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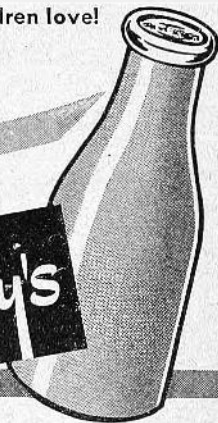
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JOURNAL of MILK TECHNOLOGY

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Editorials

The opinions and ideas expressed in papers and editorials are those of the respective authors.

The expressions of the Association are completely recorded in the transactions.

Milk Industry—Wake Up!

FOR years now, the bottled milk industry has complained about the inroads that the evaporated milk industry has made in milk consumption. At first there was more basis for complaint from the standpoint of sanitary quality of product than there is now. However, the evaporated people finally woke up, started a consistent program of cleaning up, and have been improving the innate nutritional quality of their product, an example of which is the widespread fortification with vitamin D. Now comes the report of the work on ascorbic acid in evaporated milk* whereby Josephson and Doan show that

“Fortification of vitamin D evaporated milk with 50 to 100 milligrams per liter of ascorbic acid (reconstituted basis) is a commercially feasible and economically sound proposal if the cans are sealed under vacuum. Such fortification would correct one of the most obvious nutritional deficiencies of this otherwise rather complete food. . . . The decrease in the ascorbic content of evaporated milk after the second month of storage proceeds at a slow and rather constant rate up to one year and presumably longer; but the rate of depletion in fortified, vacuum sealed milk compares very favorably with the rate in canned fruit juices, usually considered good sources of naturally preserved ascorbic acid. . . . Ascorbic acid in infant formulas prepared from fortified evaporated milk is surprisingly stable, and if such milk were available, it could be depended upon as a source of this vitamin in infant feeding. Concentrated milk may be fortified and held for 24 hours before filling and sterilizing without significant loss of ascorbic acid. . . .”

Point 1: Sharp's work showed that the appreciable ascorbic content of natural, fluid milk can be conserved by proper milk-handling. In other words, fluid milk contained much ascorbic acid but processing destroyed most of it. Bottled milk had it but lost it.

Point 2: The milk industry accepted the situation (lying down), and even encouraged the fruit juice industry to share their heretofore exclusive field. (The step from fresh orange juice to canned juices was so small that the canned foods industry has since capitalized on this open door to “invade” with a great variety of canned infant foods.)

* Josephson, D. V. and Doan, F. J.: Ascorbic Acid in Evaporated Milk. *Pennsylvania Agr. Exp. Sta. Bul.* 473 (1945).

Point 3: Fortification has paid dividends in the evaporated and oleomargarine fields. In this instant report, the possibility is revealed for the evaporated milk industry (and next—why not margarine?) to add still further to the nutritional quality of its product.

Point 4: The bottled milk industry ignored the ascorbic quality feature. The evaporated milk industry faces an open door. We stand on the side lines and watch.

Looking around we observe that milk technology has made great strides in the past few years. Dairy husbandry, milk production and transportation, milk quality control methods, milk processing technology, milk packaging practices, and milk merchandizing all have been and still are on the march of progress and improvement. But we fail to see much concern over the improvement of the product itself (except to reduce the bacterial content from, let's say, 5,000 to 4,587!). Insofar as bottled milk for household consumption is concerned, the great emphasis is on "safety" and "food value."

"Safety." This word implies near escape from a *hazard*. In growing industries such as transportation, sports, recreation, and others, the sales appeal is not made to our fear complex. They base it on attractiveness, desirability, benefit. In the milk industry, we inform the public that they escaped illness caused by milk when we emphasize its safety and our *protective* measures. Our milk plants are made to look like hospitals—and even hospitals now are beginning to get away from this "hospital" look, recognizing that this is not conducive to the best emotional condition of the patient.

"Food value." Much is rightly said about food value. But we are inclined to agree with the advertising people that this emphasis has now been worn rather thin. There is nothing emotionally stirring in these words alone. For many years now, milk has looked the same, tasted the same, and been the same (nutritionally). True, the bacterial content is a little (insignificantly) lower and the farms are cleaner and the plants are prettier but we never consumed milk because of its bacteria, farms, or plants. Homogenization of bottled milk is now fifteen years (or so) old, the mineral and protein story is twenty years old, and the vitamin story is twenty-five. In military parlance, the thrust has lost its force. The aggressiveness of the advance has toned down.

What obtains for the liquid product applied to the byproducts. "Milk fat is yielding better and better products—more and better butter and ice cream. Cheese is being improved and excellently merchandized. Skim milk goes into powder—for animals—and into paint and fiber and billiard balls—for humans.

Well, the bottled milk industry is paying a price for its failure (neglect, somnolence, and ignorance of the know-how) to put more nutritional quality into its product and for operating in such a way that the price level stays up and for complacency in standing pat on its accomplishment of achieving the support of the health departments, medical schools, and universities. Observe the relative loss of position, to say the least, that bottled milk is suffering by the initiative of the "new blood" in the competing foods.

What can be done about it all? In the first place, a good start will be made when the bottled milk industry gives a greater place in its directive councils to public service. Are we still too close to the old "milk man" days to realize that we must apply imagination and boldness and fundamental research? We see what automotive transportation is doing to the erstwhile stagnant railroad industry; we see what air transportation is doing to the steamship people; and we see on all sides the stimulus from the new day. Maybe the milk industry can be made to see that things are not going to continue as they have been.

Another important step would be for the bottled milk industry—as an industry—to sponsor the greatest coordinated research program in the history of industrial development. Heretofore the industry has had the benefit of the splendid research of the experiment stations, the universities, the Federal Government, the medical schools, and the milk companies individually. These agencies have produced an enormous volume of information, much of which has been used profitably. Competitors are now increasing their activities along these same lines. Why let them catch up? Napoleon used to say that the best defense against the enemy's fire is a well directed one of your own. All right then, success in developing the bottled milk industry beyond its present state is to do a bigger and a better job of research and development than our competitors can do.

What should this research do? First, organize so that it is not "pushed" to produce early saleable information. Give the personnel plenty of time to ponder and poke around and dig deeply way below the ground, so to speak, where no one sees what they are doing. Moreover, encourage them to criticize everything that the milk industry is now doing: good, bad, and indifferent. No person calls in a doctor until he recognizes that he is sick. Often the treatment comes too late. So a wise policy is to examine the situation before it gets beyond control. Then, organize to comprise every aspect of the bottled milk industry: production, transportation, plant processing, merchandizing, including public relations, economics, public health, employer-employee relations, education, and maybe others. Finally, back this program with the resources that only such a great industry as that of bottled milk can.

"Knowledge is Power" reiterates the American Chemical Society. Then add the influence of the engineers, the bacteriologists, the food technologists, the economists, the medical men, the merchandizing people—all engaged in a *coordinated* objective. This is the method whereby American scientific research won the war. Likewise, the milk industry *can* dominate the food field.

J. H. S.

"Milk and Food Sanitarians"

ISN'T milk a food? Yes. Then why "milk and food sanitarians"? Because heretofore, milk sanitation and technology have been the only consideration of the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS from the standpoint of the organization. As a matter of fact, probably over one half of its members—and certainly over three-fourths of its administrative members—are responsible for the quality of general foods in addition to that of milk. Thanks to the initiative of the U. S. Public Health Service, people are increasingly recognizing what we have been emphasizing for some time, namely, that the food industry in general needs the same kind of sanitary supervision that brought the milk industry to its present high state. Of course, this "same kind" does not refer to the detailed procedure but to the main directives, public health objectives, and supervising procedures.

The similarity of the problems in these two parts of the same field calls

for its formal recognition. This latter means that subjects in the whole food field—restaurants, meat packing, canning, baking, refrigeration, drying—all present problems that are solved by the responsible control men, both official and industrial, getting together at professional meetings, exchanging ideas, comparing notes, evaluating procedures, and stimulating thought. Each group has plenty to learn from the others.*

A broader program need not weaken the emphasis of any part. The limited time available for a meeting may exert some influence on the type of papers presented because naturally all the papers could not be devoted to milk exclusively. It is probable that fewer papers on dairy subjects will be presented but it is likewise probable that the topics that are presented will be those that are most pressing and that will be given more rigorous development. In any event, we see no reason why the quality of the programs should suffer because of the wider scope of the foods considered.

The effect on the *JOURNAL OF MILK TECHNOLOGY* cannot help but be beneficial. More papers of wider diversity should enlist greater patronage by subscriptions and advertisements. Such a development should hasten the time when the *JOURNAL* could issue as a monthly. Maybe this is an opportune time to revise its name to include the fields of its readers.

We see no reason for maintaining any distinction in the membership between sanitarians in governmental work (national, state, or municipal) and those in industrial, teaching, research, or administrative work. The only requirement we believe to be necessary is professional attainment: knowledge, interest, and experience. The workers in all these branches are conscientious, well-trained men, seeking the common objective of producing high quality food. All are equally desirable as members and officers. This equality of status should operate to give diversity to the programs of the annual meetings and reduce the tendency for an organization to get into a rut.

Means should be provided within the constitutional scope of the Association for the organization of local groups of milk and food sanitarians into sections which can affiliate with the national body. Such a setup would bring the influence of the many to help any local situation, and conversely, would give local conditions a national exposure. This would enhance the professional standing of the members and would constitute a stabilizing influence in the interest of employment security. Moreover, papers presented at these local meetings would be available for publication in the *JOURNAL*. Furthermore, many members who could not attend the more distant national meeting could more readily attend the regional ones.

We believe that the science and technology of milk and food production, processing, and distribution are facing a lot of changes. The application of research, the influence of new conditions of living, the effects of economic forces, the stimulus of competition for markets, and the power of a steadily increasing public health-mindedness, all contribute to the need for the sanitarian to keep posted as to what is going on, why such and such is done, how it affects his own particular field and locality, and how he will handle the situation when he meets it. His strength will lie in his knowing more about the given matter than will his competitors or others with whom he has to deal. Again, knowledge is power. This comes to the professionally alert. In these strenuous days, Heaven help the sleepers!

J. H. S.

* Since writing the above, we learn that the Missouri Association of Milk Sanitarians changed their name to that of the Missouri Association of Milk and Food Sanitarians. Insofar as we know, this live organization is the first of our milk groups to take this progressive step.—Editor

The Survival of Staphylococci Food Poisoning Strain in the Gut and Excreta of the House Fly

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INTRODUCTION

AN attempt was made to determine the possible importance of the housefly (*Musca domestica*) as a reservoir host in the transmission of staphylococcal food-poisoning. The procedures followed in making this study were isolation of staphylococci from wild-caught flies and determination of the length of survival of *Staphylococcus aureus*, 611, on the exterior and in the digestive tract of houseflies reared in the laboratory.

REVIEW OF LITERATURE

Among the early bacteriological investigations made to demonstrate the mechanical carriage of disease organisms by flies were those of Raimbert (1869) and Devaine (1870). They placed flies on material contaminated with the anthrax bacillus and were able to recover the organism from the legs of the flies. Bollinger (1874), by isolating the bacillus from the intestine of flies which were swarming around an infected carcass, showed the possibility of the fly as a reservoir host.

Nicholas (1873) observed the large numbers of flies in areas of cholera epidemics. He believed that by their habits of engorging themselves indiscriminately and disgorging themselves on utensils, they were able to transmit the cholera bacillus. Maddox (1885) isolated the vibrio from the feet and from the feces of wild-caught flies.

The work of Spillman and Haushalter (1887) indicated that tubercle

bacilli were spread by flies and that the organisms were isolated from the intestinal tract and from the feet after the flies were allowed to feed on tuberculous sputum. Hofmann (1888) found the bacillus present in the excreta of flies taken from a room where a patient died of tuberculosis.

Large numbers of flies in areas along the Nile River where purulent ophthalmia was prevalent were observed by Howe (1888). He also noted that areas with fewer flies had less incidence of disease. The indifference of the natives to the swarming of the flies around the eyes and to the sucking of the conjunctival secretions led him to conclude that flies were mechanical carriers of Egyptian ophthalmia. Bacteria similar to those found in conjunctival secretions were found on the feet of flies which had previously come in contact with diseased eyes. Flies of the same origin sent to the United States Bureau of Entomology were identified as *Musca domestica*.

In his studies of pathogenic organisms in dejections of flies, Celli (1888) was one of the first to give bacteriological evidence of the transmission of the typhoid bacillus by flies.

In 1892, the findings of Sawtchenko and Uffelman gave support to earlier findings concerning the fly as a host for the cholera vibrio. Sawtchenko found the vibrio in the intestine of artificially infected flies. Uffelman demonstrated that by the manner in which flies feed they can contaminate milk and other food.

Bacteriological studies indicating the possible transmission of plague were

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made by Yersin (1894) who isolated the bacillus from dead flies present in a laboratory where autopsies on plague animals had been made. Nuttall (1897) demonstrated the survival of the plague bacillus in the fly 48 hours after inoculation when the flies were kept at 12-14°C. If a higher temperature was maintained, the insects developed the disease and died quickly.

Vaughn, of the United States Army Typhoid Commission of 1898, was one of many investigators who reported the correlation of numbers of flies to numbers of cases in epidemics of typhoid. He observed that the habits of flies feeding on fecal and other contaminated material and then on clean food within a relatively short period of time, were significant in the spread of the disease. Hamilton (1903) isolated *B. typhosa* from "wild" flies caught in undrained privies. Mechanical spread of *B. typhosa* by artificially infected flies was demonstrated by Firth and Horrocks (1902). By recovering *B. typhosa* from the fly 23 days after it was infected, Ficker (1902) indicated that the fly may serve as a reservoir host for the agent.

During the period 1911 through 1940 most of the investigations dealing with flies correlated and substantiated the findings of the earlier workers.

In 1941, Rukland and Huddleson believed that *Brucella abortis* was carried by flies and recovered the organism from the digestive tract of the fly 96 hours after infection.

Ostrolenk and Welch (1942) made several studies of the transmission of food-poisoning organisms by houseflies. Flies infected with *Salmonella enteritidis* were capable of contaminating food. Rats were infected by eating food that had been visited by inoculated houseflies. Food contaminated by these rats was a source of infection for other houseflies. *Salmonella enteritidis* apparently survived in the housefly for the lifetime of the

fly. This work indicated that the housefly was probably important as a reservoir host in the transmission of food-poisoning, especially when food was not re-treated or was served raw after it had been exposed to flies.

Although staphylococci have been reported as having been isolated from *Musca domestica* (Hewitt, 1914) no definite study has been made concerning their importance in the transmission of pyogenic infections and food-poisoning caused by staphylococci.

MATERIALS AND METHODS

The culture of *Musca domestica* used in this investigation was secured from the stock collection maintained by the Department of Zoology and Entomology of the Ohio State University.

The houseflies were reared in a manner similar to that outlined by Richardson (1932).

Staphylococcus aureus, 611, was obtained from the stock culture collection maintained in the Department of Bacteriology. It had been isolated from a cake which caused an outbreak of staphylococcus food-poisoning in Milwaukee.

Methods and identification of Staphylococcus aureus, 611. The survival of *Staphylococcus aureus*, 611, on the exterior of the fly, in the digestive tract, and in the vomit and fecal spots of the fly was determined by isolating the organism from these sources for varying lengths of time after it had been fed to the houseflies. The isolated staphylococci were identified as the experimental strain by typical colony formation, cell arrangement, coagulability, and bacteriophage susceptibility.

Examination of morphological characteristics. All colonies which were typical staphylococcal type colonies isolated in the following procedures were stained by the Gram method. Those which gave typical cell morphology and arrangement were transferred to 0.2 percent dextrose broth and incubated for 18 hours at 37° C. for coagulase testing.

Determination of coagulability. Coagulase tests were run by mixing 0.5 cc. dextrose broth culture with 0.5 cc. citrated human plasma and incubating the mixture at 37° C. The ability of the organisms to coagulate the plasma was noted after 3, 6, and 18 hours of incubation.

Identification by bacteriophage susceptibility. Coagulase positive staphylococci were specifically identified as *Staphylococcus aureus*, 611, by the bacteriophage typing technique developed by Fisher (1945), and the bacteriophages used were secured from her. The cultures to be identified, and the test organism for control, were grown for 18 hours at 37° C. in 0.2 percent dextrose broth. The broth cultures were streaked evenly on Bacto tryptose agar plates and were allowed to dry. Three bacteriophages, one which lyses *Staphylococcus aureus* 611, and two controls, each capable of lysing many different strains but not *Staphylococcus aureus*, 611, were spotted on the streaks with capillary pipettes. When the spots had been adsorbed, the plates were incubated for 6 hours at 37° C. and 18 hours at 6-10° C. Upon observation, any degree of lysis was considered positive.

The isolated staphylococci which were coagulase positive and were lysed by the bacteriophage to which *Staphylococcus aureus*, 611, was lytically susceptible were identified as the experimental strain.

Method of feeding Staphylococcus aureus, 611. The experimental food-poisoning strain, was streaked heavily on tryptose agar plates and allowed to incubate 24 hours at 37° C. The growth was suspended in sterile 1 percent sucrose, and poured onto sterile filter pads in petri dishes. This suspension was fed to flies which had had no food for 12 hours.

Determination of mechanical dissemination of Staphylococcus aureus, 611, in the foot prints and proboscis marks of the housefly as it walks over material.

