5 percent and not more than 10.5 percent milk fat. Therefore, the amount of fruits, flavoring, etc., to be added to the standard mix required careful calculation, and firms not making the necessary adjustments found the frozen ice cream to contain less than legal minimum of milk fat. The addition of milk or cream at time of freezing appeared to be a ready method of correction but such a practice was actually in violation of Order No. 51 because the amount of mix was being increased and the intent of the order, namely the conservation of milk solids, was being defeated. In order that there would be no further misunderstanding on the part of manufacturers with respect to the handling of mixes, Order No. 59 was issued, which prohibited the addition of any milk products to a prepared mix ready for sale or use. Following the publication of this order, there has been little difficulty with the addition of milk products to prepared mixes.

Manufacturers of ice cream have, for many years, packaged ice cream bricks with sherbet or water ice centres but these specialties have not constituted any appreciable proportion of the total sales of ice cream. Under conditions of limited volume of production and increased demand for frozen desserts, manufacturers have given more attention to the possibilities of extending the quantity of ice cream available for sale. In some cases, ice cream bricks were made with sherbet or water ice centres or layers and sold as such. No objection was taken to this practice providing the product was labeled correctly. However, some manufacturers conceived the idea of blending water ice with ice cream in a manner similar to that used in making ripple ice cream. They proposed using approximately one part of water ice to three parts of ice cream. In this case, however, it was felt that the two products would not be separate and distinct as in a water ice centred brick and that the introduction of water ice to ice cream as proposed would be considered similar to the manufacture of ice cream to which fruits, nuts or other flavours and confections were added and, therefore, the finished product would have to comply with the standards for fruit ice cream. Otherwise, the practice would develop into one of uncontrolled production of substandard ice cream.

Some manufacturers were found to be using soya bean flour to increase the total solids content of ice cream. This practice is illegal in Canada from at least two standpoints. First, soya bean flour is a foreign substance, considered as an adulterant and not necessary in the manufacture of ice cream. Second, it introduces into ice cream fats other than milk fat for which the penalty is heavy. Officials of the Department of Agriculture and Pensions and National Health have developed a technique which reveals quantitatively the presence of soya bean flour in ice cream. Other cereal flours, such as Avenex, have also been used to a limited extent. Some of these have certain stabilizing properties but their use in ice cream is legal only when used as a stabilizer and when they do not introduce "foreign fats" into ice cream. In no case may the total amount of stabilizer used be more than 0.5 percent by weight.

The use of cereal flours, however, has not been limited to supplementing the solids in an ice cream mix. Some manufacturers developed a formula for so-called water ices in which these flours are used. The resulting product resembled ice cream and had a reasonably smooth texture, but contained no milk products. By virtue of this last named characteristic, there existed a very dangerous threat to the present and future welfare of the industry. All of the irregularities, which had previously occurred in the industry, were quickly stopped because of two factors. First, there was legislation dealing with the matter, and secondly, the industry and trade cooperated with officials of the Department in discontinuing the practices when they were brought to the attention of those concerned. The situation was entirely different with this new water ice.

Therefore, as a wartime measure, legislation was passed defining water ice and prohibiting the manufacture, importation into Canada, and sale of imitation ice cream.

The control exercised with respect to the volume of ice cream mix which may be manufactured during any quarter has resulted in a form of rationing of ice cream to retailers and consumers by the manufacturers. Many firms have placed their customers on a definite quota basis, thereby assuring them of regular deliveries of specified quantities of ice cream and sherbet throughout the quarter. Others have permitted their customers to take their requirements until their own quota of ice cream mix for any particular quarter was exhausted. However, in both cases, dealers have found themselves without ice cream for re-sale from time to time, particularly in periods of extremely hot weather during the summer months, but it can be said that consumers as well as the trade in general have accepted such conditions with little complaint.

Due to the need for conserving metals, the use of fibre board containers has increased considerably. Such substitutes have in the main proven satisfactory, although retailers do not favour such for bulk ice cream, due to lack of rigidity compared with metals and consequent difficulty in dipping.

As a means of conserving gasoline and rubber, manufacturers have, by mutual agreement, done away with overlapping with respect to deliveries of ice cream to the retail trade. In many districts, one firm is supplying ice cream to dealers of perhaps four or five competitors and it is estimated that some three millions miles of driving have been saved. Such a practice has demanded the fullest cooperation from those concerned, and their efforts and the results obtained deserve the highest commendation.

In conclusion, although the ice cream industry in Canada has been subjected to restrictions as to volume manufactured and encountered difficulties in obtaining adequate supplies of certain ingredients and materials, it is felt that the consumer has continued to receive a good quality product at all times. There is no doubt that the sales of ice cream would have increased considerably in the absence of any control, due to the greater purchasing power of consumers and hence these controls have been responsible for the conservation of milk products for use in the manufacture of other dairy products more urgently required.

California's New Score Card for a Milk Products Plant

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The worth of a score card to evaluate the sanitary conditions of a milk products plant has been and probably always will be debatable. Opinions vary on the subject, but I believe that a properly designed score card, applied in accordance with definite specifications, has a great deal of value.

The 1941 California State Legislature enacted a law which made it unlawful to operate a milk products plant unless said plant scored a minimum of 80 percent on the official score card established by regulation of the Director of Agriculture. Prior to the enactment of this legislation our factory or plant score card was used almost exclusively for the purpose of serving written notice to the operator to correct certain conditions which existed contrary to the provisions of the law.

The score card, prior to 1941, was used also to place a rating on a plant, but there was no legal backing to enforce scoring requirements. A low score usually meant unsatisfactory conditions and served to bring to the attention of the operator certain items in need of correction. It did, however, serve a useful purpose from an educational standpoint, but it was lacking in many respects, and in need of a general revision. A committee was selected from our staff who studied dairy plant score cards from various sections of the country, reviewed State codes, and local ordinances. A mass of information, ideas, requirements, prohibitions, and restrictions was assembled. With all this data on hand the committee went to work to pick out those essentials which were deemed necessary for the maintenance of a sanitary plant and to accomplish the purpose intended by the score card, and the law.

One of the primary objects was to overcome the objections to score cards in general. We were determined to have a score card which, in so far as practical, reflected the sanitary conditions of a plant, recognized the importance of cleanliness among the employees, allowed enough flexibility so as to be applied to both large and small plants, divorced the inspector's personality and pet ideas from its application; one which would serve as an intelligent guide to the plant operator and cause the inspector to really observe the plant thoroughly and be prepared to explain and justify all deductions. The score card also provided the administration officials a ready reference to the plant conditions and enabled them to observe the quality and quantity of work turned out by each man in the field.