Plates of nutrient agar containing 7.5 percent NaCl were exposed in the cages from 1 to 5 minutes depending on the number of flies in the cage. This culture medium inhibited the growth of Gram negative bacteria which had a tendency to overgrow staphylococci and make their isolation most difficult. The exposed plates were incubated 48 hours at 37° C. and typical colonies were identified by morphology, coagulability and bacteriophage susceptibility.

Sample flies for study were caught in a sterile test tube by manipulating the tube against the walls of the cage. Three to five flies were considered a representative sample. They were allowed to remain in the test tube for 60 minutes. After this time, during which they deposited vomit and fecal material on the walls of the tube, they were anesthetized with other soaked cotton plugs.

Determination of possible mechanical dissemination of Staphylococcus aureus, 611, by the presence of the organism on the exterior of the housefly.

The anesthetized flies were transferred to a tube of 0.2 percent dextrose broth, agitated, and removed from the medium. The broth was incubated 48 hours at 37° C. The washings which showed the presence of staphylococci, as determined by the Gram stain, were streaked on 7.5 percent NaCl nutrient agar for growth and isolation of pure cultures to be used for identification.

Determination of the distribution of Staphylococcus aureus, 611, in the vomit and fecal material of the housefly.

The tubes from which the anesthetized flies were taken were rinsed with 0.2 percent dextrose broth and the suspensions of the excreta and vomitus were streaked on the selective medium for isolation and identification of the staphylococci.

Determination of Musca domestica as a possible reservoir of Staphylococcus aureus, 611.

Before determining the presence of

the experimental strain in the digestive tract of the housefly, the remaining organisms on the exterior of the previously examined flies were removed by washing the samples for 5 minutes in a mixture (Ostrolenk and Welsh, 1942) of 1.0 percent Aerosol,* 1.0 percent sodium hydroxide, and 5.0 percent formaldehyde, followed by four rinsings in dextrose broth. To determine the efficiency of sterilization, rinsings were incubated 48 hours at 37° C. and examined for growth.

The washed flies were ground with a glass rod in a tube of dextrose broth. The suspension was streaked on tryptose agar and on salt agar plates and incubated 48 hours at 37° C. The typical colonies were identified as outlined above.

Study of Pathogenic Staphylococci Associated with Wild-caught Flies.

Collection of samples. The fly traps used to collect the samples of wild-caught flies were a modification of the one described by Howard (1931) and the Council on Health and Public Instruction of the American Medical Association. The frame was made of no. 9 galvanized wire and covered with twelve mesh wire gauze.

Flies were collected in the clinic and in the isolation barn of the Veterinary College and in a country home where flies were numerous.

Examination of samples. Only those flies which resembled *Musca domestica* were examined. Detailed identification of the species was not attempted.

The fly traps were refrigerated at 6-10° C. until the flies were inactivated by the cold. The specimens were placed in sterile test tubes, anesthetized with ether, and treated in a manner similar to the "cultured" flies. The exterior of the flies were sterilized by washing with 1.0 percent Aerosol, 1.0 percent sodium hydroxide, and 5.0 percent formaldehyde, followed by rinsing four times in nutrient broth. The

sterilized flies were ground in nutrient broth and then streaked on nutrient agar plates. After incubation at 37° C. for 48 hours, the associated bacteria which showed typical staphylococcal type colonies and cell morphology and arrangement were inoculated on nutrient agar slants and nutrient broth. Coagulase tests were used to indicate the pathogenicity of the strains. Identification of the species was not attempted.

RESULTS OF EXPERIMENTS

A suspension of *Staphylococcus aureus*, 611, in dilute sucrose solution was fed to *Musca domestica* in nine test cages each of which housed approximately one hundred flies. Five control cages were used during the investigation.

Staphylococcus aureus, 611, was deposited on plates by all of the six samples tested for 24 hours after the organism had been fed to the flies. It was not found on six plates exposed after that time.

The organism was recovered periodically from two of twenty-five suspension of specks (vomit and fecal material). The infectious dejections were collected on the third and fifth days after feeding.

The test organism was recovered from the digestive tract of fourteen of the nineteen samples on 3 consecutive days and from eighteen of thirty-two samples periodically through 28 days. Six samples examined after the eighth day were free of the test organism.

All staphylococci recovered from the samples which showed the colony characteristics of *Staphylococcus aureus*, 611, were tested for coagulability. Those strains which were coagulase positive were typed by the bacteriophage technic. Fifty percent of the strains which coagulated plasma were not susceptible to the lytic action of bacteriophage. Control plates in the bacteriophage technic showed that the bacteriophages did not become inactive

*Wetting agent distributed by Fisher Scientific Company.

nor did they lose their degree of specificity necessary in this application.

All groups of flies were examined for the presence of staphylococci before they were fed the test organism. Staphylococci were isolated from one set, but its non-coagulability showed that these organisms were not identical to *Staphylococcus aureus*, 611.

Control cages of flies maintained throughout the course of the investigation remained free of *Staphylococcus aureus*, 611.

A summary of the experimental data is given in Table 1.

Fifty wild-caught flies were obtained from different sources and examined for the presence of staphylococci. Ten flies showed the presence of these organisms; but, as determined by the coagulase test, they were not comparable to the pathogenic features of *Staphylococcus aureus*, 611.

positing them periodically as long as the organism remains in the digestive tract.

Isolation of pure cultures of staphylococci was made difficult by the presence of large numbers of a spreading organism in the natural flora of the digestive tract of houseflies. Occasional overgrowth of colonies of staphylococci by swarming organisms may account for a few discrepancies in the earlier series of experiments, and for the periodic failure to recover staphylococci from flies which still harbored the organisms.

Survival of *Staphylococci aureus*, 611, in the housefly indicates that *Musca domestica* is capable of spreading the organisms. Its actual importance as a means of transmission of *Staphylococcus* food-poisoning, could not be proven from this experimental study. An outbreak of food-poisoning

TABLE 1

PERIOD OF SURVIVAL OF *Staphylococcus aureus*, 611, IN THE INSECT AFTER INGESTION BY *Musca domestica*

		Period of Survival After Feeding															
		Hours		Days													
		12	18	1	2	3	4	5	6	7	8	12	14	15	20	21	26
I*	0/4† 0/2	2/2	1/1	1/1	‡	0/3	•	•	•	0/1	0/1	•	0/1	•	•	•	•
II	0/4 0/1	•	•	0/6	0/2	1/2	0/3	1/3	0/1	•	0/1	0/1	0/2	0/1	0/1	0/1	0/1
III	0/7 0/3	•	•	0/6	0/1	0/1	0/1	0/2	0/2	0/1	1	0/1	•	0/2	0/1	0/1	0/1
IV	0/7 5/5	•	•	6/8	1/2	2/4	0/3	1/4	0/2	2/2	1/2	0/1	•	0/2	0/1	0/1	0/1

- * I Plates over which infected flies were allowed to walk.
- II Suspensions of vomit and fecal material.
- III Broth washings of exterior of flies.
- IV Suspensions of ground flies containing material of the digestive tract.
- † / Numerator gives number of samples showing presence of test organism. Denominator gives the number of samples tested.
- ‡ • No tests made.

DISCUSSION

The presence of *Staphylococcus aureus*, 611, in the digestive tract of houseflies for 8 days after infection indicates that the housefly may serve as a reservoir host for the food poisoning strains of staphylococci.

Inconsistent recovery of the experimental strain from the vomitus and excreta suggests that the housefly does not necessarily harbor large numbers of the organisms, but is capable of de-

was not studied; nevertheless, many cases investigated by other workers have led to the conclusion that carriers among food handlers were the source of contamination. It is conceivable, therefore, that flies may initiate or augment a food-poisoning outbreak by spreading the staphylococci from handlers or contaminated equipment to foodstuffs favorable for enterotoxin production and from contaminated supplies to good food. Staphylococci may

survive in the digestive tract of flies for several days after infection and may be deposited on food even after the carrier source has been removed or after the fly has sought a new feeding location.

Isolation of non-pathogenic strains of staphylococci from wild-caught flies suggests that a fly in the natural state is capable of harboring the organism.

The absence of pathogenic staphylococci in the wild-caught flies studied may have been due to failure of the flies to have come in contact with pathogenic strains. It may be possible, also, that some strains may lose their coagulability during passage through the fly.

Torrey (1912) and others noted the appearance of many coccal forms in the digestive tract from early summer through June. From July through the fly season the rod forms were predominant. The wild-caught flies studied on this investigation were collected in July and August. Seasonal variances probably account for the infrequency of the isolation of staphylococci.

SUMMARY AND CONCLUSIONS

A food-poisoning strain of staphylococci, *Staphylococcus aureus*, 611, suspended in a dilute sucrose solution was fed to approximately nine hundred "cultured" houseflies, *Musca domestica* and was re-isolated at intervals from the insect. Organisms harbored internally were made accessible by sterilizing the exterior of the fly with a mixture of 1.0 percent Aerosol, 1.0 percent sodium hydroxide, and 5.0 percent formaldehyde. The organisms recovered from tracks and proboscis marks, vomitus and excreta, external washing, and contents of digestive tract were identified by colony characteristics, cell arrangement, coagulability, and bacteriophage susceptibility.

Staphylococcus aureus, 611, was scattered in the footprints and proboscis marks of all of six groups examined 3 days after ingestion. After this

time, the test organism was not found on any of six exposed plates. Recovery of the staphylococcus from the exterior of the fly by washing in broth was not accomplished throughout twenty-three trials. Two of seventeen suspensions of excreta and vomitus contained the test organism. It appeared on the third and fifth days after contamination. Staphylococci survived in the digestive tract of eighteen of thirty-two samples of the flies for 8 days but not in six samples examined after the eighth day.

The possibility that staphylococci may be commonly carried by flies was evidenced by the isolation of staphylococci from the digestive tract of ten of the fifty wild-caught flies examined.

Musca domestica may serve as a reservoir host for *Staphylococcus aureus*, 611, and it is possible that under suitable conditions the fly may initiate or augment a food-poisoning outbreak by spreading staphylococci from infected handlers or dirty equipment to food and from contaminated supplies to good foodstuffs which are favorable for enterotoxin production. The organism may survive in the digestive tract of the housefly several days after contamination and be deposited on food even after the carrier source has been removed or after the fly has sought a new feeding location.

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SEASIDE HOTEL

The Influence of Surface Active Cationic Germicides on the Bacterial Population of Milk*

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THE surface active cationic germicides substantially reduce the bacterial counts on eating and drinking utensils (4, 5, 7), and milk handling equipment (2, 4), and their use in these fields is already established. These substances are effective in the presence of organic matter and exhibit a relatively low toxicity. Nevertheless, their use for the sanitization of milk handling equipment may be objected to, if small amounts, introduced in the milk either purposely or through the residual remaining on the equipment, would reduce the bacterial population sufficiently to comply with the control requirements of the sanitary codes, and thus allow to dispense with good sanitary practices.

The purpose of this investigation was to determine the effect of surface active cationic germicides on the total bacterial count and total acidity of milk. Also, a method for the chemical estimation of these compounds in milk was found. The bacteriological and chemical studies demonstrate that, although the surface active cationic germicides are effective sanitizing agents for the dairy industry, they can not be used to cover up improper sanitary practices.

EXPERIMENTAL

The high molecular quaternary ammonium germicides used in this investigation were commercial 10 percent aqueous solutions of the following:

alkyl dimethyl benzyl ammonium chloride (BTC), 9-octadecenyl dimethyl ethyl ammonium bromide (Onyxide), and alkyl dimethyl 3,4-dichlorobenzyl ammonium chloride (Tetrosan).

The method of test consisted of adding 1 ml. of a hundred times the indicated concentrations of the germicides to 99 ml. of milk † in an Erlenmeyer flask, and incubating the treated milk and controls at 10°, 20–25° (room temperature), and 37° C. for 48 hours. One ml. samples were taken within one minute after the germicide was added to the milk, and also after 24 and 48 hours. Butterfield's phosphate solution was used as the diluting fluid and the samples were plated in accordance with the standard method (6) on tryptone-glucose extract agar. The plates were incubated at 37° C. for 48 hours. The counts are all expressed as the number of bacteria per ml.

The total acidity was determined for each sample at 0, 24, and 48 hours by the standard method (6a), which consisted of diluting 10 ml. of milk with an equal volume of recently boiled and cooled water, and titrating with 0.1 N NaOH using phenolphthalein as the indicator. The acidity is expressed as percentage of lactic acid.

In an attempt to obtain qualitative information on the types of organisms present, colonies were picked from the dilution plates of the various samples, transferred into nutrient broth, and

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† The raw milk was generously supplied by Borden's Farm Products of New Jersey, Inc., Newark, N. J., through the courtesy of Mr. R. Fuhle.

studied by the following characteristics: Gram reaction, appearance of growth in broth and on agar, lactose fermentation, and gelatine liquefaction.

The method of Hartley and Runnicles (3) was used for the chemical estimation of the surface active cationic germicides in milk. It consists of titrating 2 ml. of the dilution of the high molecular quaternary ammonium compound, to which is added 0.2 ml. of a 0.01 percent solution of bromphenol blue made slightly alkaline with ammonia, with a 1:2500 solution of Duponol PC. At the end-point the color changes from true blue to purple, when observed under artificial lighting.

The method of Brooks and Hucker (1), which consists of titrating the aqueous germicide with a 0.04 percent solution of bromphenol blue buffered to pH 4.6 in the presence of ethylene dichloride, was found unsuitable for the purpose.

In preliminary screening tests, alkyl dimethyl benzyl ammonium chloride (BTC), 9-octadecenyl dimethyl ethyl ammonium bromide (Onyxide), and alkyl dimethyl 3,4-dichlorobenzyl ammonium chloride (Tetrosan) were added to pasteurized milk, which was then incubated at 37° C. and observed for the appearance of a curd at 24-hour intervals. The results are presented in Table 1.

The 1:5000 dilution of the three germicides prevented curdling of the milk for at least 48 hours. At higher dilutions, however, alkyl dimethyl benzyl ammonium chloride showed a marked superiority over the other two germicides and prevented the formation of a curd in 24 hours even at a dilution of 1:25000. As a result, the further experiments were restricted to alkyl dimethyl benzyl ammonium chloride.

In order to determine whether the addition of alkyl dimethyl benzyl ammonium chloride to milk had any influence on the formation of a curd, sterilized milk containing various concentrations of the germicide was

TABLE 1

EFFECT OF VARIOUS HIGH MOLECULAR QUATERNARY AMMONIUM GERMICIDES ON THE CURDLING OF PASTEURIZED MILK AT 37° C.

Dilution	Onyxide			Tetrosan			BTC			hours
	24	48	72	24	48	72	24	48	72	
1:5000	—	—	—	—	—	—	—	—	—	—
	—	—	+	—	—	+	—	—	+	
	—	—	+	—	—	+	—	—	+	
1:10000	+	—	+	..	—	—	+	
	+	—	+	..	—	—	+	
	—	+	..	+	—	+	..	
	+	+	—	+	..	
1:25000	+	+	—	+	..	
	+	+	—	+	..	
	+	+	—	+	..	
	+	+	—	+	..	
1:50000	+	+	—	+	..	
	+	+	—	+	..	
1:100000	+	+	—	+	..	
	+	+	—	+	..	

The controls all formed a curd within 24 hours.
 + indicates the formation of a curd.
 — indicates the absence of a curd.

adjusted to different acidities by the addition of lactic acid and left to stand for several hours. The results are reported in Table 2.

TABLE 2

INFLUENCE OF ALKYL DIMETHYL BENZYL AMMONIUM CHLORIDE AND LACTIC ACID ON THE CURDLING OF STERILIZED MILK

Concentration of germicide	Percent lactic acid					
	0.3	0.4	0.5	0.6	0.7	0.8
0	—	—	S	+	+	+
1:500	P	S	+	+	+	+
1:1000	P	S	+	+	+	+
1:5000	—	—	S	+	+	+
1:25000	—	—	S	+	+	+

— indicates the absence of a curd.
 P indicates slight separation.
 S indicates slight curd, thick.
 + indicates a definite curd.

In the absence of alkyl dimethyl benzyl ammonium chloride, separation begins when the acidity reaches 0.5 percent, and a definite curd forms at an acidity of 0.6 per cent. In the presence of 1:500 and 1:1000 of the germicide, separation starts at an

TABLE 3

ACTION OF 1:5000 AND 1:25000 DILUTIONS OF ALKYL DIMETHYL BENZYL AMMONIUM CHLORIDE IN PASTEURIZED MILK

Temperature	Expt. Hours	Control		1:5000		1:25000		
		counts	% acid	counts	% acid	counts	% acid	
20°	1	0	<3000	0.154	<3000	....	<3000	0.154
		24	47 x 10 ⁶	0.158	....	....	73 x 10 ⁶	0.154
		48	245 x 10 ⁷	0.481	233 x 10 ⁷	....	165 x 10 ⁷	0.322
	2	0	5000	0.154	....	0.154	7480	0.154
		24	37 x 10 ⁶	0.168	77 x 10 ⁵	0.163	255 x 10 ⁵	0.154
		48	159 x 10 ⁷	0.401	118 x 10 ⁷	0.163	178 x 10 ⁷	0.290
37°	1	0	<3000	0.154	<3000	0.145	<3000	0.154
		24	130 x 10 ⁴	0.522	....	0.140	62 x 10 ⁶	0.204
		48	65 x 10 ⁴	0.700	264 x 10 ⁷	0.136	....	0.444
	2	0	2065	0.154	710	0.154	1550	0.154
		24	155 x 10 ⁴	0.572	250 x 10 ²	0.163	150 x 10 ⁵	0.401
		48	30 x 10 ⁴	0.700	48 x 10 ⁷	0.222	<30 x 10 ⁶	0.636

All the values are average of two determinations, and the counts represent the number of bacteria per ml.

acidity of 0.3 percent. Lower concentrations do not seem to have any effect. Apparently, in the experiments reported here, separation or curdling is influenced by factors other than those operating in untreated milk. Consequently, it seemed inadvisable to report

any observation on this phenomenon. The action of 1:5000 and 1:25000 dilutions of alkyl dimethyl benzyl ammonium chloride on the bacterial count and acidity of pasteurized milk at 20° and 37° C. was investigated. The results are given in Table 3.