Arriving at the values for each item was no easy task. In setting these values the real importance of the item to the quality of the product in its relation to public health was kept in mind.

In breaking the score card down into the old traditional headings of building and equipment on one hand, and methods on the other we find our score card with a total of 350 points, giving 201 points, or 57.4 percent to building and equipment, and 149 points, or 42.6 percent to methods. This may not be the most desirable relationship, but it is doubtful if any one can say just what this relationship should be. We do know, however, that the score card is so set up that a plant is required to have both reasonably good building construction and equipment, and must employ good methods. In other words, a plant with good buildings and equipment, having poor methods, will not make a passing grade, and a poorly equipped plant with good methods likewise will not make the required 80 percent.

To be effective, it was necessary to develop a guide or key to the use of our score card. This was important for several reasons. First, and perhaps most important, was the necessity of keeping the inspectors uniform in its application; and, second, many items needed detailed explanation. In using the score card each item is given full credit or no credit at all. For instance, if 5 pasteurizing vats are examined and 4 found satisfactory and the other one not, then no credit will be allowed for this item. If the floors in the processing room are found satisfactory, but those in the wash room are found to be in need of repair, then no credit is given for satisfactory floors. Some have criticized this method on the ground that it was too severe and does not reflect the true condition of the plant. Careful consideration was given to this matter, and it was decided that full credit for each item must be earned by complete compliance.

This system has accomplished two important things. It has kept the field men together in their scoring and has served to emphasize faulty plant construction, plant maintenance, poor methods, and made the plant operator conscious of them.

Like in many states, California has several hundreds of so-called counter freezers. Our law makes no distinction between these small installations and other types of milk products plants. The freezer must be housed in a separate room with a floor of cement, title, or other approved nonabsorbent material, and sloped to a floor drain. The room must be supplied with running water, proper light, and adequate ventilation. Provisions for the proper washing and sterilizing of equipment must also be provided. In scoring such

MILK PRODUCTS PLANT SCORE CARD

STATE OF CALIFORNIA. DEPARTMENT OF AGRICULTURE. SACRAMENTO

DIVISION OF ANIMAL INDUSTRY—BUREAU OF DAIRY SERVICE

Trade Name__________ Owner or Manager__________

Town__________ Business Address__________

Products Manufactured or Processed__________

Factory License No.__________ Date__________

Inspection Made: Before, during, after processing (hour)__________M

ITEM NUMBER		PERFECT SCORE A	ALLOWED B
1.	LOCATION: Surroundings clean 1; sanitary 4; orderly 1; attractive 1	7	
2.	ARRANGEMENT: Rooms—adequate number 4; size 4; convenient 2; attractive 1; shafts, pulleys, pipes, ledges, clean 2	13	
3.	FLOORS: Smooth 4; sound 5; properly sloped to trapped drain 5; non-absorbent 5; clean 4	23	
4.	WALLS: Sound 4; smooth 4; light color 1; non-absorbent 4; clean 4	17	
5.	CEILINGS: Sound 2; smooth 2; proper height 4; light color 1; clean 2	11	
6.	DOORS, WINDOWS: Screened (or protected) 5; good repair 2; doors open out and self-closing 3; clean 2	12	
7.	LIGHT: Adequate and evenly distributed 4	4	
8.	VENTILATION: Adequate and evenly distributed 5	5	
9.	WATER SUPPLY: Clean 2; approved source 5; sufficient outlets 1; hose satisfactory 1; abundant 1	10	
10.	TOILET: Good repair 1; vestibuled 1; ventilated 1; self-closing door 1; lavatory 1; soap 1; towels 1; clean 2; fly proof 1	10	
11.	DRESSING ROOM: Clean 2; ventilated 2; orderly 1	5	
12.	HAND WASHING FACILITIES: Wash basin 1; convenient 1; warm water 1; soap 1; towels 1; clean 1; sufficient 1	7	
13.	COLD STORAGE ROOMS: Proper construction 4; free of odors 2; proper temperature 1; clean 3	10	
14.	WASTE DISPOSAL: Sewer facilities 5; covered waste containers 2	7	
15.	WASHING FACILITIES: Wash tanks 2; condition 1; sufficient brushes 1; suitable 1; adequate 1; washing powder 1; clean 1	8	
16.	STERILIZING FACILITIES: Adequate 5; efficient 5; convenient 1; temperature indicators accurate 1; clean 2	14	
17.	CONTAINERS: Smooth 1; no open seams 2; rust-free 2; clean 5; sterilized 5; dried 5; protected storage 1	21	
18.	VATS: Smooth 2; tight surfaces 4; free of exposed copper or rust 2; proper covers 2; clean 5; sterilized 5; dried 5	25	
19.	COOLING FACILITIES: Adequate 2; smooth 1; sound surfaces 2; free of exposed copper or rust 2; clean 5; sterilized 5; dried 5; protected 2; proper temperature 5	29	
20.	SANITARY PIPES, FITTINGS AND PUMPS: Proper type 1; smooth surface 2; free of dents 2; free of exposed copper 2; flush type valve 3; leak detector type valve 2; clean 5; sterilized 5; dried 5; protected 2	29	
21.	THERMOMETERS: Approved type of mounting 3; accurate 5; sufficient 3; indicating thermometer 3	14	
22.	THERMOMETER CHARTS: Proper 2; correctly recorded 3; filed 2	7	
23.	OTHER EQUIPMENT: Adequate 2; good repair 7; clean 5; sterilized 5; dried 5; protected 2; (underline equipment examined) freezer, homogenizer, churn, separator, bottler, weigh tanks	26	
24.	PROTECTION OF PRODUCT: From contamination 5, (flies, dust, odors, vermin, water); proper delivery temperature 2	7	
25.	EXPEDITIOUS OPERATION: Celerity and dispatch 2	2	
26.	LABELING: Of products—Legal 2	2	
27.	LABORATORY CONTROL: Satisfactory 4	4	
28.	PERSONNEL: Sufficient 1; clean habits 10; clothing 2	13	
29.	TRANSPORTATION VEHICLES: Protected 1; clean 1; attractive 1; legal signs 1	4	
30.	STORAGE OF SUPPLIES: Clean 2; orderly 1; properly protected 1	4	
	TOTAL POINTS	350	
	PER CENT	....	

Draw line through items in Column A which do not apply to this Milk Products Plant, and do not include such items in total for perfect score.

Duplicate copy received

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Representative

DS FORM 30

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small installations, many of the items on the score card are not applicable and are, therefore, deleted. Since the majority of these operators purchase their mix already prepared, items such as Nos. 18, 19, 20, 21, 22, and 29 appearing on the score card do not apply.

Each milk products plant must be scored at least once during each calendar year, but if the plant fails to make the required score of 80 percent, an official order is served on the operator to correct faulty conditions, and within a reasonable length of time a rescore of the plant is made.

This type of score card has given very good results, and since its adoption there has been a noticeable improvement in plant conditions, appearance, and operations. The card seems to stimulate good housekeeping and encourage the pride that usually goes with a clean, well kept plant.

Problems of the Control Official

ANDREW J. KROG

Health Officer, Plainfield, New Jersey

In my report to this committee last year, I pointed out some of the problems that had already arisen through wartime economic conditions, and F. D. O. #8, in conjunction with the sanitary control of ice cream. The past year has shown that although F. D. O. #8 has restricted the sale of ice cream to civilians, actually total gallonage was not very much altered. In 1943, the 412 million gallons of ice cream plus the 47 million gallons of sherbet accounted for almost as much as the 462 million gallons of ice cream and 9 million gallons of sherbet of 1942.

Since F. D. O. #8 restricted ice cream to civilian consumers approximately 35 percent, it can be seen that the armed forces and other "quota exempt" agencies have utilized approximately 25 percent of the ice cream manufactured in 1943—and that civilians ate five and a half times more sherbet in 1943 than they did in 1942, whether they liked it or not.

The problems relative to the sanitary control of ice cream have been tremendously aggravated by the economic conditions of the past year.

PERSONNEL

Ice cream plants' trained personnel has, to a large degree, been drawn off by the industrial and Selective Service programs. The ice cream industry has been classified as "unessential"—at least from the draft board viewpoint. Since most "scientific" ice cream men are technical school graduates of the past ten years, it is not uncommon to find that most plants have lost many of their key men. The high salaries available to unskilled labor (both male and female) for non-manual jobs have withdrawn the older, well-trained clean-up men from many plants. Women, who had years of experience in packaging ice cream, have also left employment by this industry to seek the "greener pastures" of defense plants.

Present ice cream personnel is characterized by extremely high turnover. Attempts to maintain control programs have been hindered by this, since the employes being trained for a specific operation frequently leaves the plant before his training is completed. In spite of this, most plants in the area of this observer have continued to maintain fairly intelligent control of their raw materials, processing, freezing, and storage operations, and have conscientiously attempted to adhere to bacteriological standards.

EQUIPMENT

The dairy industries have been given a high priority for new equipment.

The ice cream portion of the industry has of necessity been given a lower priority than that assigned to fluid milk plants. It is well known how difficult it has been for fluid milk operations to obtain replacements of badly worn devices. It has been even more difficult for the ice cream industry.

Although ice cream manufacturers are well aware of the need for replacing inadequate pasteurizers, storage tanks, and other necessary equipment, they must wait for these items until all milk plant needs have been satisfied. Prior to the past few years, homogenizers were used quite exclusively in ice cream plants. Since many fluid milk processors are now in the market for these devices, the program of substituting sanitary head machines in the ice cream industry for the old obsolete "insanitary" style must be postponed further.

New freezing equipment is not as yet available. Parts can be obtained for batch and continuous freezers already in operation, but although metal has been assigned for the manufacture of new freezers, machine tools have not yet been released for this purpose. Refrigeration equipment, luckily, has not broken down at such a rate as to handicap ice cream manufacturers. F. D. O. #8 has decellerated normal wear and tear, in most plants.

Packaging equipment has become quite a problem in many ice cream plants. Old models are abandoned, since repair parts are not available and machining facilities are difficult to obtain. This has been an advantage in one respect, by decreasing the number of novelties on the market, the control of ice cream has been simplified to a degree.

SUPPLIES

The set-aside programs of the War Food Administration have made it more difficult for the manufacturer to obtain supplies of acceptable quality. In order to permit ice cream manufacturers to obtain sufficient materials for their F. D. O. #8 quotas, "temporary" permits have been given to previously unaccepted sources of supply. Investigation of some of these temporary licensees' facilities has pointed out that the practice of issuing such permits without the usual inspection is dangerous—it may set back the entire control program.

The swing to vegetable fillers which began last year has been curtailed definitely in this territory. The continued appearance of advertisements detailing the merits of such filling practices indicates that this may not be true over the entire country.

The development of pudding mixes, derived exclusively from non-dairy ingredients, which are processed in ice cream equipment and packaged with ice creams is looked upon with question. Although the combination package may be properly labeled, the consumer is notorious for his inability to understand what he reads and frequently does not realize that the two-flavored product that he has bought is half ice cream and half something else which may be palatable, but which definitely is not ice cream. (The latter is still defined as a dairy product.)

The shortage of flavoring materials, especially chocolate products and fruits, has become acute. Since cocoa beans are largely under British control, there is a strong possibility that even after the successful conclusion of the European war, African beans will not be available to the United States. The European market will provide a greater return.

The high costs of crop gathering labor and the draught in the Eastern Atlantic area has made fruits extremely high in price. Fruit ice creams will probably do with less fruit and more artificial flavor until after next year's crops are reaped.

INSPECTION

The personnel, equipment, and supply problems reviewed above have of necessity increased the frequency with which inspections must be made of all phases of ice cream manufacturing. The inability to expand health departments' control personnel during wartime has made it necessary to place more responsibility on manufacturers for their own control systems. Most manufacturers have been extremely cooperative, and have arranged for facilities to aid in the control of both the raw and processed products. The policy of health department representatives' discussing sanitation methods with the plant personnel in an instrumental manner has been found much more effective than attempting to obtain adherence to standards without a preliminary discussion. (The extreme turnover in ice cream plants makes the institution of an educational program essential.) If this work is carried out by people definitely not identified with the plant management—as for example, the health department representatives —it is much more effective.

The inspection of dispensing outlets has required more attention during the past year, because of the labor turnover at these agencies. Here, too, some instruction in the proper manner of sanitizing dispensing equipment has been essential to obtain consistent compliance with standards.

A review of cleaning operations at many plants has shown that plant managements are not too well acquainted with the development of detergents suitable for the cleaning of specific types of accumulation. The educational program should review the characteristics of commercially available materials which aid cleaning.

CURRENT PROBLEMS

The Eastern Atlantic area has just suffered an extreme drought. Locally produced dairy products for use by the local ice cream manufacturing industry will be much less available, therefore, for the next year. This anticipates that the ice cream industry will have to obtain raw materials from hitherto uninspected sources, to a greater degree. In order to avoid troubles from poor supplies, arrangements are being made for a uniform system of grading products outside of the immediate milkshed, so that all control men can refer to identical standards in reporting on products under their immediate jurisdiction.