TABLE 4

ACTION OF 1:5000 AND 1:25000 DILUTIONS OF ALKYL DIMETHYL BENZYL AMMONIUM CHLORIDE IN RAW MILK

Temperature	Expt. Hours	Control		1:5000		1:25000		
		counts	% acid	counts	% acid	counts	% acid	
20°	A	0	303000	0.164	499000	0.164	....	0.164
		24	95 x 10 ⁷	0.682	190 x 10 ⁶	0.237	39 x 10 ⁷	0.364
		48	265 x 10 ⁷	0.786	60 x 10 ⁷	0.418	155 x 10 ⁷	0.696
	B	0	290000	0.150	290000	0.150	290000	0.150
		24	44 x 10 ⁷	0.400	167 x 10 ⁶	0.202	68 x 10 ⁷	0.223
		48	77 x 10 ⁷	0.745	153 x 10 ⁷	0.458	230 x 10 ⁷	0.687
	C	0	....	....	290000	0.150	290000	0.150
		24	....	....	43 x 10 ⁷	0.236	42 x 10 ⁷	0.223
		48	....	....	235 x 10 ⁷	0.464	123 x 10 ⁷	0.682
37°	A	0	179000	0.164	175000	0.164	190000	0.164
		24	35 x 10 ⁶	0.701	130 x 10 ⁷	0.487	140 x 10 ⁷	0.638
		48	<30 x 10 ⁷	0.905	110 x 10 ⁷	0.637	<30 x 10 ⁸	1.045
	B	0	108000	0.150	108000	0.150	108000	0.150
		24	47 x 10 ⁷	0.660	79 x 10 ⁷	0.477	250 x 10 ⁷	0.628
		48	64 x 10 ⁶	1.038	54 x 10 ⁷	0.564	165 x 10 ⁷	0.905
	C	0	....	....	108000	0.150	108000	0.150
		24	....	....	89 x 10 ⁷	0.477	125 x 10 ⁷	0.591
		48	....	....	22 x 10 ⁷	0.650	75 x 10 ⁶	0.955

All the values are the average of two determinations, and the counts represent the number of bacteria per ml.

At 20° and 37°, the bacterial counts of the untreated and treated milk increased to approximately the same degree throughout the 48-hour test period, while the acidity of the untreated milk was much higher than that of the milk with the 1:5000 dilution of the germicide and slightly higher than that with the 1:25000 dilution.

The results on the effect of 1:5000 and 1:25000 dilutions of alkyl dimethyl benzyl ammonium chloride in raw milk are presented in Table 4.

Dilutions of 1:5000 and 1:25000 of alkyl dimethyl benzyl ammonium chloride caused no reduction in the initial bacterial count of raw milk. After incubation at 20 and 37° C., the counts of the treated milk were the same as those of the untreated milk. Both dilutions of the germicide, especially the 1:5000, kept the acidity at a lower level than that of the controls during the first 24 hours. After 48 hours, however, the acidity of the control and of the milk with the 1:25000 dilution of the germicide were about the same.

Since the 1:5000 and 1:25000 dilutions failed to influence the bacterial counts and had only a slight effect on

the acidity, the effect of higher concentrations of alkyl dimethyl benzyl ammonium chloride was studied. The precipitating action of this material on the proteins of the milk mentioned previously, limits the concentrations which can be used. However, the 1:500 and 1:1000 dilutions did not interfere with the tests. The results on the action of these two dilutions on raw milk are reported in Table 5.

Both the 1:500 and 1:1000 dilutions of the germicide caused an immediate reduction in the initial bacterial count of raw milk. The 1:500 dilution killed over 90 percent of the organisms, and the 1:1000 dilution about 60 percent. After incubation at both 20° and 37°, neither the 1:500 nor the 1:1000 dilutions appreciably affected the bacterial counts. The effect on acid production was even more pronounced than with the 1:5000 and the 1:25000 dilutions.

Another series of tests using the same dilutions (i.e., 1:500, 1:1000, 1:5000 and 1:25000) in raw milk, was performed on a single sample of raw milk, except at 10° where a different sample of milk was used. The results are reported in Table 6.

TABLE 5

ACTION OF 1:500 AND 1:1000 DILUTIONS OF ALKYL DIMETHYL BENZYL AMMONIUM CHLORIDE IN RAW MILK

Temperature	Expt. Hours	Control		1:500		1:1000		
		counts	% acid	counts	% acid	counts	% acid	
20°	D	0	184500	0.155	14500	0.155	73500	0.155
		24		0.572	241 x 10 ⁵	0.182	35 x 10 ⁶	0.185
		48	105 x 10 ⁷	0.735	61 x 10 ⁷	0.300	173 x 10 ⁷	0.400
	E	0			14500	0.155	73500	0.155
		24	same as D		200 x 10 ⁵	0.182	130 x 10 ⁶	0.184
		48			69 x 10 ⁷	0.296	229 x 10 ⁷	0.364
37°	D	0	146000	0.155	5200	0.155	20800	0.155
		24	53 x 10 ⁷	0.682	120 x 10 ⁵	0.155	214 x 10 ⁵	0.186
		48			<30 x 10 ⁷	0.336	270 x 10 ⁶	0.300
	E	0			5200	0.155	20800	0.155
		24	same as D		157 x 10 ⁵	0.155	44 x 10 ⁶	0.407
		48			175 x 10 ⁶	0.386	80 x 10 ⁶	0.482

All the figures are the average of two determinations, and the counts represent the number of bacteria per ml.

TABLE 6

ACTION OF VARIOUS CONCENTRATIONS OF ALKYL DIMETHYL BENZYL AMMONIUM CHLORIDE IN RAW MILK

Temp.	Hrs.	Control		1:500		1:1000		1:5000		1:25000	
		Counts	% Acid	Counts	% Acid	Counts	% Acid	Counts	% Acid	Counts	% Acid
10°	0	76000	0.155	36000	0.155	68000	0.155	89000	0.155	70000	0.155
	24	43 x 10 ⁵	0.155	33 x 10 ⁵	0.173	31 x 10 ⁵	0.177	30 x 10 ⁵	0.182	90 x 10 ⁵	0.155
	48	88 x 10 ⁶	0.186	91 x 10 ⁶	0.200	52 x 10 ⁶	0.200	40 x 10 ⁶	0.200	36 x 10 ⁷	0.200
	0	74000	0.155	36000	0.155		0.155	71000	0.155	85000	0.155
	24	35 x 10 ⁵	0.155	205 x 10 ⁴	0.168	36 x 10 ⁵	0.182	33 x 10 ⁵	0.182	72 x 10 ⁵	0.155
	48	63 x 10 ⁶	0.182	85 x 10 ⁶	0.191	70 x 10 ⁶	0.196	38 x 10 ⁶	0.200	38 x 10 ⁷	0.191
20°	0	198000	0.156	98000	0.156	177000	0.156	194000	0.156	268000	0.156
	24	62 x 10 ⁷	0.528	45 x 10 ⁶	0.186	39 x 10 ⁶	0.200	152 x 10 ⁶	0.218	36 x 10 ⁷	0.241
	48	64 x 10 ⁷	0.719	42 x 10 ⁷	0.254	65 x 10 ⁷	0.346	95 x 10 ⁷	0.382	125 x 10 ⁷	0.664
	0	227000	0.156	93000	1.156	187000	0.156	162000	0.156	206000	0.156
	24	53 x 10 ⁷	0.519	260 x 10 ⁵	0.186	72 x 10 ⁶	0.200	142 x 10 ⁶	0.186	33 x 10 ⁷	0.218
	48	63 x 10 ⁷		78 x 10 ⁷	0.318	40 x 10 ⁷	0.359	55 x 10 ⁷	0.364	83 x 10 ⁷	0.682
37°	0	230000	0.156	55000	0.156	175000	0.156	172000	0.156	240000	0.156
	24	65 x 10 ⁶	0.614	240 x 10 ⁵	0.182	73 x 10 ⁴	0.423	62 x 10 ⁷	0.546	120 x 10 ⁷	0.650
	48	42 x 10 ⁶	1.080	91 x 10 ⁷	0.309	84 x 10 ⁶	0.528	52 x 10 ⁷	0.640	140 x 10 ⁷	0.895
	0	238000	0.156	70000	0.156	197000	0.156	187000	0.156	227000	0.156
	25	40 x 10 ⁶	0.582	180 x 10 ⁵	0.182	215 x 10 ⁶	0.354	72 x 10 ⁷	0.546	112 x 10 ⁷	0.673
	48	210 x 10 ⁵	1.095	230 x 10 ⁶	0.250	166 x 10 ⁶	0.415	35 x 10 ⁷	0.670	41 x 10 ⁷	0.975

All the values are the average of two determinations, and the counts represent the number of bacteria per ml.

TABLE 7

INCREASE IN BACTERIAL COUNTS AND ACIDITY WITH TIME

Temperature	Hours	Control		1:500 BTC	
		counts	% acid	counts	% acid
20°	0	191000	0.146	42000	0.146
	24	50 x 10 ⁷	0.372	52 x 10 ⁸	0.170
	31	105 x 10 ⁷	0.605	84 x 10 ⁷	0.227
	36	172 x 10 ⁷	0.632	72 x 10 ⁷	0.307
	48	46 x 10 ⁷	0.691	98 x 10 ⁷	0.401
37°	0	172000	0.146	43000	0.146
	24	51 x 10 ⁷	0.639	33 x 10 ⁸	0.172
	31	38 x 10 ⁷	0.695	30 x 10 ⁷	0.256
	36	90 x 10 ⁸	0.707	99 x 10 ⁷	0.277
	48	75 x 10 ⁸	0.778	108 x 10 ⁷	0.369

All the values are the average of four determinations, and the counts represent the number of bacteria per ml.

The above results are in agreement with those given in Tables 4 and 5. Regardless of the concentration, the germicide did not hold down the bacterial count of raw milk. There was a gradual increase in acid formation with decreasing concentrations of alkyl dimethyl benzyl ammonium chloride.

The results obtained at 10° indicate that the counts increased considerably in all cases, but that very little acid was produced in the control, as well as in the presence of the germicide. There was practically no difference between the control and the treated milk after 48 hours.

The lack of influence of alkyl dimethyl benzyl ammonium chloride, at any of the concentrations studied, on the bacterial counts of milk, prompted an investigation in which shorter time intervals between samples were allowed. This was necessary to find out whether or not there was an increase and subsequent decrease in the bacterial count of the untreated milk in the interval between 24 and 48 hours.

The results presented in Table 7 demonstrate that there was no increase in the bacterial counts of raw milk in the interval between 24 and 48 hours at 20°, and only a slight increase at 37°. Hence, the values reported here do represent true values of the bacterial population, which justifies the observation that alkyl dimethyl benzyl

ammonium chloride does not affect the bacterial count of milk. A study of the types of organisms present in treated and untreated milk revealed that there were few gram-positive acid-producing organisms in the treated milk. The bacterial flora of the treated milk was composed primarily of gram-negative rods, e.g., coliform organisms. Gram-positive cocci as well as gram-negative rods were found in the controls.

To confirm the above findings, cultures of *Streptococcus sp.* and *Escherichia coli* were isolated from milk, and the action of 1:500, 1:5000 and 1:25000 dilutions of alkyl dimethyl benzyl ammonium chloride on these organisms in sterile milk was studied at 20°.

The results presented in Table 8 indicate that the concentrations of alkyl dimethyl benzyl ammonium chloride tested did not affect the growth of *Esch. coli* in milk, since the count and the acidity were practically the same as in the controls. On the other hand, 1:500 and 1:5000 dilutions of the germicide checked the growth of the *Streptococcus* in milk and consequently repressed the formation of acid. The 1:25000 dilution, however, did not have any effect. At 10° C., the effect on the bacterial counts was similar.

TABLE 8

EFFECT OF ALKYL DIMETHYL BENZYL AMMONIUM CHLORIDE ON *Strep. sp.* AND *E. coli* IN STERILE MILK AT 20°

Hours	Control		1:500		1:5000		1:25000	
	counts	% acid	counts	% acid	counts	% acid	counts	% acid
<i>E. coli</i>								
0	87 x 10 ⁴	0.146	84 x 10 ⁴	0.146	82 x 10 ⁴	0.146	79 x 10 ⁴	0.146
24	191 x 10 ⁸	0.312	47 x 10 ⁸	0.198	202 x 10 ⁶	0.284	192 x 10 ⁶	0.275
48	33 x 10 ⁷	0.443	31 x 10 ⁷	0.350	40 x 10 ⁷	0.410	37 x 10 ⁷	0.448
<i>Strep. sp.</i>								
0	34 x 10 ⁴	0.146	39 x 10 ³	0.146	31 x 10 ³	0.146	31 x 10 ⁴	0.146
24	253 x 10 ⁷	0.621	<30 x 10 ³	0.202	<30 x 10 ³	0.191	196 x 10 ⁷	0.570
48	31 x 10 ⁸	0.717	<30 x 10 ³	0.235	<30 x 10 ³		35 x 10 ⁸	0.668

The values for the counts and percent acid represent the average of four determinations.

CHEMICAL ASSAY

A series of tests were carried out to determine whether or not surface active cationic germicides could be estimated in the presence of milk. Various dilutions of the germicides were prepared, both in water and in milk and tested by the method of Hartley and Runnicles. The results are presented in Table 9.

TABLE 9

ESTIMATION OF HIGH-MOLECULAR QUARTERNARY AMMONIUM GERMICIDES BY THE METHOD OF HARTLEY AND RUNNICLES

Germicide	Concentration	ml. 1:2500 Duponol PC	
		in water	in milk
Alkyl dimethyl benzyl ammonium chloride	1:1000	4.01	3.67
	1:2000	2.00	1.81
	1:3000	1.53	1.21
	1:4000	1.13	0.94
	1:5000	0.93	0.77
	1:7500	0.68	0.54
	1:10000	0.44	0.37
9-Octadecenyl dimethyl ethyl ammonium bromide	1:20000	0.23	0.16
	1:1000	4.77	4.25
	1:2000	2.25	2.14
	1:3000	1.45	1.34
	1:4000	1.11	0.99
	1:5000	1.01	0.74
	1:7500	0.62	0.56
1:10000	0.49	0.38	
1:20000	0.21	0.19	

The values are the average of five determinations.

The results indicate that Hartley and Runnicles' method can be used to estimate surface active cationic germicides in the presence of milk. Its range appears to be limited to between 1:1000 and 1:20000. The reproducibility of the results is demonstrated by the average deviation which never was greater than 0.04 ml. for any of the concentrations tested and never more than 0.02 ml. in the range between 1:5000 and 1:20000. The readings were always lower in the presence of milk, possibly due to the fact that there is a combination between certain constituents of the milk and the surface active cationic germicides.

Besides the quantitative procedure described above, a rapid, qualitative test has been developed which allows the detection of surface active cationic germicides in aqueous solutions. This test is a modification of the method of Hartley and Runnicles and consists of adding 0.7 ml. of the indicator solution to 2 ml. of the solution under test. The indicator solution is made up of 2 parts of 0.01 percent bromphenol blue made slightly alkaline with ammonia and 5 parts of 1:2500 Duponol PC. When a surface active cationic germicide is present at a concentration of about 1:7000, the test solution is pure blue, while otherwise it is purplish. The indicator can be so varied as to allow the test to be sensitive to

higher or lower concentrations of the surface active cationic germicides, by increasing or decreasing the amount of Duponol PC. The values reported in Table 9 can be used as a basis for preparing the proper indicator.

DISCUSSION

The results obtained in this investigation demonstrate that the surface active cationic germicides do not influence the bacterial counts of pasteurized or raw milk, stored at any temperature.

The higher concentrations of alkyl dimethyl benzyl ammonium chloride, e.g., 1:500, reduced the initial count of milk immediately after the addition of the germicide. This temporary reduction, however, had no appreciable effect on the counts after the milk had been incubated for 24 or 48 hours.

A lack of correlation between the bacterial counts and the total acidity of the treated milk was observed. Whereas the increase in counts upon incubation was approximately the same in both the treated and untreated milk, less acid was produced in the treated milk. This was especially noticeable with the higher concentrations of alkyl dimethyl benzyl ammonium chloride. For instance, the counts of the control in one test increased to 64×10^7 , while the acidity reached 0.719 percent. With a 1:1000 dilution of the germicide, the count increased to 65×10^7 and the acidity to only 0.346 percent. All the results followed the same pattern.