Details on this program will probably appear in other releases from this committee. The points primarily involved are that milk and milk products for use in the ice cream industry of the Eastern Atlantic area be derived from healthy cows, cooled rapidly, and handled in clean, sterile equipment. Thermoduric characteristics of raw products should be determined by laboratory pasteurization, utilizing temperatures, and exposes equivalent to those of the processing plants to whom the products will be confined.

The end of the European war will not alter this situation, particularly; the Eastern Atlantic milkshed has not been primarily involved in the development of products for export. The supply of dairy products to the liberated countries may utilize as much of these materials as has been hitherto exported for lend-lease purposes.

The Federal Food and Drug Division recently investigated the use of carcinogenic and lead containing dyes in cosmetics. These materials have been kept out of dairy and other food products quite successfully, but the investigation of one control agency showed that some are being employed in the printing inks used on food containers, including ice cream cups and novelty envelopes. Although on first consideration this might seem a trivial matter, the observation of children eating ice cream from cups will show that they customarily lick the outside. For this reason, it is felt that ice cream manufacturers should instruct their printers to use only acceptable dyes in their printing on ice cream containers.

The overrun percentage at which ice cream is sold has required much policing, during the past year, and will continue to do so until after F. D. O. #8 has been repealed. It is especially important that the small containers be checked for overrun contents. These containers, generally packaged directly from the freezing equipment, have been found to carry overruns much in excess of that permitted by the areas' laws.

The custom of packing ices and sherbets with ice cream in plant filled containers has caused a tremendous increase in the consumption of sherbets and ices, as well as a tremendous irritation and lowered nutrition to consumers. In order to keep this practice within reason, it is worthwhile to point out to manufacturers that the labeling of a package "ice cream and ices" indicates that at least half of the contents of the package by weight must be ice cream. Many containers have been found where the ices or sherbets constitutes two-thirds of the package by volume, and since ice cream is frozen to a higher overrun and ices and sherbets to a lower one, frequently the weight of these materials is even more.

THE OUTLOOK

The experience of the past year has shown that in spite of present hardships, ice cream manufacturers can, with cooperation, maintain their products at least bacteriologically, to prewar standards. The chemical constitution of ice cream can not be expected to return until after F. D. O. #8 is removed. Although most ice cream manufacturers were quite unwilling to reduce the fat and serum solids contents of ice cream before the adoption of F. D. O. #8, they learned that consumers would buy all that they were permitted to manufacture, anyhow—since there is not enough ice cream on the market to meet consumers' demands. It is to be expected that ice creams will return to their former chemical composition, when competition returns.

The Manufacture and Sale of Ice Cream in Pennsylvania During 1943

RALPH E. IRWIN

Director, Bureau of Milk Sanitation, State Department of Health, Pennsylvania

Our chairman allows the members of his Committee to report for the particular State or Province with which he is familiar. So, it is possible to include a little "horn blowing" for a particular State or Province. Therefore, I feel free to announce that Pennsylvania leads all States and Provinces in ice cream production, per capita consumption and quality ice cream.

In 1935, at the request and with the approval of the ice cream manufacturers, the Pennsylvania legislature passed a law requiring the dairy products used in the manufacture of ice cream to meet the same sanitary requirements as milk for sale to the consumer. The same law requires the pasteurization of the dairy products used in the preparation of ice cream. Thus Pennsylvania combines cleanliness and safety for ice cream the same as for bottled milk. The requirements of this law and the interest of the ice cream manufacturers in the preparation of such a law may be the reason for the popularity of ice cream in Pennsylvania. Reports from the Milk Industry Foundation record Pennsylvania far in the lead of all states in ice cream production and in per capita consumption. Apparently cleanliness, safety, and real goodness are appreciated by the consumer.

While materials for the construction

of plants and equipment have been restricted, methods having to do with cleanliness and safety have been emphasized as follows:

1. The sterilization of equipment, pipes, and fittings immediately before the preparation of ice cream mix or ice cream.

2. The pasteurization of the ice cream mix recording the time and temperatures on a recording thermometer chart signed, dated, and on file in the milk plant where the mix is pasteurized.

3. The cleansing and sterilization of ice cream containers immediately before filling or the use of clean sterile containers delivered to the plant in closed sterile packages.

4. Prevent flies having access to the ice cream mix during and after pasteurization, the ice cream and the cleansed containers, equipment and fittings.

5. Prevent those having a headache, intestinal pain, or the "sniffles" from taking part in the preparation of ice cream mix and ice cream or in cleansing containers, equipment, etc.

What about our milk producer and ice cream manufacturer during the war? Our producer knows that our men and women in the armed services need the best food there is and more of it. So our producer is more particular in selecting a dairy herd that is free from tuberculosis, Bangs disease and mastitis; more diligent in preparing the corn and alfalfa for his silo; more attentive in providing fresh water for his cows, wholesome concentrates for milk production, and more insistent on stable sanitation and accurate production records.

Clean milk necessitates a clean milk house, clean utensils and equipment, and clean methods. Wet hand milking is abolished.

Our producer knows how flies killed our soldiers in the Civil War and in the Spanish War and how fly control was inaugurated in the first World War. He does not have to be told that privy vaults must be fly tight, water supplies protected from surface drainage, and manure piles located inaccessible to the cows. The producer knows that his brothers in the factories and his boys and girls in the Army cannot win a war on dirty food.

For cleanliness and quality we need a prosperous producer. A planned scarcity may help a few but a milk producer in Pennsylvania has had and still wants a planned abundance.

Our ice cream manufacturer is now a business man, a manager, a laborer, and a patriot. Yes, he can go to his plant a half hour earlier to have hot water ready to sterilize his equipment prior to making ice cream mix or freezing ice cream. In the past he did let this "scalding business" wait a day or two but not now. Every day is Flag Day. His mix is accurately pasteurized and each recording thermometer chart is dated, signed, and placed on file in his plant. The ice cream containers are cleansed and sterilized with heat—no "tb bugs" for his army. He used to feed the flies in the ice cream room, entertain them all day, and then gas them before going home. Not so now. No fly has access to his ice cream mix or ice cream or cleansed containers and equipment. His ice cream must be safe. Flies will have no place in the history of this war.

Our Pennsylvania milk producer and our Pennsylvania ice cream manufacturer are at war. More ice cream—cleaner ice cream—safer ice cream—these are their Bonds for Victory.

L. C. BULMER
W. C. CAMERON
H. L. DELOZIER
O. A. GHIGGOILE
RALPH E. IRWIN
ANDREW J. KROG
JOHN M. SCOTT
F. W. FABIAN, *Chairman*

EXCERPTS FROM THE REPORT OF THE CHIEF OF THE U. S. BUREAU OF DAIRY INDUSTRY, 1944

Market Problems

As a result of wartime demands the dairy industry is now producing and marketing approximately 15 billion pounds more milk annually than in the years immediately preceding the war. About two-fifths of the increase, or 5 percent of the total annual production, is going into lend-lease products. Military outlets take the rest of the increase, and more.

In the post-war period, when purchases for these outlets begin to decline, the dairy industry will be faced with the choice of either reducing milk production on the farm and curtailing operations in processing plants or increasing domestic consumption sufficiently to absorb the amount now going into lend-lease and a large part of the military purchases.

Many people in the United States are not now getting all the dairy products they need or want. Whether or not domestic consumption can be increased sufficiently to maintain the present output of the dairy industry, however, will depend not only on the post-war buying power of the people but on the combined efforts of dairy farmers, processors, and distributors to stimulate greater consumption through the use of educational and advertising programs. The effectiveness of such efforts will in turn depend on improving the quality, palatability, and safety of all dairy products, increasing the efficiency and economy of processing and distribution, and, above all, improving the average productivity per cow and per acre in order to decrease the farmer's cost of milk production. Greater efficiency on the farm and in the factory and savings in distribution costs to the consumer would make it possible to supply more milk to more people at less cost.

Cheese

For several years the Bureau has advocated that all milk intended for cheese making be graded; and also that it be pasteurized, regardless of quality, in order to enable the cheesemaker to control the making process more exactly. Cheese manufacturers generally are adopting the Bureau's method as rapidly as the availability of pasteurization equipment will permit. Introduction of the method in seven states that are producing cheese for shipment overseas has resulted in a marked improvement in the average grade. The work in Minnesota and Indiana has been practically completed and the results tabulated. In the Minnesota factories that were assisted by Bureau field men, the average percentage of U. S. No. 1 cheese was increased from 36 percent in 1942 to 99 percent in 1943. The production of U. S. No. 2 cheese in the same period decreased from 36 to 0.85 percent, and the production of undergrade cheese decreased from 27.8 to 0.12 percent.

One objection often cited against the use of pasteurized milk in making Cheddar cheese is that it slows down the rate of ripening. Experiments during the year indicated that if the milk has a high bacterial content the rate of ripening, or proteolysis, is retarded by pasteurizing the milk. When such milk is not pasteurized, however, the resulting cheese is very inferior in quality and abnormal in composition. On the other hand, if the milk is of high quality, pasteurization has no significant effect on the rate of ripening of the cheese.

During the year a number of companies indicated an interest in using the Bureau's new method of dehydrating natural Cheddar cheese, which was announced a year ago. One commercial company used the method in preparing 6 million pounds of dehydrated, compressed cheese-soya soup stock, of which 20 percent was dehydrated cheese. The new method of dehydrating cheese reduces the weight by 35 percent and the shipping or storage space by about 40 to 46 percent, and also makes it possible to transport and utilize the cheese without waste even though refrigeration is not available. Research on the method itself has been completed, but certain long-time keeping-quality tests are still under way.

DRIED MILK

It has long been recognized that the deterioration of dairy products that contain fat, such as butter and dried whole milk, is caused largely by oxidation of the fat. Commercial companies have used various procedures in an attempt to retard the oxidation process, including the use of antioxidants, low storage temperatures, and, in the case of dried whole milk, the use of inert gas to replace oxygen, but without complete success.

During the year the Bureau of Dairy Industry completed a fundamental study, with pure butterfat, to determine the relationship between oxygen concentration and the rate of deterioration of the fat. The results showed that as the amount of oxygen available for contact with the fat was reduced, the rate of oxidation or spoilage of the fat was slower, indicating that it would be possible to keep butterfat indefinitely without spoilage if it were packaged entirely free of oxygen.

The results of the fundamental study were confirmed by an analysis of the oxygen content and flavor score of 1,200 paired samples of dried whole milk that were packed and submitted by several commercial companies. Samples that contained about 3 or 4 percent of oxygen were found to keep twice as long as similar powder packed in air.

In the course of its research with dried whole milk, the Bureau concluded that considerable quantities of oxygen-containing gases were held within the powder by adsorption, even after the oxygen in the free space in the package had been reduced to 3 or 4 percent. The most practical method of attaining a concentration of less than 3 percent of oxygen in the container is through the use of a vacuum of more than 29 inches.

LACTOSE FROM CHEESE WHEY

Investigations relating to the manufacture of lactose, which have been under way intermittently for several years in the Bureau of Dairy Industry, were concluded during the year with the formulation of six different processes for producing lactose from cheese whey. Heretofore lactose was made largely from the whey that is produced as a byproduct in the manufacture of casein.

One of the important wartime needs for lactose is as a food for growing the molds that yield penicillin. Estimates indicate that 6 or 7 million pounds are now required annually for this purpose; this is approximately the total amount produced in former years. Moreover, no practicable commercial method for producing penicillin synthetically—which would eliminate the need for lactose—is available as yet.

The six new processes range from a simplified procedure which requires a minimum of equipment and labor but produces a crude product to a process requiring more labor and equipment but producing a sugar of high technical grade. Any of the processes may be modified by introducing parts of another process, thus enabling the manufacturer to formulate a procedure suited to his particular conditions. All processes require but one crystallization and yield grades of lactose suitable for many uses.

WARTIME ICE CREAM

In ice-cream mixes ranging from 8 to 14 percent butterfat, whey solids could be used to replace 15.6 to 37.5 percent of the nonfat milk solids normally used, with no adverse effect on the quality of the finished product. Where skim-milk solids are not available or are needed for more important uses, the substitution of whey solids would be of value in keeping ice-cream production up to the maximum amount permitted under wartime conditions.

Wartime restrictions on the amount of milk solids allotted to ice-cream manufacturers created renewed interest in the manufacture of sherbets as a means of extending the use of the available milk solids. To help these manufacturers, the Bureau made a study of the whipping properties of sherbets, with a view to determining the factors involved in controlling the overrun. It is generally accepted that the overrun should be low, but this has been difficult to accomplish. The experiments showed that the best quality of sherbet is obtained by drawing from the freezer at the lowest possible temperature and taking the overrun then existing. The biggest factor affecting overrun is the sugar content, that is, the higher the sugar content the lower the overrun obtainable. Sherbets of unusually low milk-solids content whip slowly.

Help was also offered ice-cream manufacturers in the time-consuming and puzzling operation of calculating mixes. A simpler and more direct method of making the necessary calculations was developed and published.

SYNTHETIC UREA IN DAIRY RATIONS

Short supplies of protein feeds in recent years have focused the attention of research workers on the possibility of using synthetic urea to meet the protein requirements of dairy cattle.