These observations indicate that, in the presence of milk, alkyl dimethyl benzyl ammonium chloride in sufficiently high concentrations, does inhibit the growth of certain types of bacteria normally present in the milk. The percentage of acid observed in the various samples demonstrates that there is a preferential action against the gram-positive acid-forming organisms, e.g., *Streptococci*. This is borne out by the observation that very few

gram-positive organisms were detected in the treated milk, but that on the other hand there were a large number of gram-negative rods. The inhibition of the growth of *Streptococcus sp.* but not of *Esch. coli* by concentrations of 1:500 to 1:5000 alkyl dimethyl benzyl ammonium chloride in sterile milk, is further confirmation for the above views.

The interpretation of the results of this investigation from a practical standpoint leads to the conclusion that the surface active cationic germicides can be recommended as sanitizing agents in the dairy industry. In actual practice, where solutions of the order of 1:5000 are used, the solution adhering to the equipment would be diluted to such an extent that it could not influence the quality of the milk.

The unscrupulous addition of these germicides to milk would not alter the bacterial counts of the milk, and the presence of the surface active cationic germicides could easily be detected chemically. Therefore, the use of these compounds in the dairy industry can never serve as a substitute for good sanitary practices and cover up for negligence, even though they will materially assist in achieving better sanitary conditions.

SUMMARY

Alkyl dimethyl benzyl ammonium chloride is shown to lack any influence on the bacterial counts of raw or pasteurized milk, at concentrations ranging from 1:500 and 1:25000. The higher concentrations have an inhibitory effect on the growth of gram-positive acid-producing organisms, but not on that of gram-negative ones. The lower concentrations do not have such an effect.

A chemical method for the estimation of surface active cationic germicides in milk is described, as well as a qualitative test for their detection in solutions.

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ANNUAL MEETING, OCTOBER 24-26, 1946
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Official Headquarters
SEASIDE HOTEL

Thermal Death Range of Bacteria in Milk*

A New Electric Sampling Device

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THE heating of milk has long been used to improve its keeping quality and more recently, by pasteurization, to destroy pathogenic microorganisms that may be present and thus to assure a product of safe sanitary quality.

The thermal death points of many species of pathogenic bacteria have been studied under varying conditions, but without agreement among investigators regarding the exact combination of conditions under which death occurs. The resistance of bacteria to heat varies with the species and is influenced by environmental conditions, and especially by the age of the culture.

In 1911, North (1) summarized opinion regarding the thermal death points of various strains of pathogenic bacteria based upon authoritative work published up to that time. There was general agreement on the relative status of the more common species and he listed in the order of their thermal resistance the pathogenic microorganisms that might be present in milk; namely, *Mycobacterium tuberculosis* var. *bovis* and var. *hominis*, *Salmonella paratyphi*-A and -B, *Bacterium typhosum*, streptococcus, and *Corynebacterium diphtheriae*.

Later, North and Park (2) endeavored to establish more precisely the thermal death ranges of these microorganisms. They used a relatively simple piece of equipment. A coil of lead pipe was submerged in a water bath maintained at a selected temperature, and a funnel was attached to the upper end of

the coil with rubber tubing, the edge just above the surface of the water. A culture of the microorganism under investigation was mixed quickly with a large volume of milk in the funnel and then allowed to flow through the lead pipe coil; the time required was about five seconds. The milk was held in the coil for a definite heating period and then a 10-ml. portion was drawn, cooled quickly, and tested for survival of the microorganism. The capacity of the coil was such that several 10-ml. portions could be drawn, thus providing for repeated tests at one holding period or a series of tests at different holding periods. While exposure to heat was more precise in these experiments than in previous work, obviously the data acquired were not satisfactory for application to pasteurization at very short periods and high temperatures. The shortest holding period reported for the experiments was twenty seconds, and the temperature in this case was 170° F. It is unlikely that any method employing manual operation can be depended upon to produce reliable results for shorter periods at higher temperatures.

The Sanitary Code of New York State specifies that in pasteurization every particle of milk shall be subjected to 143° F. for thirty minutes or 160° F. for fifteen seconds. Both methods have been studied extensively to determine their effect on the physical properties of milk and also their value in destroying pathogenic bacteria. The efficiency of treatment at 143° F. for thirty minutes was established by experiments on a plant scale at Endicott, New York, in 1921-

* Presented at the Twenty-Second Annual Conference of the New York State Association of Milk Sanitarians, September, 1945.

1922 (1) by the U. S. Public Health Service in cooperation with the Health Departments of the City and of the State of New York. The comparative efficiency of heating to 160° F. for fifteen seconds has also been investigated, notably in 1927-1928 (3) by the Health Department of the City and of the State of New York. Those experiments indicated that under actual operating conditions the tubercle bacillus, the most resistant microorganism studied, was killed at temperatures less than those required by the Code for specified exposure times. Data that are used currently regarding the conditions required for destruction of many species of bacteria in milk are based upon these experiments of 1927-28 and are still inconclusive.

The problem of the range of temperatures and times required for the destruction of various species of pathogenic bacteria is in need of reinvestigation, particularly at 175° F. and higher, with holding times of less than five seconds. Effective high-temperature short-time methods are advocated to provide pasteurization with minimal changes in the physical character of the milk. The practical difficulties of collecting samples representing exposure of cultures of bacteria in milk to certain temperatures for periods shorter than fifteen seconds has restricted precise investigation. Recently, however, the Trumbull Electric Manufacturing Company, Plainville, Connecticut, constructed a unique mechanism for the collection of samples at intervals of one second based upon a plan developed by C. W. Weber of the Bureau of Milk Sanitation. Through their courtesy this device was made available for the first time in its experimental form for use in the present studies.(4) The equipment consists of an electric timing device which is capable of producing electric impulses at intervals ranging from one second to twenty seconds or from one minute to twenty minutes. The elec-

tric impulses activate a series of electromagnets, each of which controls the piston of a 10-ml. syringe. Originally the needles of these syringes projected directly into the hot milk but this part of the device has been remodeled by the authors. Air pressure or vacuum produced by the syringe is transmitted through a rubber tube to the cylinders of a smaller syringe the needle of which is immersed in the liquid to be sampled. One of the magnetic devices is designed to eject about 2 ml. of material into the main body of the liquid and the others are designed to withdraw 2-ml. portions of the mixture for testing.

In the present studies, 1,200 ml. of milk in an aluminum holder were heated to a predetermined temperature in a water bath provided with thermostatic control and continuous agitation of the water. The milk was stirred by a propellor operating at 1,700 r.p.m., which is sufficient to produce vortical action. An aluminum container was found to be more satisfactory than one of glass because of its higher thermal conductivity. When the milk reached the temperature selected and while it was being stirred, the timing device was set to operate the syringes so that initially one discharged a culture into the center of the vortex and the others, successively, at 1-second intervals withdrew portions from the perimeter. The collecting syringes are so arranged that the needles are held below the surface of the milk, whereas the needle of the syringe discharging the culture is just above the surface.

Because the volume of culture used is very small in relation to the amount of heated milk, about 2 ml. and 1,200 ml., it can be assumed that the culture reaches the temperature of the milk immediately upon completion of mixing and thus that any preheating time can be disregarded. In order to reduce the cooling time to insignificance, the collecting syringes contain 2 ml. of cul-

ture medium maintained at 20° C. or less by immersion in a bath with circulating cold water. Thus, the 2 ml. of milk withdrawn are completely and immediately mixed with 2 ml. of cold nutrient broth medium. Because of the rapid reduction in temperature, the cooling time is a negligible factor.

lected after a longer time. At shorter intervals the color was somewhat less intense, and mixing could not be considered to be complete.

Preliminary studies were made of the thermal death points of three strains of *Bacterium coli*, two so-called heat-resistant strains obtained from the

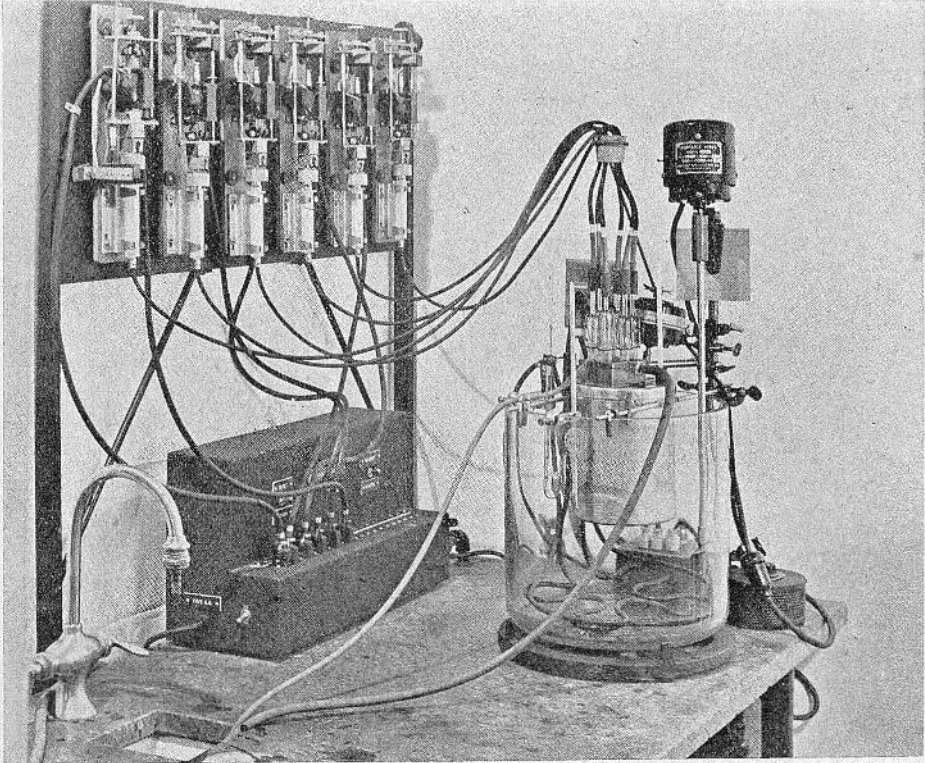


FIGURE 1
Electric Sampling Device

It was necessary to determine first the time required for the complete mixing of the culture with the preheated milk. As a substitute for the culture, 1 ml. of an aqueous solution of methylene blue dye was discharged into the center of the milk; samples of the mixture were withdrawn at the perimeter at 1-second intervals and the colors compared. Twelve experiments showed that after 2-second periods the color of the milk was the same as that col-

lected after a longer time. At shorter intervals the color was somewhat less intense, and mixing could not be considered to be complete. Preliminary studies were made of the thermal death points of three strains of *Bacterium coli*, two so-called heat-resistant strains obtained from the Office of Milk Investigations, U. S. Public Health Service, in 1935, and the third a laboratory control strain isolated in 1933 from polluted water and considered to be representative of the coliform group. Addition of 2 ml. of a 24-hour broth culture to 1,200 ml. of unheated milk produced an initial plate count of from 30,000 to 35,000 bacteria per milliliter. Table 1 shows the results of tests of these strains in milk heated to 80° C.

TABLE 1

SURVIVAL OF 3 STRAINS OF BACTERIA OF THE COLIFORM GROUP IN MILK AT 80° C.

Strain	Age of Culture	Maximum Survival Time	Minimum Survival Time	Number of Observations
# 34460*—stock culture	24 hours	<2 seconds	<2 seconds	7
	48 "	5 "	<2 "	3
# 3635†—heat-resistant (2AF)	24 "	7 "	<2 "	5
	48 "	7 "	<2 "	11
# 3636†—heat-resistant (3U)	24 "	7 "	<2 "	7
	48 "	3 "	<2 "	5

* Isolated from a sample of polluted water, 1933.

† Received from U. S. Public Health Service in 1935.

From these limited studies it is obvious that the thermal death point is not constant for *Bact. coli*, and therefore only a thermal death range based on results of repeated tests with many cultures can be determined. It is planned to continue and extend the investigation to pathogenic microorganisms, in particular, *Mycobacterium tuberculosis*. The procedure outlined will obviate the destruction of bacteria during periods of preheating and cooling and thus will indicate what may be accomplished at any given temperature in any given time.

The almost universal use of the phosphatase test to determine the degree of heat treatment of milk also makes it desirable to study further the effect of high temperatures for short holding times on the inactivation of

the enzyme phosphatase as it may affect the use of the test to indicate adequate pasteurization. The new sampling procedure will facilitate such a study.

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Significance of Thermoduric and Thermophilic Bacteria in Milk and Their Control*

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MILK and milk products are produced in an environment of microorganisms. The cow, the barn, the feed, the air, the utensils, the machinery, the milking machine, the milker—all may and frequently do have millions of bacteria present. In fact milk drawn from the udder under sterile conditions may have as high as 3,500,000 bacteria per ml. It is the exceptional cow that produces sterile milk. Milk from most cows show a few bacteria, from 300 to 500 bacteria per ml. when drawn under aseptic conditions. So it is not strange that we should find a few thousands in milk

classified according to their functions such as saprogenic, zymogenic, and pathogenic; their food and oxygen requirements; their metabolic products; their temperature relations, and so on. However, for the purpose of this discussion we shall classify them according to their *optimum* temperature relations.

From the standpoint of optimum temperature relationships, there are different kinds of bacteria: some that can live and grow at very low, some at very high, and some at temperatures in between. The bacteriologist classifies these three groups as follows:

<i>Name</i>	<i>Minimum</i>	<i>Optimum</i>	<i>Maximum</i>
Cryophilic bacteria	32° F.	59° F.	86° F.
Mesophilic bacteria	59° F.	98.6° F.	113° F.
Thermophilic bacteria	113° F.	131° F.	158° F.

handled in the best manner and many millions in milk handled in a poor, insanitary way.

Our next query should be, what kind of bacteria are present in milk handled in the usual manner? Well, this varies but as a rule there are many different kinds or, as the bacteriologist would say, many different genera and species. This is not the place to take up a scientific discussion of the various kinds of bacteria but it is necessary to give some general classifications of bacteria in order to understand this discussion.

There are many different bases for classifying bacteria. They may be

You will note that the term "thermoduric" is not included in this classification. The reason is that it is a specialized term. Thermoduric in dairy bacteriology is used to designate a group of bacteria which will withstand the temperature of milk pasteurization, 140 to 145° F. for 30 minutes or 160-161° F. for 15 to 16 seconds, but will not grow at this temperature. It is a matter of heat tolerance or resistance and not growth. In contradistinction to this, the term thermophilic means heat loving and growth only in the presence of heat.

The optimum temperature for the thermoduric bacteria is about the same as for the mesophilic group, 70 to 98° F. while that for the thermophilic is much higher, 131° F. It should be

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noted that the above temperatures are growth temperatures. Both the thermophilic and thermoduric bacteria will survive (not grow) in temperatures as high as 212 to 248° F. for 15 minutes.

It is, therefore, evident that we should expect to find more thermophilic bacteria in milk pasteurized at 142 to 145° F. for 30 minutes than in milk pasteurized at 160 to 161° F. for 15 to 16 seconds since the pasteurizing temperature is within the growth range of thermophilic bacteria and there is sufficient time for them to grow, especially since milk may remain in the pasteurizing vat longer than the 30 minute interval. Conversely we should expect to find more thermoduric bacteria in the high temperature, short-time pasteurized milk than in the low-temperature, long-time pasteurized milk since they are heat resistant. They are not about to grow at 142 to 145° F. but the longer time at this temperature is unfavorable to them. Thus, it becomes evident that the farm presents a greater possibility of thermoduric contamination in milk while for thermophilic bacteria, the holding type of pasteurizer is the chief source of contamination. In short, thermoduric bacteria are a problem of the producer, and thermophilic bacteria of the dealer.

EXAMPLES OF THERMODURIC BACTERIA

Keeping in mind that the term thermoduric refers to a group of bacteria and not any one species or even genus of bacteria, let us see the kind of bacteria that are able to withstand pasteurizing temperatures. Most investigators agree that the micrococci predominate. Here are the names of some of the more common ones that survive pasteurization: *Micrococcus albus*, *Micrococcus aureus*, *Micrococcus candidus*, *Micrococcus conglomeratus*, *Micrococcus epidermidis*, *Micrococcus luteus*, and *Micrococcus varians*. The next most commonly found group includes the streptococci such as *Streptococcus thermophilis*,

Streptococcus liquefaciens, *Streptococcus bovis*, *Streptococcus glycerinaceus*, *Streptococcus inulinaceus*, *Streptococcus fecalis*, and *Streptococcus zymogenes*.

After the streptococci, sarcinae are most prevalent such as *Sarcina lutea* and *Sarcina rosea*. Next come the rod-shaped bacteria mostly of the sporogenic type such as *Bacillus cereus* and *Bacillus subtilis*. Some idea of the relative numbers of each of these four groups of bacteria which survive pasteurization in milk is given by the data of Hileman *et al.* They found in the laboratory pasteurization of 484 samples of milk from 49 producers that the surviving bacteria were composed of 79.3 percent micrococci, 7.4 percent streptococci, 8.1 percent sarcinae, and 5.2 percent rods.