Made from coal, air, and water, urea looks like fine stock salt. It contains no protein itself but it does furnish the nitrogen needed to make protein in the animal body. The bacteria in the paunch of the cow and other ruminating animals combine the nitrogen of the urea with other feed constitutents to make protein in much the same way that plants take nitrates from the soil to make protein. Unlike ruminants, hogs and poultry cannot use urea to synthesize protein in the body.

In a 5 months' feeding experiment at Beltsville, cows fed corn silage made with the addition of 0.5 percent urea produced practically as much milk as when they were fed with the grain ration. There was no advantage in putting the urea in the silo with the corn. Cows fed urea as the principal source of protein declined only 13.5 percent in milk production in 100 days, which was only about two-thirds as much as would ordinarily be expected on other feeds.

Other feeding experiments showed that soybean meal can be replaced with an equal weight of low-protein feed plus one-seventh as much urea without affecting milk production materially one way or the other. The greatest usefulness for urea on dairy farms will be on those where plenty of grain is grown but where there is need for additional protein. This need can be supplied with urea more cheaply than with oilseed meals. The cost of urea is not likely to exceed 1 cent per cow per day.

THE UNIDENTIFIED GROWTH FACTOR IN MILK

Results of research reported previously by the Bureau of Dairy Industry have indicated that milk contains some "growth promoting" substance that has not been identified and is not any of the known nutrients. The work showed also that various milk products (commercial skim-milk powders, cheeses, commercial casein), liver extracts, beef muscle, lettuce, hays, etc., possess this growth-promoting property, whereas yeast, white flour, reenforced white flour, whole wheat flour, and various grains do not. The liver extract that is used intramuscularly in the treatment of pernicious anemia is a particularly good source of it, being about 1,600 times as potent as whole milk.

During the past year a concentrated preparation of the unidentified growth-promoting factor was made, which, although impure, was active in doses as small as 2 micrograms daily. It is none of the now known vitamins, but is a material that is active in doses of the magnitude of some of the known vitamins.

MILK PROTEINS

The Bureau has now developed methods for the determination of threonine, an essential amino acid that was discovered first in casein; and of serine, the amino acid linked to phosphoric acid in casein and in vitellin of the egg.

Serine and threonine are themselves quite stable; but it was found that when they are combined in proteins they are chemically much more reactive. The serine group, for instance, can be made to lose water and combine with other groups. Thus serine, which itself is not an essential amino acid, can be converted while combined in the protein molecule into cystein or cystin, two varieties of an amino acid present in casein which under some circumstances are essential for optimum growth.

In proteins like casein and the vitellin of the egg, in which phosphorus is combined with some of the serine, not only is the serine chemically reactive, but the phosphorus combined with it also possesses biological properties which may make it very useful in the animal organism. Results obtained in connection with this work are consistent with the idea that certain enzymes can either destroy combined serine and set free phosphoric acid, or leave the serine intact and liberate a phosphoryl group capable of contributing to carbohydrate metabolism.

The Bureau investigators believe that further work may explain the specific functions of the two phosphoproteins, casein of milk and the vitellin of egg, especially as related to the nutrition of the nursing mammal and the chick.

New Books and Other Publications

Food Regulation and Compliance, by Arthur D. Herrick. Vol. 1. Published by Revere Publishing Co., New York, 1944. XVI+646 pages.

The author states that it has been his objective to present the legislation affecting foods and their marketing comprehensively and in such a manner as to enable the producer and distributor to understand and to apply these statutory requirements to his particular products. Effort is made to explain the law in terms familiar to the reader; thus many illustrations are presented together with actual label titles and forms. All of this is done to help the reader to intelligently apply the law to his particular problem.

The presentation is chiefly built about the framework of the Federal Food, Drug, and Cosmetic Act as "being the principal statute concerned with food regulation in the United States. Other statutes, generally speaking, serve merely to complement its provisions." Particular emphasis is placed on the opinions and rulings of governmental agencies, especially the Food and Drug Administration through its Trade Correspondences, Food Inspection Decisions, and S.R.A.—Chemical issues.

The treatise is heavily documented both with official citations as well as bibliographical references to the technical literature. Official methods are printed for determining the fill of the container, together with lists of the label weights for canned foods. Early legislation, and then current enactments, are followed by a detailed study of the application of the law to the many food labeling, processing, packaging, and sponsoring practices, as well as standards, declarations of net contents, imitations and frauds, unstandardized products, special dietary foods, preservatives, and label display and exemptions.

Dictionary of Engineering and Machine Shop Terms, by A. H. Sandy. First American edition revised by I. E. Berck. Published by the Chemical Publishing Co., Inc., Brooklyn, N. Y. 1944. 153 pages. $2.75.

This volume is strictly a dictionary to help the beginner as well as the experienced person in the engineering world to know the correct meaning of many common words and terms with shades of meaning peculiar to the industry, as well as to become acquainted with some new ones introduced by new processes. The definitions are short, easy to understand, and number about eighteen hundred.

A Study of the Effectiveness of Sulfonamide Preparations in the Elimination of Bovine Mastitis, by W. W. Swett, R. R. Graves, C. A. Mathews, J. Frank Cone, and P. C. Underwood. Technical Bulletin No. 884, December 1944. U. S. Department of Agriculture, Washington, D. C. 20 pages.

This bulletin presents the results of the first ten months' work from the intramammary injections of sulfanilamide-in-oil, and sulfadiazine-in-oil, used singly or in combination, indicating the high merits of these preparations for use in eliminating mastitis infections, particularly streptococcal, staphylococcal, and coliform infections.

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Association News

Philadelphia Dairy Technology Society

"Fats in Human Nutrition" was the subject of a very interesting and educational talk by Dr. Herbert Longenecker, Director of Research of the University of Pittsburgh, before sixty-five members of the Philadelphia Dairy Technology Society and their friends at the March dinner meeting in Philadelphia.

Dr. Longenecker, a recognized authority on human nutrition, chose this subject as one of particular interest to dairymen because of the presence of butterfat in milk, and it proved to be so.

The next meeting, to be held the second Tuesday in May, will feature a "Question and Answer" program participated in by all present. From questions submitted, members particularly qualified to lead the discussion of each are chosen in advance, so that they will have time for preparation. This type of program was introduced very successfully in 1944, and a lively and educational meeting is being anticipated.

HELEN A. SUTTON,
Secretary.

Michigan Association of Dairy Milk Inspectors

The Bacteriology Department of Michigan State College and the Lansing Department of Health are making a study of various well-known procedures, plus a few new methods, under general farm conditions wherein the farmer is given a technique and materials. He is then left alone to carry out the procedure as he would under conditions where testing was not being done. Each farmer is checked weekly over a period of a year in order to include all seasonal variations. Ten producers are used on each test and a total of 80 farms are included in the study. All types of machines are distributed proportionally on each procedure.

To teach Michigan farmers proper methods of handling dairy equipment and dairy products in order to improve the quality of milk and cream is the purpose of an experiment recently undertaken at Michigan State College, financed by a grant of $15,000 from Swift & Company, of Chicago. (See page —).

Hugel Leonard, Sanitarian of Health Department District No. 1, comprised of Crawford, Kalkaska, Missaukee, and Roscommon counties, arranged and conducted two milk sanitation meetings for the producer and distributors in his district.

The program consisted of a discussion of detergents and milk sanitation on the farm and in the plant, illustrated with slides.

There was a total attendance of 225 people. Local equipment companies displayed dairy equipment and utensils.

The committee on education arranged an extension course which included general bacteriology, sanitation bacteriology, and standard methods. The instructor is Dr. W. L. Mallmann, professor of Sanitary Bacteriology at M.S.C.

Herreid Joins Staff at Illinois

Doctor E. O. Herreid has resigned his position at the University of Vermont to become Professor of Dairy Manufactures in the College of Agriculture at the University of Illinois. Doctor Herreid, a veteran of World War I, received his B.S. degree from South Dakota State College in 1927. He then went to Minnesota where he studied under the late Professors Palmer and Eckles, receiving his Doctor's degree in 1933. A member of the Dairy Department staff at Minnesota from 1928 through 1935 he joined the Department of Animal and Dairy Husbandry at Vermont in 1936 where he served as Professor of Dairy Manufactures. Doctor Herreid was also secretary of the Vermont Dairy Plant Operators and Manager's Association. He has published a number of research articles on market milk, a field in which he is recognized as an authority. Mrs. Herreid and the two younger sons plan to join Doctor Herreid at Urbana in June. The older son is hospitalized in San Antonio, Texas, after having served overseas with the 9th Army.

Michigan Studies Milk Improvement

A $15,000 grant by Swift & Company, Chicago, to the agriculture experiment station of Michigan State college for use in a project relating to improvement of cream and milk for manufacturing purposes was accepted by the State Board of Agriculture, governing body of the college, on January 18.

Three Michigan State staff members have been assigned to work on the two-year project. J. M. Jensen, extension assistant professor in dairy, will work full-time on the project, and E. G. McKibben, head of the department of agricultural engineering, and A. L. Bortree, bacteriology instructor, will assist on a part-time basis.

Demonstrations will be given for Michigan farmers in the proper handling of dairy equipment and dairy products so that the quality of milk and cream is preserved. Improved methods and procedures will be developed and passed along to the dairy farmer, after which the results of the change from old to new will be determined.

Emphasis will be placed on the elimination of dairy equipment contamination by proper cleansing with different solutions, correct storage temperatures, use of modern heating and refrigerating equipment, prevention of yeast and mold, and greater efficiency in doing the milking chores. One demonstration will show how to clean a milking machine in five minutes, a job ordinarily requiring 20 minutes by older methods still in use on most dairy farms.

Title of the project is "Improving Cream and Milk for Manufacturing Purposes."

Brucellosis Vaccine Authorized for Adult Cattle

Biological supply houses that produce brucellosis vaccine under licenses issued by the Bureau of Animal Industry, U. S. Department of Agriculture, may now recommend the vaccine, under certain conditions, for adult animals as well as for calves.

As first used in the official Federal-State campaign against brucellosis, or Bang's disease, vaccination was limited to calves. Subsequent research and field trials, however, have shown that the vaccine is effective in preventing brucellosis in adult cattle. But because of certain physiological effects of vaccination that interfere with the results of future blood tests for brucellosis, vaccination of adult cattle is advised only in certain instances. It is not recommended when vaccinated animals are to be sold subject to a blood test, nor is vaccination of adult cattle advised when the future control of the disease in the herd is to be based on the elimination of reactors to the customary blood test, or in lightly infected herds where the disease has been inactive for some time.

The Bureau's recent official notice provides that licensees may recommend the vaccine for the immunization of bovine animals over 4 months of age if not more than 4 months in pregnancy and if use of the vaccine is not prohibited by the State. The purpose of limiting its use in animals advanced in pregnancy is to prevent possible adverse effect of the vaccine on the unborn calf. The second limitation is to prevent possible conflict with existing State laws that govern the marketing of biological products.

Human Brucellosis of Caprine Origin

Because goat breeding is a relatively minor industry in the United States, undulant fever of caprine origin was rather late in attracting general attention in the medical and veterinary professions in this country. The disease, was, however, long known and feared, for, in 1905, a shipment of 65 goats from Malta was quarantined, rejected, and destroyed on account of having been found to have brucellosis. A few weeks later, 8 members of the ship's crew who had drunk the milk of these goats developed undulant fever. In Texas, 19.4 percent of a herd of 128 goats were found to be infected with *Brucella melitensis* in 1911, and 12 human cases were traced thereto, the same year. In 1922, the U. S. Public Health Service reported 35 human cases of captine origin in Phoenix, Arizona. Veterinarians recall that State Veterinarian W. A. Stevenson, of Utah, died in 1923 from undulant fever, contracted in handling afterbirths of infected goats. Giltner, of the U. S. Bureau of Animal Industry, in 1934, following an investigation in the Southwest, contended that caprine brucellosis was a potential menace to human health. The 3,636 unclassified human cases in the United States in 1943, tabulated by the U. S. Public Health Service, lent force to Giltner's contention, since 339 of these were in Texas, 244 in California, 40 in Colorado, and 26 in Oklahoma. A survey of cheese making from goats' milk in southwestern Colorado, which had developed into a sizable industry there, revealed important facts concerning the incidence of infective goat cheese derived from the lowly bred and rather badly managed "brush goats" of that section. Of 19 samples of goat cheese examined, 8 were positive for *Brucella melitensis* when injected into guinea pigs—an interesting fact in view of other cheese-borne infections coming to light. (Geo. W. Stiles, Bacteriologist in Charge, Pathological Laboratory, U. S. Bureau of Animal Industry, Denver, Colorado—J. A.V.M.A., April, 1945, page 224.)

Orange County Milk Sanitarians' Association

A number of persons interested in milk sanitation in Orange County felt a need last summer for an organization of milk industry representatives. Milk plants in Orange and adjacent counties, as well as representatives of official control agencies, were circularized and the interest was surprisingly great.

The membership consists of veterinarians, company and official milk inspectors, plant managers and general plant employees. We also have a number of laboratory technicians among our members.