THE SOURCE OF THERMODURIC BACTERIA

There is evidence to indicate that one of the principal sources of thermoduric bacteria is the udder of the cow. Data collected at various times from aseptically drawn milk indicates that from 40 to 75 percent of the bacteria found were thermoduric micrococci. No spore formers were found.

A second source of thermoduric bacteria in market milk is the farm utensils such as the milk pails, cans, and milking machines. It has been shown that they will survive the concentrations of chlorine and salt brines such as used to sterilize milk cans and pails on farms. Utensils not properly drained and cleaned will contain sufficient nutrients for prolific growth of bacteria, many of which may be thermoduric types. When it comes to milking machines, there is ample evidence to show that they may be a prolific source of not only thermoduric but a great many other types of bacteria.

All evidence indicates that many of the thermoduric bacteria especially the micrococci found in milk originate in the udder and are carried by the milk to the pails, cans, and milking ma-

chines. If these farm utensils are not cared for properly, they may be a rich source of thermoduric bacteria. This of course does not exclude other sources of contamination such as soil, feed, etc.

That there are many bacteria with different degrees of sensitivity to heat is evidenced by the fact that there seems to be little relationship between bacterial counts of milk before and after pasteurization either by the holding or the high-temperature, short-time methods.

METHODS OF DETECTING THERMODURIC BACTERIA

There are several methods for determining the individual farms that are contributing excessive numbers of thermoduric bacteria to the milk supply. One commonly used method is to pasteurize samples of milk from individual producers in the laboratory and then plate them. This is expensive and time consuming. To cut down the expense a standard loopful, 0.001 or 0.01 ml. of laboratory pasteurized milk may be inoculated into an oval test tube containing melted standard milk agar, mixed well, and incubated at 37° C. for 48 hours. The results obtained by this method show very good agreement between the standard plate count and this less expensive method.

Another method is to pasteurize the samples in the laboratory at 161° F. for 16 seconds, then incubate them for seven hours at 37° C., after which they are examined microscopically. A modification of this method is to incubate the raw milk for two hours at 58° to 60° C. after which a microscopic examination was made. The authors of this method claim that the viable thermoduric bacteria present in raw milk may be determined in this manner since all the non-thermoduric bacteria have been destroyed and will dissolve during the two hour incubation period. A standard is proposed of not more than 40,000 thermoduric

bacteria in raw milk as determined by this method. Most investigators find that laboratory pasteurization tends to give lower bacterial counts than commercial pasteurization, irrespective of the time and temperature used.

It is also interesting to note that neither the resazurin nor the methylene blue tests were an accurate index of thermoduric bacteria. Thus, raw milk might pass these tests satisfactorily and yet be a source of thermoduric bacteria in the milk supply.

SANITARY SIGNIFICANCE OF THERMODURIC BACTERIA

There is no evidence to indicate that the thermoduric bacteria cause disease. From what has been said so far, it should be clear that the presence of excessive bacterial counts in milk due to thermoduric organisms would indicate improper care of milking utensils such as milk pails, cans, and milking machines. This type of carelessness is not good sanitation and should not be condoned.

SUMMARY OF FACTS ON THERMODURIC BACTERIA

Thermoduric bacteria are a group of bacteria which are able to withstand pasteurizing temperatures but are not able to multiply at these temperatures. Four groups of thermoduric bacteria are commonly found in milk, viz., micrococci, streptococci, sarcinae, and bacilli. Of these four groups, the micrococci are by far the most common. One of the principal sources of thermoduric bacteria is the cow's udder since milk drawn aseptically from the udder predominates in micrococci. Many species of these have been demonstrated to be the same as the thermoduric bacteria found in milk. Other sources of thermoduric bacteria are poorly cleaned and improperly sterilized milk pails, cans, and milking machines contaminated with milk from the udder and from other sources.

There are three different methods of determining the presence of thermophilic bacteria in milk, viz., laboratory pasteurization, then plating; laboratory pasteurization and incubating 7 hours at 37° C., then examining microscopically; and incubating raw milk 2 hours at 58° to 60° C., then examining microscopically. Laboratory pasteurized milk tends to give lower counts than commercial pasteurization, irrespective of the time and temperature used.

The control of thermophilic bacteria is a producer's problem while the control of thermophilic bacteria is a dealer's problem.

THERMOPHILIC BACTERIA IN MILK

Thermophilic bacteria are more resistant to heat and chlorine than are thermophilic bacteria and therefore present more of a problem in the dairy once they become established. They are more of a homogeneous group than are the thermophilic bacteria. They are troublesome not only in the dairy industry but also in many other food industries such as the sugar, flour, and canning industries.

Thermophilic bacteria belong to two genera, the *Bacillus* and *Clostridium*. They are sporogenic rods some of which are facultative anaerobes while others are obligate anaerobes. They are classified into three groups as follows:

1. *Flat-sour thermophilic bacteria* found in (a) *Non-acid foods* such as vegetables, sugar, starch, condensed milk, meats, and similar foods. These bacteria are facultative anaerobes and produce spores which are heat resistant. The best known member of this group is *Bacillus stearothermophilus*.

(b) *Acid foods* such as tomatoes and tomato products. *Bacillus thermoacidurans* is typical of this group. It is an aerobic, sporogenic, aciduric bacterium, the spores of which are not as heat resistant as the spores of some of the other thermophiles.

The flat-sour group is characterized by the production of acid without gas. This is in contrast to the other types of thermophilic spoilage which produce gas and acid. The absence of gas in the flat-sour type of thermophilic spoilages makes it impossible to detect until the cans are opened. This type of spoilage gave considerable trouble during World War II since many meat products were reinforced with soya and wheat flours, and canned foods with sugar—some of which contained the flat-sour type of bacteria. The manner of handling and the storage temperature of the tropics were ideal conditions for the development of this group of bacteria. The result was much thermophilic spoilage of food.

2. *Thermophilic anaerobic bacteria* of which *Clostridium thermosaccharolyticum* is the type species. These bacteria form very heat-resistant spores, produce acid and gas, and grow only in the absence of air. Spoiled canned food such as vegetables, meat, or condensed milk is easily detected because of the bulged ends of the cans.

3. *Sulfide thermophilic bacteria* more commonly known as the "sulfur stinker" is the third group of thermophilic bacteria causing spoilage. A typical species of this group is *Clostridium nigrificans* which produces large amounts of hydrogen sulfide from the proteins in the food which darkens the contents of the can. It is an anaerobic rod producing subterminal spore which is very heat resistant. It does not attack any of the carbohydrates present in the food.

Of the three groups, the flat-sour bacteria are the most frequently encountered and cause the most trouble while the sulfide bacteria are least common and therefore cause the least trouble.

Some of the thermophilic bacteria that have been isolated, identified and grown in milk are *B. aerothermophilus*, *B. calidus*, *B. coagulans*, *B. kaustophilus* and *B. moliquefaciens*.

SOURCE OF THERMOPHILIC BACTERIA

If one takes a small amount of soil, say 5 gm., and boils it in 95 ml. of water for 5 minutes, and plates 1-ml. portions on a suitable medium, colonies of thermophilic bacteria will be present after 48 hours incubation at 113° F. It is a rather puzzling fact that thermophilic bacteria will be present under natural conditions in abundance at temperatures below their optimum or even their minimum which varies a great deal according to the species. Various theories have been advanced to explain this fact but they will not be discussed here. One rather unusual theory that has been advanced is that they come from the planet Venus where they find favorable thermal conditions for their development (47 to 50° C.).

It is certain that they are present in the soil on feed such as roughage and grains, in manure, on cow hairs, stable air, improperly cleaned milking utensils, and the like, and undoubtedly get into milk from these sources. The udder has not been found to be a source of contamination for thermophiles such as is the case with thermodurics. Once they get into milk they are very resistant to heat and to chlorine. If the utensils are not thoroughly scrubbed and cleaned daily, they collect in the dirty portions of them and persist indefinitely. The accumulation of milk stone, which consists of dried and coagulated milk together with calcium and magnesium salts, serves as an ideal protective coat for thermophiles. Unless it is removed, it serves as a focus for seeding the milk. The only way to eliminate thermophiles, whether in the milk plant or on the farm, is through scrubbing and cleaning of utensils and machinery coming in contact with the milk.

In condensed milk thermophilic bacteria may be introduced by the use of sugar which may be a source of all three types of thermophilic bacteria

which have just been described. A high thermophilic count in milk may be caused by any one or all of the following: (a) contaminated farm milk which seeds the pasteurizer, (b) repasteurized milk, (c) thin layer of cooked milk or milk stone on walls of pasteurizer in which thermophiles grow, (d) defective pasteurizer construction such as dead spaces, ends, etc., so that not all milk reaches pasteurizing temperature, (e) excessive amount of foam so that not all the milk is heated to proper temperature, (f) vats may not be cleaned between runs, and (g) filter cloths.

METHODS OF DETERMINING THERMOPHILIC BACTERIA

It is necessary to use special media to determine the number and kind of thermophilic bacteria in food products. The culture plates and media must be incubated at 131° F. for 48 hours in order to determine true thermophiles. Plates incubated at lower temperatures such as 113 to 120° F. may be either thermoduric or thermophilic bacteria since this is the border line temperature between the two groups.

SANITARY SIGNIFICANCE OF THERMOPHILES

Thermophilic bacteria are non-pathogenic. They have a sanitary significance in that they indicate carelessness in cleaning and caring for milk and the utensils and equipment in which it is handled. In a food so responsive to its sanitary environment as milk, carelessness can not be tolerated. The best that science and experience provide is none too good and afford only the minimum factor of safety when intelligently carried out by inherently clean workmen.

PIN POINT COLONIES

There are several causes of pin point colonies on agar plates made from milk. The principal ones are: (a) too many bacteria per plate, (b) reaction

of the culture medium, (c) carrying over of food materials such as lactose or sucrose in lower dilutions, and (d) presence of thermoduric or thermotolerant bacteria such as *Streptococcus thermophilus*. No thermophilic bacterial colonies are present in milk plates incubated at standard temperatures, either 90 or 98.6° F. because they will not grow at such low temperatures even though they are present in the milk.

SUMMARY ON THERMOPHILIC BACTERIA

Thermophilic bacteria are more heat resistant than thermoduric bacteria. They are found in soil, feeds, grain, cow hairs, manure, improperly cleaned utensils, and elsewhere. They are carried from the farm to milk and dairy plants where they are propagated principally in the pasteurizing equipment, especially if it is not cared for properly. Thermophilic bacteria are classified in three groups and are found in industries other than the dairy industry. They are not pathogenic and have a sanitary significance only in that they indicate carelessness in properly washing and handling dairy utensils and equipment.

CONTROL MEASURES FOR THERMOPHILIC BACTERIA

From what has already been said, some of the means of controlling the thermo-bacteria are evident and have been indicated. Other methods of control have not been mentioned so far. A detailed list follows:

1. Scrub and thoroughly clean all farm utensils and dairy plant equipment to free them of milk film, and

milk stone. Free the cracks and crevices of milk nutrients in which bacteria may grow.

2. Carefully select the type of detergent suitable for cleaning the type of equipment being used. Research has developed new types of cleaners that are more efficient and economical than the old types formerly used. A good detergent will save labor and will do a better job at less cost.

3. Promptly cool the milk at 50° F. or below. Thermophilic bacteria do not grow below 113° F. and thermoduric bacteria are greatly retarded at low temperatures.

4. Milk foam may be a prolific source of thermo-bacteria. Equipment in which foam forms is frequently filled and emptied of milk several times without removing the foam in which case the foam may seed each batch of milk passing through. Air-space heaters and air temperature-recording thermometers should be used to make sure that the bacteria in the foam are destroyed.

5. Pellicle formation on the surface of hot milk in a vat should be avoided since the pellicle affords protection for the heat resistant and tolerant bacteria.

6. Avoid repasteurizing pasteurized milk. This builds up thermophilic bacteria since they get two chances to grow instead of one.

7. Shut down and clean the pasteurizer every 2 or 3 hours. Long continued runs afford thermophilic bacteria an excellent opportunity to grow.

8. Check the pasteurizing equipment for leaky regenerators, dead-ends, condensates draining into the system, poorly draining vats, and foam and pellicle formation. All can be a potent source of thermobacteria.

Inauguration of the Standard Food Ordinance in Richmond, Virginia

H. CLIFFORD MITCHELL

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EARLY PRACTICE

THE first knowledge of public health activity in Richmond, Virginia, was in 1871 when a board of health was appointed by the City Council. For many years the Board of Health recognized the need for a food inspector, but it was not until June 9, 1904, that the City Council authorized the appointment of an inspector. These first inspectors were appointed and governed by the Police Department, which could recall them for police duty at any time. Thus, the initial work was greatly hindered as they spent a large part of their time performing police duties. The inspectors of those days operated under the regulations of the Richmond Pure Food Laws, passed in June 1904.

Food inspections prior to 1908 were along the lines of condemnation of spoiled meats and vegetables rather than measures having more intimate connection with the relation between food supplies and disease.

Early in 1906 Dr. Ennion G. Williams, member of City Council, later Commissioner of Health for the State of Virginia, had a resolution adopted providing for investigation of the health work of Richmond by a committee of which he was chairman. This committee held many sessions and had the expert advice of Professor W. T. Sedgwick who spent several days in Richmond for that purpose. As a result of their labors, an ordinance was adopted in June 1906 providing for the complete reorganization of the health work in Richmond. Under this ordinance, the Board of Health was

created and empowered to elect a full-time health officer.

In August 1908 the first inspection of restaurants was made. The only authority for inspections at this time was rules and regulations passed by the Board of Health requiring reasonable cleanliness in all places and prevention of the sale of spoiled or unwholesome food.

Prior to 1942 all restaurant sanitation was guided by rules and regulations of the Board of Health and additions to the Sanitary Code made by the City Council. The last revision of the Code prior to passage of a food ordinance in 1942, was an ordinance requiring foods to be stored or displayed off the floor, requiring utensils and equipment to be kept clean, and providing for screening of the buildings in fly breeding season. This regulation was adopted October 17, 1930.

Realizing that the old rules and regulations, often amended, were inadequate and in many instances contradictory, the Health Department recognized the need for a complete change in the laws governing eating and drinking establishments.

In attempting to select the best possible ordinance, we concluded that a food ordinance to be workable must have been tried out and shown to be legal in all respects and able to withstand court trials. It must include all the modern practices of sanitation relative to eating and drinking establishments. The ordinance should be sufficiently flexible to permit changes to include the latest developments in sanitation. It must be complete so as

to permit uniform enforcement and so constructed that it is possible to determine whether or not it is being adequately enforced.

STANDARD FOOD ORDINANCE

After studying many ordinances, we found that the standard food ordinance of the U. S. Public Health Service met the requirements we considered necessary. This ordinance was prepared and presented to the Ordinance Committee of the City Council by the Mayor on March 10, 1942. The Committee held a public hearing regarding the Ordinance. The Health Department contacted the Hotel Association, the Restaurant Association, and the Retail Druggists' Association, explaining each item of the Ordinance in detail. These organizations appeared before the Committee at the hearing and approved the Ordinance as presented by the Health Department. The Ordinance Committee approved the Ordinance and sent it to the City Council, who adopted it June 14, 1942, allowing all establishments twelve months to comply.

The Food Ordinance as recommended by the U. S. Public Health Service may be adopted using the grading system and revocation of permit for enforcement or using the revocation of permit only. For several reasons the non-grading system was adopted in our City. It was felt by the Health Department that sanitation at food establishments was too obsolete to change to a grading system immediately. The field sanitarians were too insufficiently trained in the inspection of eating and drinking establishments to expect consistent grading in each district throughout the city. The non-grading system allowed only the Health Officer or the Chief of the Bureau of Sanitation to revoke a permit.

It is obvious that an Ordinance is no better than the enforcement agency.

In order to provide a consistent inspection and proper interpretations, classes were held for inspectors in which they were taught the satisfactory compliance and public health reason for each item of sanitation. Also, four inspectors have been sent to the University of North Carolina School of Public Health to attend the short course available for sanitarians. In addition to this instruction, considerable time was spent in the field with the men on inspections. By providing this instruction, we felt that all interpretations of the Ordinance would be as uniform as possible.

The Standard Food Ordinance has proved to be very satisfactory in our City although the war has prevented its being enforced as well as desired. During the war many establishments were unable to obtain necessary equipment; however, that condition has been relieved to some extent.

INSTRUCTION

After passage of the Ordinance, it was found that it would be necessary to conduct schools for restaurant employees in addition to enforcing the ordinance. The U. S. Public Health Service cooperated with our Health Department in conducting these schools, and the Restaurant Association played a great part in getting the owners and managers to cooperate by sending their personnel. Even with the large turnover in personnel, this type of instruction started paying dividends following the first school.

The Virginia Alcoholic Beverage Control Board has also been of great assistance to our Department in enforcing the Ordinance. In our State it is first necessary for an establishment to have a restaurant license in order to obtain a license to sell beer and wine. It was agreed between our Department and the Alcoholic Beverage Control Board that we would send them a copy of all correspondence sent to estab-

lishments holding A. B. C. licenses. Upon receipt of our correspondence one of their investigators immediately visits the establishment advising the owner that he must comply with the Health Department Ordinance governing eating and drinking establishments in order to hold his license to sell beer and wine. We have found this cooperation invaluable to us in enforcing the ordinance.

ENFORCEMENT RESULTS

Complete coverage has been attained by dividing our City into eight districts with a sanitarian assigned to each district. It is the duty of each sanitarian to inspect all food establishments in his district, in addition to carrying on the environmental sanitation program in the same area. We now have 897 eating and drinking establishments under inspection, of which 152 have had their permits revoked for violations or have closed on their own initia-

tive for repairs to prevent revocation of their permit.

We felt that a complete record system was necessary to carry out successful control of food establishments; therefore, we adopted a system which included all features of the plan used by the U. S. Public Health Service. Due to the large number of records involved we use a visible record, letter size, rather than the ledger. A folder is made for each establishment which carries the copies of the last six inspections and any correspondence which may have been sent to the owner or manager. By means of this plan, we can accurately tell at a glance the condition of any establishment.

Although many owners objected to the ordinance at first and had to be forced to comply, we have reached the point where most restaurant owners are satisfied with the results and are now in complete accord with the program.

ANNUAL MEETING, OCTOBER 24-26, 1946
ATLANTIC CITY, N. J.

Official Headquarters
SEASIDE HOTEL

The Dairy Plant Operator's Viewpoint

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THE results secured and the improvements made in the dairy industry by means of milk inspection have been the results of the system operating much as a complex of checks and balances. It is obvious that the operator will likely object to recommended improvements because of cost. It is equally natural to expect the inspector, especially one who is young and just out of school, to make what the operator regards as excessive recommendations. Many of the improvements are inaugurated against the wishes of the operator, but, nevertheless, once these have been installed, the operator is usually proud of them. Between the conservatism of the one and the aggressiveness of the other, there lies a middle road which leads to the advantage of operator, inspector and consumer, a program that is economical and practical. When neither the health official or the operator assumes an arbitrary and dictatorial attitude, much, if not all, of the good which may be obtained through milk inspection is lost. Many such cases exist, but fortunately they are not preponderant and when it is considered that, from the standpoint of age, dairy inspection is still almost in its infancy, the progress made from the year 1860 to the present has been remarkable.

No serious attempt at milk inspection was made until 1860, although, according to written record, the milk of cows, sheep, or goats has been used as food for humans since at least 2000 B.C., if not earlier. Such supervision of milk production and processing as existed between 1860 and 1890, was confined chiefly to an examination of

the product for the presence of preservatives and for adulteration. The germ of present day inspection, the control of bacterial flora, is to be found in the English Aylesbury Dairy Company's decision to divide their milk supply into that for direct consumption and that fit only for butter production. From such humble beginnings has developed the rather complex, refined requirements of today.

During this developmental period, glaring mistakes have been made by the processors and equally glaring ones by inspectors, although neither group enjoys hearing of them. These mistakes are not to the discredit of either, and they have served the very useful purpose of lowering some of the overconfidence of the more radical members in either group and have helped immeasurably in the formation of the rational inspectional codes in effect. The plant operator may be asked to make radical changes in equipment and equipment arrangement. He is usually a very conservative man, and logically so, because he has his life savings invested in his business and the safety of his investment depends on the correctness of the decisions he makes. He is loathe to make changes the purpose of which he does not understand, but the costs of which he is asked to pay and the results of which he must live with. Divergence of opinion in such matters has, in some cases, given rise to controversy. In most instances a wholesome airing of the pros and cons for the recommendations made has followed and out of this system of give and take has come a commendable improvement of market milk supply.

THE PROCESSORS' VIEWPOINT

The purpose of this paper is to criticize no practice in milk inspection, but rather to point out some practices in plants which inspectors may overlook and which many operators believe to be important. In a majority of cases, failures in compliance with requests of the inspector are due to disagreement as to the efficacy of the recommendation or to ignorance of the requirement, and at times to faulty reasoning. For instance a shortage of raw materials may blind the operator as to the necessity of receiving only safe milk and insisting on the purchase of inadequately inspected milk. The intelligent operator should have a greater interest in the receipt and processing of quality products than the inspector.

If we assume that the function of the inspector is to assure the delivery of wholesome milk to the consumer, then the requirements which are sometimes asked for may be subject to question by the operator. For instance, a dairy may consistently put out milk of 20,000 or less bacteria per gram without having what the inspector considers adequate overhead lighting. The manufacturer believes the wholesomeness of his product is the important objective of his operation. The average manufacturer believes there is too great a trend towards regimentation of type and placing of equipment. Too often, unless he is building a new building, he has little choice in the arrangement of his equipment and unless he has a large retail business he is limited to the less costly types of equipment. Properly designed machinery is essential, but it often receives attention to the exclusion of that which should be given over to methods. Some of the poorer milk is produced on farms elaborately equipped and some of the better milk is produced on farms without milk houses. This is not to be construed as minimizing the importance of good equipment and milk houses, but rather to emphasize what good methods are capable of accomplishing.

In the case mentioned, methods of cleanliness, prompt cooling, prompt delivery and protection from human and dust contamination were responsible for wholesomeness, while good equipment and machinery are the tools by which good methods may or may not be carried out.

THE MILK PLANT

The milk plant man will always have difficulty in securing a uniformly good raw milk supply. Plants large enough to afford the employment of a field man have a great advantage over the smaller competitor unable to employ one. This creates the complaint of the processor that too much inspection of milk is done in the receiving room. This is the wrong end of the line unless results there are to be used as a guide for locating those producers who most need help at the farm. The inspector or processor will always encounter producers unable or unwilling to produce clean milk and some producers profess to think that, if they have a milkhouse with an insulated cooling tank, their milk miraculously becomes an article beyond criticism.

The lack of proper methods is not to be found on the farm alone; milk is often subjected to potential contamination in the plant. Slovenly workmen are given to insufficient care of their person and are likely to be equally slovenly in their care of milk. The requirement of wash sinks in the work rooms with running water provides facilities for cleaning, but the unclean appearance of these basins at most times of the day must have a depressing effect on any visitor. A workman dressed in a clean white suit, neither shabby nor torn, with a cover of some type for his head, and with clean face and hands, can usually be developed into a workman following cleanly methods. It is true that he needs to be reminded of his appearance for the first few weeks before cleanliness becomes a habit with him. Personal cleanliness should be insisted upon.

Visual and bacteriological cleanliness are two different things. Some workmen actually do not know how to wash equipment. Rinsing with lukewarm followed by hot water is not proper washing. And washing with a detergent that will remove the tin plating from copper equipment or decolorize the pyroglaze of milk bottles is not proper washing either, at least from the viewpoint of the owner who must replace the equipment and possibly lose a market because the loss of tin and exposure of the milk to bare copper or iron added objectionable off-flavors to his milk. Many operators badly need advice as to washing and detergents. It is realized that in the matter of recommending detergents to the plant man the inspector is walking on thin ice, but it is possible for him to recommend types suited for particular purposes. Demonstrations in the proper washing of equipment and milking machines cannot be commended too highly. What part of the equipment does the inspector examine to check for dirt and grease left after washing? If the plant man has his attention called to seams and places difficult to reach, isn't he much more apt to see that such parts of equipment are kept clean? The inspector is better able to advise as to cleaners and cleaning methods than the average operator.

Many creamery men mistakenly object to the covering of all equipment so that milk is protected from dust and light from the time it is dumped until bottled or canned. In one plant, in a carefully conducted test, which illustrates the value of covering equipment, the sterilization by steam from the inside of a large open coil cooler reduced the average bacterial count of the milk from 60,000 to 20,000. It is true that this heating ruined an expensive cooler, due to unequal expansion, but other efficient methods are possible for sterilization and protection from dust contamination. After all equipment has been covered, there is still chance of contamination from

dust. Vats with hinged covers and cabinet and wall type coolers usually have cold water pipes above them, which, with ceilings, act as condensers of vapor and dust catchers. Contaminated condensed steam from these may drop on pasteurizing and holding vats and may gain entrance to the milk through the hinged openings of the covers. Gutters suspended from the pipes may be used to drain the condensed, contaminated steam, but the requirement of adequate ventilation by means of fans is a better remedy for such difficulty.

Flush and leak detector valves are so generally and favorably accepted that most plant men take them for granted. There are districts, however, where, strange as it may seem, they are not required. The milk man would appreciate having his thermometers checked for accuracy more frequently and have phosphatase tests made of his product at intervals. He does wonder about the requirement of two thermometers on each vat, however, for it seems to him to serve as much purpose as would two steering wheels on a car. This is especially true for the smaller plants where, for economic reasons, a plentitude of equipment is lacking. A major proportion of emphasis placed on methods rather than on equipment in the case of small plants catering to the populations of small towns and villages would be particularly pleasing to these smaller operators.

Among many of the lesser matters that the operator fails to understand is the extreme variation at times found in bacterial counts of the same milk. The operator does not understand that a count is approximate and he is prone to accuse the inspector of holding the samples too long before plating is done. An explanation, or even a demonstration, would tend to allay suspicion and improve confidence in the inspector. The operator believes, too, that small utensils should be examined as carefully as large equipment; that sediment

tests should be followed up with subsequent tests, if shown to be unsatisfactory; that consideration be given to the operators' side of any controversial issue. This last point is important in building mutual confidence and is especially apt to occur where the inspector has more theoretical than practical experience. The attitude of an inspector can either make him highly successful or a failure, provided his inspections are thorough. There are many ways by which cooperation, rather than antagonism, may be developed. Creamery men are generally guilty in their use of large numbers of pails, measures, and similar small containers. The less handling milk or cream receives in such utensils the better and the inspector should frown on such practices.

Insistence on better methods might prevent much of the denting of pipe lines, dented fittings and dented separator and clarifier discs. Milk stone can be found in threads of piping when it does not occur on the surface of pipe over which the milk flows. It would seem more accurate to report where the milk stone is found than to report an entire line as containing stone. Admittedly, the coiling of hose means better housekeeping, but it probably is less sanitary, because coiled hose becomes dirty from lying on the floor and the worker has an appreciable amount of this dirt transferred to his hands in coiling and uncoiling this hose. Some operators believe that the hose problem solution still lies ahead. These would seem to be matters of plant management, but they are also problems for the inspector insofar as they affect sanitation in the plant.

THE ICE CREAM AND BUTTER PLANT

Butter and ice cream plants have been neglected by the inspector. Such plants need inspection much the same as milk plants; many common practices endanger the cleanliness of the finished product. The filling of ice

cream cans and butter tubs or boxes on the floor is a reprehensible habit because of the danger of splashes of water from the floor. Cans and tubs may be easily set on a truck to avoid such possible contamination. Cleaning the outside of ice cream cans with cloths is filthy procedure and the storage of ice cream mix in ten gallon cans is not good usage. Handling of butter with rubber gloves is not so radical a procedure as would at first seem to old time creamery men. While possibly not so important as with milk, pasteurization of ice cream mix and churning of cream merit consideration as does the proper cleaning of pasteurizers, freezers and homogenizers. These practices are but a few of those which might be mentioned, but they are illustrative of the need of more thorough inspection of these branches of the industry.

The inspector has a job to do, also, so far as can washing is concerned, for the proper washing of cans has not been satisfactorily solved. The use of alkaline cleaners appears to aid in forming scale from the minerals of milk and water. Acid cleaners will break up scale, but their cleaning effect depends upon the addition of wetting agents. The newer cleaners contain a neutral polyphosphate and wetting agent and they may prevent milk scale by segregating the precipitated mineral and results to date would seem to indicate that they will. Once the problem is solved, manufacturers will expect inspectors to take a leading part in teaching proper methods of handling this long perplexing and important problem, and in aiding in the selection of the proper cleaner for a particular use.

Progress made in ice cream bacterial control is evidenced by the fact that thirty years ago the United States Public Health found in 267 samples examined an average count of twenty-six million bacteria. Many codes now place the maximum count at 100,000 to 500,000. In 1936 there were exam-

ined 480 samples, the average count being one million. Not only should there be a maximum count standard, but the samples should be free of extraneous material, of disease producing bacteria, and should not be loaded with miscellaneous bacteria. As with milk processing, the employee should be free of disease, the water used examined for purity, and work rooms protected from flies and insects. Not only should the dairy products entering the mix be pasteurized, but also such supplements as sugar, gelatine, egg yolk, color and nuts. Non-alcoholic flavors often contain bacteria.

Plant men would generally approve the requirement that ice cream dippers be held in running water for rinsing

and would also favor those practices required in the milk plant such as washing and sterilizing all equipment, including the freezer and homogenizer, after the day's use. Insistence by some inspectors on the use of sterilizers that may predispose to the development of oxidized flavors or to metal corrosion are frowned upon by many operators. Enforcement of practices that safeguard the wholesomeness of a dairy product constitutes the best advertising that product can have.

Fortunately, the qualifications of inspectors are high in most instances. When tact is added to technical skill and knowledge, the inspector's value is enhanced, especially to the plant operator.

ANNUAL MEETING, OCTOBER 24-26, 1946

ATLANTIC CITY, N. J.

Official Headquarters

SEASIDE HOTEL

Environmental Farm Sanitation

FRED B. WELCH, M.D.

City Health Commissioner

"PEOPLE are funny", said State Milk Inspector De Lind, "It is difficult to play the game with them, because they are living things who can think and reason". It was a hot day in the later part of August. We were sitting in the Health Department office and the conversation was about milk inspection on the farm. There had been many similar meetings, over a long period of past years. Perhaps the conferences started by telling stories, talking about our children, but invariably the discussion would revert to milk inspection. Pleasant meetings with pleasant memories—education acquired by conversation, the easy way by mutual exchange of experiences and ideas.

"You are right" said our City Milk Inspector. "People are funny. No one knows better than the milk sanitarian the different types of people who produce milk for the urban market, for he meets men and women of every type and stripe. He soon learns that there are those who are honest and dishonest, those who are industrious and lazy, those who are workers and procrastinators, those who are cooperative and uncooperative. He meets people who are intelligent and ignorant, light hearted and despondent, generous and miserly. In all his inspection routes there are no two families alike".

"You said a mouthful that time", said Inspector De Lind, as he shifted a black Havana cigar to the other side of his mouth. "I heard a professor of sociology up at the University of Wisconsin say the other day, 'Each is an individuality within itself, cast in a mold which will never be re-used'".

This conversation brought to my mind a lecture heard at a meeting of Boy Scouts many months before. I remembered the speaker said that it is impossible to play the game of life if the rules in the book are not followed. That no player can win alone; he must work with and support the team in which he plays. Every member must be loyal to his team and give to the team all the effort that it is possible for him to give. And, above all, every member of the team must obey the rules of the game, if he expects the team to play and win. "If you play to win, and you lose, be a good loser", said the speaker.

So I broke into the conversation and told them about this lecture and how the lecturer ended it by giving a definite illustration. "And", I said, "as near as I can remember it, the pitcher in the baseball game was in the process of winding up before throwing the ball, it was strike two on the player at bat, with two out for the team at bat. The pitcher unwound, over came the ball, and the big boy back of the catcher said "Strike three—you're out". All of the players on the field started to leave the diamond, tossing their gloves to the other side, who were going out. Only the boy at the plate still stood there, his face flushed with anger, with the bat still in his hand. Suddenly he began to remonstrate with the umpire, saying in a very loud voice that he had been robbed of another chance. The big boy walked up to him and said, "You are only one member of your team. If you wish to play ball you must follow the rules and abide by the decision of the game. Get out and play ball, you are delaying the

game." And the player did that very thing.

"Let's cut out this philosophical stuff and get down to brass tacks", said our Sanitary inspector. "Did you know that the boss stuck his neck out the other day when he agreed to write a paper on 'Improvements in Environmental Farm Sanitation'? Gee, I hate to see him get his head chopped off". Our Sanitary inspector has a way of saying cruel things in a most beneficent way.

The State inspector relit his cigar, blew a big puff of smoke and said, "Let him go with us this afternoon when we inspect those two farms. If, after real field experience, and our help, he is still unable to write a good paper, then he should be decapitated". The black Havana cigar tilted toward his nose, as he gave me a friendly nod.

Soon we were on our way by auto, and as if by coincidence, the route that we were taking, lead by the farm where I was born. There was the old home in which I had spent many happy hours resting on a hill, a half mile from the roadway. Of the original buildings, it was the only one remaining. New structures had replaced the others. Memories of the distant past came flooding back across the mirror of my mind. There in front of the home, a thousand feet down the hill, was the open well, forty feet deep and cased up with wood. My mother drew water from that well, with an oaken bucket, when she came there as a bride. Beside the well, beneath a straggley tree, was the old house of mystery, about which my mother used to weave fantastic stories. The cow barn, on the east side of the hill, I could dimly see, with its manure pile and the ever present pond of water, stagnant from the dung and urine of farm animals. There beside it stood the hog house, with a swill barrel beside it. Filled with hog-wash, with refuse from the kitchen floating in it, and over all, a cloud of stable flies whirling in the sunlight. Cinematographic mental pic-

tures appeared upon the mental screen in rapid succession—my father always wanting a cool drink of water, because of a diabetic thirst, and the well seemed far away to little feet that loved to play. The ill-smelling privy nestled among the lilac bushes in the backyard, filled with metallic colored flies in the summertime. Mosquito netting placed over the food on the dining room table to protect it from the hundreds of flies in the home. Children going through the dining room and kitchen yelled "Shoo fly" in trying to drive out the flies by waving in the air pieces of paper tied to a broomstick. Pans of milk covered with thick cream setting in the pantry, waiting to be skimmed for churning. The wash bench, outside the summer kitchen, with its pail of water, and its tin wash basins hung on nails above it. Chickens, ducks, and turkeys were fed in the back yard beside the wood pile. Interwoven through the panorama was the vivid picture of my mother, working in the garden, kitchen or barn—the bread winner of the family.