At the first meeting, the following officers were elected: President, Dr. Harry G. Hodges; Vice-president, S. Abraham; Treasurer, Richard Russ; Secretary, H. B. Marlatt; Executive Committee, Andrew Tomkins, Milton Kinney, and George Decker.

Submitted by,
S. ABRAHAM

New Members

ACTIVE

Chapman, Dr. Orren D., Director, Bureau of Laboratories, Dept. of Health, 766 Irving Ave., Syracuse 10, N. Y.

Gotta, Charles E., Milk Sanitarian, State Health Department, Lansing 4, Mich.

Haskell, Dr. Wm. H. Senior Milk Specialist, U.S.P.H. Service, 1852, U. S. Custom House, Chicago 7, Ill.

Madariaga, Sr. Justino Sanchez, Bahia de Todos Santos #91, Col. Huasteca, Mexico City, Mexico.

Mallman, W. L., Michigan State College, East Lansing, Mich.

Miller, Harry E., School of Public Health, University of Michigan, Ann Arbor, Mich.

Pertusson, O. B., Milk Inspector, Medical and Health Department, Hamilton, Bermuda.

Wolcott, Arthur, Dairy Inspector, City Health Department, Saginaw, Mich.

ASSOCIATE

*Abbuehl, Ernest A., Mgr. and Fieldman, Stella Cheese Co., Clear Lake, Wis.

*Ahlstrom, Walter, Technical Control Director, Carnation Co., 5225 Wilshire Blvd., Los Angeles 36, Cal.

*Anderson, Kenneth, Fieldman, Stella Cheese Co., Box 431, Amery, Wis.

*Bandeen, K. C., Isabella County Health Dept., Mt. Pleasant, Mich.

*Barbee, James C., Veterinarian, Abbotts Dairies, Inc., 36 W. Newton St., Rice Lake, Wis.

*Barnhart, J. V., Laboratory Technician, State Department of Agriculture, 2819 Third Ave., Richmond, Va.

*Belfer, Samuel, Director, The Belfer Laboratories, 746 Jefferson Bldg., Peoria, Ill.

*Bell, George, Director of Lab., Meadowmoor Dairies, 4534 No. Maplewood Ave., Chicago, Ill.

*Bernhardt, Christian, Fieldman, Abbotts Dairies, Inc., Bruce, Wis.

*Beyrer, E. E., Vice-President, Connorsville Co-op Creamery Assoc., Downing, Wis.

*Bicknell, W. E., Cass County Health Dept., Cassopolis, Mich.

*Boisvert, Oscar, Manager, Laurentide Dairy Products, Ltd., Ste-Anne-De-La Perade, Champlain, Canada

*Braddock, Tom, Territory Supt., De Laval Separator Co., P. O. Box 12, De Kalb, Ill.

*Broome, Dr. A., Battle Creek Health Dept., Battle Creek, Mich.

*Brunner, Lt. T. F., Adjutant, 7 sv. C., Med. Laboratory, Fort Omaha 11, Neb.
*Bubb, Donald L., St. Joseph County Health Dept., Centreville, Mich.
*Calder, T. B., Chemist in Charge, W. Clark, Ltd., 955 Amherst St., Montreal, Canada.
*Carnes, R. W., Supervisor, Field Dept., Abbotts Dairies, Inc., Chetek, Wis.
*Chute, Ralph M., Hillsdale County Health Dept., Hillsdale, Mich.
*Coltson, Russell H., Oakland County Health Department, Pontiac, Mich.
*Crossman, H. J., Genesee County Health Department, Flint, Mich.
*Donnelly, John, District No. 7 Health Department, Gladwin, Mich.
*Driederic, Frank J., Alger-Schoolcraft Health Dept., Manistique, Mich.
*Durocke, John E., Dairy Inspector, Chicago Board of Health, 9335 Rhodes Ave., Chicago, Ill.
*Eccleston, Guy C., District No. 3 Health Department, Charlevoix, Mich.
*Esmond, Raymond K., Mgr., Dean Milk Co., Box C. Harvard, Ill.
*Fischer, Arnold J., Fieldman and Tester, Prescott Creamery Co., Box 27, Prescott, Wis.
*Gibblin, Joseph J., 204 Fulton St., Olean, N. Y., Gibblin's Dairy.
*Gibson, Gilbert G., Director of Laboratory, Sidney Wanzer & Sons, 130 W. Garfield Blvd., Chicago, Ill.
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*Grosso, Antonino Luis, Cangallo 3782, Buenos Aires, Argentina, Production, Kraft Cheese Company of Argentina.
*Guerin, Wm. J., Jr., Fieldman, The Borden Co., 530 Sycamore Road, De Kalb, Ill.
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*Kopitzke, L. E., President, Wisconsin Cheesemakers Assn., Marion, Wis.
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*Nelson, D. J., Pet Milk Co., Hudson, Mich.
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*Wyma, John, Ottawa County Health Dept., Grand Haven, Mich.

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"Dr. Jones" Says—*

One of Channing Pollock's stories I read a while ago—it was about some people that bought an old place in the outskirts of a city. It was an unattractive neighborhood: poor roads, a few run-down houses, a rubbish dump in the offing—that sort of thing.

Well, they began fixing the place up: changed the house over so it was artistic, set out trees and shrubbery, laid out a drive-way and all that. After a little the idea began to spread. The neighbors began fixing up and the city paved the street. People began buying lots and building good houses. Now it's an extra nice residential section.

It all started from those first people fixing up their own place. And, the moral of the story: if we want a better world, the most convincing way to go about getting it is to improve conditions where we are.

A fellow I heard about: a part of his job every day is expounding the virtues of one of these patent remedies for prevention of colds—we'll call it Sniff Snuffer. A friend dropped in on him one day and found him dragging around, himself, with a bad cold. "Well," he says, "can't be you used Sniff Snuffer." He gave him a funny look—"Oh, *that* stuff!" he says. Well, anybody't felt that way about it: he couldn't be a very convincing salesman. If he could demonstrate, from his own experience, that it was as good as he claimed it was, less eloquence might carry more conviction.

This same general idea, of course, applies to public health as well as other things. I don't see many people but what want to have good health themselves and'll agree that it's essential to their individual success and happiness. But what ain't so easy for 'em to see—some of 'em—is that they can't assure their own good health just by looking out for themselves.

The best place to be healthy is a healthy community but healthy communities don't just happen. They're made that way by application of measures that're well-known and well-proven. It takes more'n a good health officer to do it. He's got to have back of him people that understand what he's trying to do and why and are whole-heartedly for it. In short, the best way to start improving conditions is to let our own lights so shine that men can see our good works and see't they *are* good.

PAUL B. BROOKS, M.D.

* *Health News*, New York State Department of Health, Albany, Feb. 19, 1945.