There were things I could not see in these memory pictures, but they were there just the same: the long hours of drudgery, seven days a week, fifty-two weeks a year, with never a vacation—the worry over the uncertainties connected with farming, such as accidents and sickness of the workers, animal diseases, destruction of crops by plant insects and parasites, heavy rainfall, drouth, frost, hail, snow, wind storms and the ever present dread of fire.

Is it any wonder, I thought, that these people developed self-reliance and a pronounced individualism? Yes, it was hard to play the game with them for their reactions were controlled by their environment. Education can change environment, but it is an exceedingly slow process. Environment is all our contacts and all our experiences from the time the spark of life is kindled until the flame goes out. I was suddenly awakened from my

reverie by the loud barking of a dog. We were entering the driveway of our first place of inspection. "This man's name is Henry Durkin", said our local milk inspector. "Like the kid in your ball game, he had two strikes against him before he started farming, but he has not fanned out yet—not Henry. The land which he purchased was impoverished, and probably at its best was none-too productive, and the buildings were in a dilapidated condition and very poorly arranged. Last month I gave Henry a pedometer and told him to carry it while he was doing his chores. The distance walked during last month was over 150 miles. This man has come up the hard way and must be judged by what he has accomplished, not what can be seen by inspection. He is an energetic and orderly man, and has produced under difficult circumstances a very good milk. He has no milk house, as you can see. His wife is a very neat woman, so we have allowed him to wash the milk utensils in the kitchen of his home".

"Do you know", said the state inspector. "that during the cold weather the milk utensils on most dairy farms will be handled and cleaned in the farm house, if the milk house is not properly heated. All milk inspectors are cognizant of this fact. They may even carry the milk to the kitchen to be strained into the cans; milk is thus exposed to sources of infection other than that of the regular milk handlers. In locations like Wisconsin where the winters are severe, it is a good health policy to insist that the milk house shall be heated". We met Henry in the barn. He was a jigging man—stood first on one leg then the other and the muscles of his face twitched when he was attentive. Inspector De Lind said, "Your local inspector was just telling us how you produced a high quality milk with this minimum of equipment. You certainly have a clean, well-lighted and well-ventilated barn".

"When I came here, it certainly was

well-ventilated. The wind blew right through the side boards", said Henry.

The local inspector called my attention to the waterproof cement floor, free from manure and covered with a thin coat of lime, and the fact that the windows were properly screened. He pointed out that the barn had been recently whitewashed and the ceiling was free from cracks. "Henry, you certainly did a wise thing when you got your horses out of the cowbarn. Horses should never be in a cowbarn, because of the ammoniacal odors from the urine of these animals can taint the milk", said the State inspector.

Just then, Henry's wife, Effie, came into the barn. She was short and fat, and when she laughed, she laughed all over. "Did you tell the boys that we are going to build a new milk house next month", she asked of Henry. "Yes", said Henry, "Effie's uncle died this summer and left us a thousand bucks. It is the first gift of money that we have had since we were married and I am going to take it and build a milk house".

"No, you are not", said Effie, "You are going to take half of it and build a milk house, and the girls and I are going to use the other half for improvements in our home. We are tired of carrying water 365 times a year and we are going to install a hydro-pneumatic water system. We are going to turn the old pantry into a modern bath room. We are going to have a sink in the kitchen, a hot water heater in the basement and a modern cement septic tank to take care of the sewage. After, all, it was my 'unk' that left the thousand smackers", and she laughed till she shook all over. Henry did not laugh. The muscles of his face began to twitch and he continually shifted his weight from one leg to the other. It was evident that he was greatly disappointed, and when he said "O.K." he said it begrudgingly.

"Effie is right" said the State inspector. "You are a man of considerable mechanical ability and you

can do most of the work yourself. We will send you the plans for building the septic tank and milk house and your county organization will lend you the forms and equipment for doing the work. Good bye, Mr. and Mrs. Durkin, we must be on our way to the Lappin Farm”.

The State inspector put another black cigar in his mouth, the local inspector filled his pipe, and after both were lit the State inspector said, “Did you notice how dejected Henry Durkin became when his wife suggested that the inherited money be equally divided for the benefits of both? That sort of thinking is difficult to understand. There is much unbalanced thinking about farm environmental sanitation. It should be planned so as to benefit the greatest number and eliminate health hazards”.

“You need not worry in this case”, said the local inspector, “for I am going to have a friend of mine help Effie and her girls in planning their home improvements, and when you come back for your next inspection you will find that Henry has done a swell job”.

“It is difficult to understand”, said the inspector from the State, “why farm sanitation has always trailed behind that of municipal sanitation. How common it is to visit farms that have expensive barns; barns that have every convenience and represent the investment of many thousands of dollars and yet to find the farm house has no sanitary conveniences. All farm homes should be equipped with running water and flush toilet and concrete septic tank installation. These are not luxuries—but a sanitary necessity. Even the poorest city families have these privileges. Many times it has been called to my attention by milk inspectors that there should be a flush type toilet and wash basin in the basement of the home, and that this toilet room should be made available to farm help by an outside entrance. The inside toilet or outside privy that offers no privacy and is not readily available, causes

the help to use outside places. Unsanitary practices are thus created. Adequate hand-washing facilities should be available in the home, milk house, and barn; clean hands are important in sanitary milk production.

“There are the buildings of the Lappin farm on that hill beyond the woodland”, said the pipe-smoking inspector. “This should be lesson number two for our friend the city doctor. Old Phineas Lappin built these buildings for his son, Frank, about ten years ago, and money was no object. They were planned to give the highest degree of efficiency with the minimum amount of effort. Old Phineas got his money from an uncle who was an oil prospector. He never could have made it farming. He is a miserly old man, who carefully counts his pennies. Frank has one of the finest homes and barns in this section of the state. Hot water is supplied to the home, barn, and milk house from a central plant in the home basement. Water softeners of the Zeolite type insure safe, soft water. The milk house is of the very latest design, and cost three thousand dollars. It consists of three rooms: one for washing, one for cooling, and one for the small oil-burning hot water boiler. The milk house is reached from the barn by a two door corridor. So much for the buildings. Now let me say a few words about the man we are to meet. Frank is the kind of a man that never does anything today that he can postpone until tomorrow. He might be termed a procrastinator, but old Phineas calls him a ‘damned lazy lout’. He married a poor city girl who always felt above her neighbors. He has two children who go to school in the city. No one of the family cares a whoop about the farm. Frank would move to the city tomorrow if old Phineas should pass away. There is no teamwork here no common interest like we found on the other farm. Beautiful equipment, yes, but with the personal element lacking”.

We had now driven into the drive-

way and Frank came out to meet us. "Hello, inspector", he said, "How is everything in the city"? When we went into the barn, it had a manure-like smell. A very large barn with the most modern equipment, but in a most unsanitary condition. "Well, Frank, I see that you have neglected to follow out the orders that I issued at my last inspection", said the city inspector. Frank did not get mad. He simply shrugged his shoulders, shook his head and said, "Gee, boys, this job is too much for me and the hired man. I tell you things are hell when you can't get help. If I had my way I would quit this business".

The milkhouse was no better. The windows were closed and the ventilators that lead from the ceiling to the roof were plugged with gunny sacks. The washing tanks in the milk house were filled with dirty chlorinated water. The city inspector said, "Frank, you have got three strikes against you. You are shut off from our market".

"Well, I guess I will have to take it to the cheese factory, they are not so finicky there. Come on in boys, and I'll mix you a drink. The little lady is at her bridge club in the city". When we got into the car for our homeward drive, the State inspector said, "You can see, Doctor, that good equipment does not always mean clean milk".

"The point I would like to emphasize is that the keystone in the arch of rural sanitation is a safe water supply", said our local inspector. "Due credit must be extended to the Bureau of Plumbing and Domestic Sanitary Engineering of the Wisconsin State Board of Health for their educational program and the enactment and enforcement of the Well Construction Code. Great progress is also being made in the creation of better sewage disposal systems on the farm and in the rural schools. Safe water not only protects the rural population from water borne diseases, it also protects

the urban groups that may come in contact with them either directly by visiting the farm, or indirectly by consuming products from it".

"Well, we are nearly home", I said, "and not one word has been said about that 'Wonder Drug' called D.D.T.".

"I did not mention it, because I consider it a minor factor in rural sanitation. Its value is only that of a pest control agent. It can do great harm, if it is not intelligently used", said the State inspector.

"You are right", I said, "for many insects have been most valuable to mankind and have played an important part in the development of his civilization, of which the domestication of the honey bee in the twilight of antiquity is an outstanding example. The reciprocal modifications of flowers and insects, in the process of evolution, had advanced so far that in many cases they can exist only by virtue of this relationship. For cross-pollination, many plants are dependent upon insects. Continuous warfare occurs in the vast kingdom of the insects, one group preying on the other. If we disturb the biologic balance in nature by destroying certain predators, parasites, and pollinators, great economic losses may result. The controlled use of D.D.T. on the farm will prevent fly torment in the barns, corrals, and pastures. Well screened barns, milk houses, and homes are just as essential as ever, for farm sanitation. Flies do not die for a definite time after coming in contact with D.D.T.". A pheasant cock darted across the roadway in front of our auto, resplendent in his multi-colored plumage. "I almost robbed some hunter of a swell bird", said our local inspector, and then he seemed in deep meditation as he silently smoked his pipe.

"Do you know" he said finally, "that we have not said a word about milk as a source of human infection? What about milk-borne epidemics, of

communicable disease such as scarlet fever, septic sore throat, and diphtheria? These epidemics are mainly explosive in type and in every case the milk worker is the causative factor".

"You are right", said the State inspector. "Many of the pathogenic organisms of these so-called milk-borne diseases can enter the udder of the animal and produce mastitis. Pathogens may thus be transmitted through the milk for many weeks. Fortunately, most cases of bovine mastitis are due to organisms that cause no harm to people, but nevertheless, every effort must be directed toward the prevention and control of this condition because of the economic loss caused the milk industry. It is also a fact that they may be a producing factor in many of the so-called gastrointestinal upsets in children. Domestic cattle as a source of milk infection are becoming less and less a problem of state and municipal departments of health. Nation wide campaigns for the eradication of bovine tuberculosis with every state in the Union on the accredited list, has practically eliminated this disease in this country. Now a campaign for the elimination of Bang's disease is in the process of evolution. Too much credit cannot be given veterinary science for this wonderful work in the field of animal husbandry and for the prevention of this disease".

"In our appraisal methods for measuring the quality of rural farm sanitation, I think we have given the Doctor 'much food for thought'" said the inspector, "and it is to be regretted that time does not permit us to discuss some of the other factors involved such as neighborhood environment, rat eradication, pasteurization of milk and milk products for rural consumption, faulty construction of farm buildings and garbage disposal systems".

"May I leave this thought in parting"? said the State inspector, as we got out of our car in back of my office, "the progress of rural sanitation has

been a slow and arduous process. In its development, we have only passed the threshold. The problems that we face in the future are difficult, and will require careful planning and study, if we are to solve them for the benefit of the greatest number. The education of all that can be educated is necessary if we decrease the gap between sanitary attainment and its practical application. The Grange and Farm Bureau have waged front line battles for rural welfare. The rural church and parent-teacher association, the 4-H Clubs, and the Boy and Girl Scout organizations, have been leaders and builders in rural community health education. These efforts are commendable, but they are not broad enough in their scope. We must make public health teaching an integrated part of the rural school program. We must educate the 451,661 rural school teachers in the fundamental principles of health education so they can in turn impart this knowledge to the 12,000,000 rural school children. Rural educators recognize health as one of the major social problems. They are looking forward to our help in meeting these objectives. If proper health guidance is given to the rural school child from the time he enters school and until he leaves, you will have created a health consciousness which will lead the way to a better and more healthful way of living. We must have this form of education if we are to use intelligently and efficiently the equipment which modern science has developed".

As I sat alone in my office, memories of the day came tumbling down from the storehouse of the brain, like nuts from a tree when touched by the first frost of autumn. One picture seemed to overlap the other and their sequence was not logical.

"Could this be but a dream", I asked myself, and as if in answer, I could hear the striking of a clock, and someone gently saying, "wake up, old man, it is seven bells, and time for break-

(Continued on page 306)

New Books and Other Publications

Glycerin, Its Industrial and Commercial Applications, by Georgia Leffingwell and Milton Lesser. Published by Chemical Publishing Co., Inc., New York, 1945. 259 pages. \$5.00.

"When he extracted 'the sweet principle of fats' from olive oil, neither Scheele nor his generation suspected the full importance of the achievement. They could not guess that in a highly industrialized future, this product, under the name of glycerin, would develop into a thing of a thousand uses: in therapeutics, food processing, cosmetics, and scores of industries.

"In the ordinary course of eating and drinking, all of us get indirectly a daily supply of the substance somewhere along the line: so many simple, homely items of consumption contain glycerin; milk, for example, and butter, cheese, salad oils, lard, vegetable shortenings, cocoanut products, nut meats, etc.

"The average person knows glycerin only in its most elementary form, whether on the kitchen shelf, on the cosmetic table, or in the medicine chest. He is but vaguely aware, if at all, that it is an essential though invisible ingredient in endless items of everyday use or consumption; or that it enters importantly into a large number of technical and industrial processes."

These above quotations indicate the extensive uses of glycerin. The authors have compiled a list of 1,583 commercial uses of glycerin, including 23 in cleaners and laundry aids, 36 in agriculture, 26 in beverages, 23 in sanitation and personal hygiene, 94 in cosmetics, and 85 in foods.

This book is a comprehensive survey of the large number of industrial products which contain glycerin in smaller or larger percentages. Each chapter covers the use of glycerin in a particular branch of industry, and contains a discussion of the properties of glycerin which render it useful for the industry covered in the chapter.

The book is written in a clear, readable style, useful (and interesting) to the industrialist for its wealth of information as to the usefulness of gly-

cerin for many purposes, and to the teacher who can use it to good purpose in showing students the potentialities in chemical technology.

The Analysis of Foods, by A. L. Winton and K. B. Winton. Published by John Wiley and Sons, Inc., New York, 1945. 999 pages. 208 illustrations. Price \$12.00.

To the old-timers in food analysis—those who used Leach and Winton's *Food Inspection and Analysis*—and both old-timers and new-comers who use the *Methods of Analysis* of the Association of Official Agricultural Chemists, this book is welcome. It combines the best features of both books. The former was useful and practical; the latter is compendious and detailed. The instant book presents the subject of food analysis in an orderly, discriminatory, and explanatory arrangement. Subjects are introduced with brief discussions of their characteristic place in the total analytical picture, and equipment and methods are presented with helpful suggestions. In organization, the authors proceed from general to detailed. The methods follow closely the wording of the *Methods of Analysis* of the Association of Official Agricultural Chemists, but are decidedly easier to follow. Copious references are given to the literature and illustrations are adequate.

The first 25 pages is devoted to a description, with illustrations, of the equipment and standard solutions needed for food control work.

Part I, pages 27 to 416, deals with General Methods: microscopic, physical, and chemical. Then comes the determination of the *Organic Elements* (C,H,N), followed by *Constituent Groups* (water, protein, ether extract, nitrogen-free extract, fiber, and ash),

then the *Chief Constituents of the 6 Groups* (water, protein, fat, carbohydrate and organic acids, fiber, and ash). This is succeeded by the *Alcohols* and then *Traces* (vitamins, natural colors, artificial colors, and chemical preservatives).

Part II, pages 417 to 946, deals with Special Methods for cereals, fatty foods, vegetables, fruits, sugars and saccharine foods, alcoholic beverages, dairy products, animal foods, alkaloid products, food flavors, leaven, and salt.

Teachers will find convenient "A Suggested Short Course in Food Analysis," carrying references for the analysis of cereal foods, oils and fats, fruit products, saccharine foods, wine, milk, butter, meat, flavoring extracts, and baking powder. Such an arrangement acquaints the student with the type of work, the analytical procedure, and the reference material which he will constantly use in his later food work.

The poor quality of the paper, probably the result of wartime restrictions, precluded clear reproduction of half-tones, necessitating the use of line and wood cuts. The latter give an atmosphere that reminds the reader of some of his earlier texts—an excellent tonic in these days of streamlined, popularized, and caricatured texts.

Surface Active Agents, by C. B. F. Young and K. W. Coons. Published by the Chemical Publishing Co., Inc., Brooklyn, N. Y., 1945. 381 pages. \$6.00.

The theoretical aspects of surface tension, its application to industrial fields, effects of surface active agents, and the relation between surface tension and other physical properties of matter are treated in detail.

The rest of this book deals with diverse branches of industries in which surface active agents are used, and contains many typical formulae which will facilitate the formulation of emul-

sions and other products based on the utilization of surface active agents.

Methods for the determination of surface tension are described and apparatus used are illustrated. A comprehensive alphabetical list of wetting and other surface active agents, giving also the chemical composition, the industrial use, as well as name and address of the manufacturers, will prove of great value to chemists and other workers of many industries.

The chapter headings are: Theory of Surface Tension; Determination of Surface Tension; The Structure of Wetting Agents and Specific Surface-Tension Agents; Emulsions; Plating, Metal Cleaning, Pickling and Etching; Cosmetics; Leather; Flotation; Inks; Textiles; Cutting Oils; Adhesives; Foods; Lubrication; Soldering, Brazing; and Welding.

Chemistry of Food and Nutrition, by H. C. Sherman. 7th Edition. Published by the Macmillan Co., 60 Fifth Ave., New York, N. Y., 1946. 675 pages. \$3.75.

This new edition—seventh—of Sherman's widely used text has been increased in size from 611 pages in the 1941 (6th edition) to 675 pages in the instant one. Chapter XXIX on "Nutritional Characteristics of the Chief Groups of Food," and Chapter XXX on "Causes and Extent of Variations in the Nutritive Values of Foods," are new, and the others have been rewritten and/or enlarged, especially Chapters XXVI, XXVII, and XXVIII. Many new reading references have been added, especially the useful National Research Council's Recommended Daily Dietary Allowances and a Family Food Plan. The entire book has been reset in larger type, made possible by smaller margins and decrease in only one line to the page. The format has been changed a little in the direction of a more modish setup. Much material is printed in smaller type as a teaching aid for omission in

shorter courses. The book in general, however, retains all the qualities which have made the earlier editions popular, namely, convenience of arrangement, authoritativeness, many references, and clear and interesting presentation.

Soap in Industry, by Georgia Lefingwell and Milton Lesser. Published by the Chemical Publishing Co., Inc., Brooklyn, N. Y., 1946. 204 pages. \$4.00.

This book is a practical treatise which will provide chemists, manufacturers, salesmen, industrial workers and students with many useful hints as to the utilization of soaps in manufacturing processes. One of the peculiar properties of soap that make it useful in a great variety of manufacturing processes is its faculty of penetrating and carrying other substances with it.

Another property of industrial significance is that of lowering surface tension. In many industrial processes soap functions advantageously for other than detergent reasons, due to its efficiency as a dispersing agent in a wide range of emulsions.

In the various industries, many special soap-like products are employed for specific tasks. These products, whose raw materials are fats and oils, are treated separately in detailed discussions of individual industries.

The authors have included a wealth of formulae carefully selected during their many years of experience with industrial soaps and their application. Attention is called to the distinctive qualities of the various formulae, the methods of their preparation, and their uses. However, the authors seem to identify the requirement of cleanliness in the dairy industry with the use of soap, whereas it is generally known that the use of soap is prohibited except in plant lavatories and garages. Cleanliness is emphasized in restaurant sanitation by directions on the use of soap, especially on floors. These two chapters are the only ones out of twenty-three on various industries that do not give a list of a dozen or more references to the literature.

The book makes interesting reading on the wide application of soap to many industries.

STANDARD METHODS FOR DAIRY PRODUCTS

Summary of Recommended Changes for the Ninth Edition

The subject matter of the Eighth Edition of *Standard Methods for Dairy Products* has been entirely rewritten by Dr. A. H. Robertson, Director of the State Food Laboratory, Albany, N. Y., and Dr. Luther A. Black of the Sanitation Division of the U. S. Public Health Service, Cincinnati, Ohio, with the active assistance of the following referees: Mac H. McCrady (Montreal), S. R. Damon (Indianapolis), W. D. Tiedeman (Albany), C. A. Abele (Chicago), C. K. Johns (Ottawa), M. W. Yale (Green Bay, Wis.), F. W. Fabian (East Lansing), E. H. Parfitt (Chicago), A. W. Fuchs (Washington), and L. H. Burgwald (Columbus). More than 40 additional members of the Committees involved in the work have contributed to the preparation by participation in conferences or through submitted criticisms and suggestions. An effort has been made to keep the report widely representative of the best thought in the milk and dairy products field of all of the countries actively participating in the work of the American Public Health Association.

This revision has been carried out under the direct supervision of the undersigned Chairmen of the Committees participating in the preparation of this report. These committees are: The Committee on Methods for Examining Milk and Milk Products of the Laboratory Section, R. S. Breed (Geneva), *Chairman*; Joint Committee on Frozen Desserts and Their Ingredients, of the Laboratory and of the Food and Nutrition Sections, F. L. Mickle (Hartford), *Chairman*; Committee on Bio-assay of Foods of the Food and Nutrition Section, H. T. Scott (Madison), *Chairman*. The Chemical Methods are included through the cooperation of the Association of Official Agricultural Chemists, represented by A. C. Hunter.

Important changes in the report may be summarized as follows:

1. Chapter 1 discussed the advantages and disadvantages of the more common quality tests for dairy products. Much of this material intended for the guidance of those who use the methods described was scattered throughout the Eighth Edition. This has been assembled

in one chapter for the Ninth Edition. The subject matter deals with the selection of the most useful methods, shows how they are used, and finally suggests interpretations for quality standards as applied to acceptable milk and cream. Although quality standards now in use are given in the text, it is felt that each jurisdiction involved must fix its own standards suitable for enforcement under local conditions of production and marketing. The material is presented in the following order: "Raw Milk for Pasteurization," "Pasteurized Milk," and "Raw Milk to Be Consumed Raw." Under this arrangement the directions for laboratory procedures are made direct and specific.

2. The style of presentation of methods has been confined insofar as possible to the imperative. This style alone reduces the verbiage in directions taken from the eighth edition by nearly 25 percent and results in a much improved coordination and sequence of thought.

3. A cross reference system, which is a modification of the Dewey library system, has been used extensively. The references appear in bold face, which makes the need for paging somewhat unnecessary. In addition to the cross references, a subject index at the end of the book and a Table of Contents at the beginning have been included. The cross reference system reduces the paging by an additional 5 percent. The inclusion of new material, however, makes the new edition larger than the old edition.

The cross reference system consists of a number at the left of the decimal, which indicates in which one of the thirteen chapters the references may be found. The number at the right of the decimal indicates the paragraph or the subject heading in which the specific reference appears.

The titles for the thirteen chapters follow:

<i>Chapter</i>	<i>Title</i>
1.	Selection and Interpretation of Quality Tests
2.	Microbiological Methods for Milk and Cream
3.	Detection of Special Bacterial Groups or Species
4.	Microbiological Methods for Butter
5.	Microbiological Methods for Cheese
6.	Microbiological Methods for Frozen Dessert Ingredients
7.	Microbiological Methods for Frozen Desserts
8.	Sterility Tests for Dairy Equipment
9.	Extraneous Matter (Sediment) in Dairy Products
10.	Determination of Vitamins in Dairy Products
11.	Phosphatase Methods to Determine Pasteurization
12.	Chemical Methods
13.	Screening Tests

4. Because extensive studies on the Methylene-Blue Reduction Test have demonstrated the need for counteracting the effect of creaming during the incubation of samples, hourly inversion of the sample tubes to re-distribute the fat and bacteria has been prescribed in the modified procedure. A special modification of the procedure for recording methylene blue reduction times is introduced. The results obtained thereby seem to correlate more closely with quality standards which have been set up for interchangeable use with other methods of determining quality. The directions follow:

"Except where reduction time is less than 1 hour, record the reduction time at hourly periods. After incubation for 30 min., examine the tubes. If any samples are reduced, record the reduction time as 30 min. To avoid misinterpretations (errors greater than ± 30 min. in readings) when a sample is reduced very shortly after any reading, but the reduction of which is not noted until the next hourly reading, routinely make the second reading after 1.5 hours incubation at 37° C. and successive readings at hourly intervals thereafter. Record as the reduction time the interval in whole hours between the initial triple inversion of the sample and the disappearance of the blue color therein. For instance, if the color disappears between the 0.5-hour interval and 1.5-hour reading interval, note the reduction time as 1 hour; similarly if between the 1.5-hour and the 2.5-hour reading, as 2 hours, etc. Invert once, immediately after each reading, all tubes which have not decolorized, unless there is reason to believe that complete reduction in any tube will occur well within a 30-min. interval after any particular reading. Any such tube which is not entirely reduced and which is left without inversion, is read in the regular manner as follows: Record a sample as reduced when the column as viewed through the wall of the tube is completely decolorized, exclusive of the portion 5 mm. in depth at the top or at the bottom of the mixture. When samples are decolorized, remove them from the bath at the designated intervals and record the reduction time of each."

5. The "One-Hour" Resazurin Test and the "Triple-Reading" Resazurin Test have been accepted as useful standard methods.

6. Directions for the preparation of lactose broth, Endo agar, and eosin-methylene-blue agar have been added to the coliform section.

7. Microbiological Methods for Cheese have been included as follows:
- (1) Methods for determining the yeast and mold content (A spoilage problem) in soft type cheeses, such as cottage cheese, cream cheese, etc.
 - (2) Methods for the isolation and identification of pathogenic bacteria in cheese. In the latter section, attention is given to the isolation from cheese of pathogenic streptococci of Lancefield's Group A, species of *Brucella*, *Salmonella typhosa*, and other salmonellas, the pathogenic shigellas, and enterotoxigenic staphylococci.
8. Methods for examining stabilizers have been added to the chapter on Microbiological Methods for Frozen Dessert Ingredients.
9. Procedures for making Sediment Tests from Milk have been changed so as to permit both the Mixed Sample Method and the Off-Bottom Sample Method. Directions are furnished for preparing standard sediment discs which are reproducible. Methods for checking the efficiency of the various sediment testing devices on the market are also given.
10. Because of the close relationship between Filth, Extraneous Matter, and Sediment in Dairy Products, methods used by the U. S. Food and Drug Administration have been included in Chapter 9 for the determination and identification of filth in various dairy products, including cream, butter, cheese, dried milk, evaporated milk, and condensed milk.
11. Methods for the determination of thiamin hydrochloride, riboflavin, and niacin have been added to Chapter 11 on Determination of Vitamins in Dairy Products.
12. Methods for the determination of phosphatase in milk have been extended to include methods for its determination in cream, chocolate flavored milk, butter, cheese, and ice cream.
13. Screening tests have been segregated in Chapter 13. Although screening tests have been recognized but tacitly heretofore, they are now given recognition as rapid sorting procedures. The use of these methods permits the examination of a much larger number of samples than could otherwise be examined in the same length of time. Obviously, most examinations of finished products are necessarily of a survey character from the standpoint of a regulatory agency. As milksheds enlarge, the need for screening tests becomes greater. Screening tests should not be used when laboratory results may be needed for court testimony. The use of screening tests saves time which can be used advantageously to correct unsatisfactory conditions.
- Among recognized screening test procedures are the following:
- a. Practical field sterilization procedures for agitators and sampling tubes.
 - b. Sampling of the milk after it is dumped into the weigh vat.
 - c. Loop measurements for 0.01 ml. portions for the direct microscopic method.
 - d. Burri Slant Method as a semi-portable modification of the agar plate method to determine relative degrees of contamination.
 - e. A single tube test for coliform bacteria where successive samples are removed at frequent intervals during the pasteurization process.
 - f. Tests to check the presence of bacteria that survive pasteurization.
 - g. Tests to detect the presence of thermophilic bacteria.
 - h. Volumetric measurement of test portions of frozen desserts.
 - i. New York City field phosphatase test to determine whether or not milk has been pasteurized.
 - j. Modified Babcock methods (Minnesota Modification and Pennsylvania Modification) for determination of the milk fat in frozen desserts.
14. Miscellaneous Items.
- a. Transfer pipette specifications are shown in diagrams of the pipettes and are not included as part of the description of the pipette in the text.
 - b. An outline of specific procedures with a table of illustrations is provided to guide in "Selecting and Counting Colonies on Agar Plates."
 - c. When the number of fields to be counted, using the direct microscopic method, is constant, a working factor should be substituted for the microscopic factor. The working factor is obtained by dividing the microscopic factor by the number of fields counted. The use of the working factor simplifies the calculations when determining the number of clumps or bacteria per ml.
 - d. The application of the coliform test to raw milk, other than Certified Raw Milk, is not recommended or approved. The coliform test as applied to freshly bottled pasteurized milk is a delicate test when used to detect recontamination from equipment subsequent to pasteurization.

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 Association News
Dairy Technology Conference at
University of Maryland

A Dairy Technology Conference will be held at the University of Maryland, December 3, 4, 5. Outstanding speakers have been obtained to discuss topics of interest to all persons engaged in milk and ice cream plant activities, in field work, or in dairy inspection. This conference is a combination of separate short courses for fieldmen and dairy technologists which have been given in the past. For details, write the Dairy Department, University of Maryland, College Park, Maryland.

Massachusetts Milk Inspectors'
Association

The next meeting of the Massachusetts Milk Inspectors' Association will be held at the Hotel Sheraton, Springfield, on October 2-3. In addition to a program now in course of development, the officers for the ensuing year will be nominated. Election will take place at the annual meeting which will be held at Worcester, on January 7-8, 1947, in connection with the Union Agricultural Meeting.

ROBERT E. BEMIS
Secretary-Treasurer

Metropolitan Dairy Technology Society

The Metropolitan Dairy Technology Society will begin its season with its Fall meeting at the usual place, namely, the Hotel George Washington, corner 23rd Street and Lexington Avenue, New York. Meetings are held on the third Tuesday of each month. The annual meeting is held in December when officers are elected for the ensuing year.

The Society has had a fine growth and there are many new faces in this active organization.

F. C. BUTTON

Secretary-Treasurer

Philadelphia Dairy Technology Society

The first meeting of the 1946-1947 season will be held at the Whittier Hotel, 140 North 15th Street, Philadelphia, on Thursday, October 10.

W. S. HOLMES

Secretary-Treasurer

Missouri Association of Milk and Food Sanitarians

At the meeting of the Missouri Association of Milk Sanitarians, held last May, the name of the organization was changed to the "Missouri Association of Milk and Food Sanitarians."

The organization also adopted a resolution relative to restaurant equipment and Public Health Bulletin No. 280 (see bottom of this page).

CHARLES E. CARL

Acting Secretary-Treasurer

Oklahoma Association of Milk Sanitarians

The annual meeting of the Oklahoma Association of Milk Sanitarians will be held at Lawton, Oklahoma, on October 7th and 8th.

The State Department of Health just concluded a two day milk seminar at Oklahoma City, on August 5th and 6th. About 65 milk sanitarians attended this meeting.

W. B. LANPHERE

Secretary-Treasurer

RESOLUTION RE FOOD-HANDLING ESTABLISHMENTS**Missouri Association of Milk and Food Sanitarians**

WHEREAS, The Sanitarian Section of the Florida Public Health Association has unanimously adopted a resolution at its general session December 5, 1944, treating the design, construction and installation of restaurant, soda fountain and bar equipment; and

WHEREAS, it is the opinion of this association that the objectives of said resolution are already covered by Public Health Bulletin No. 280 (Ordinance and Code Regulating Eating and Drinking Establishments recommended by the U. S. Public Health Service, 1943 edition); and

WHEREAS, it is the further opinion of this association that said Bulletin 280 is of such standard character as to warrant widespread acceptance and use by health authorities; therefore be it

RESOLVED, that the Missouri Association of Milk and Food Sanitarians now recommend that Public Health Bulletin 280 be adopted and used as a guide by sanitarians, equipment manufacturers and operators in the establishing of design and construction standards for equipment used in eating and drinking establishments; and be it further

RESOLVED, that the members of this association shall in the future accept for new installation only that equipment which has been designed and constructed to satisfy the requirements of said Public Health Bulletin No. 280.

CHARLES E. CARL

Acting Secretary-Treasurer

HORATIO NEWTON PARKER—AN APPRECIATION



In the retirement of Horatio Newton Parker from active duty, the milk sanitarians will truly miss the council and rare good judgment of an outstanding man in this field. Mr. Parker has served the industry long and well in many capacities during his fifty years as a sanitarian.

Few public health officials have the wealth of experience in so many fields as Mr. Parker. After graduating from Massachusetts Institute of Technology in 1895, he held successively positions as assistant biologist, Boston Water Works, (1896-99); assistant and then chief biologist, Metropolitan Water Works of Massachusetts, (1900-01). He was elected Health Officer of Montclair, New Jersey, in which capacity he served for three years, (1901-04), after which he went with the U. S. Geological Survey as assistant hydrographer and assistant engineer (1904-10).

Parker was a pioneer in water sanitation as his record shows. It was while he was with the Metropolitan Water Works of Massachusetts that he traced an outbreak of urogena infestation in Lake Cochituate and

Basin No. 3 due to turbidity occasioned by work being done in the reservoirs of Lake Cochituate.

His first experience with a food borne infection came while he was Health Officer of Montclair, New Jersey. An outbreak of typhoid fever occurred which was difficult to trace since curiously enough it was contracted only by people who were using pint milk bottles. The solution proved to be a typhoid carrier prematurely discharged from a New York hospital whose milk was delivered to his home only in pint bottles.

In 1910 Parker first entered the dairy field as dairy bacteriologist at the University of Illinois and assistant bacteriologist in the Illinois Agricultural Experiment Station where he remained until 1917. While at Illinois he traced three separate outbreaks of typhoid fever, one at the state reformatory due to a carrier working in the refectory, another in Belleville traced to a woman carrier on a farm supplying milk to the city, and a third epidemic at Rockford traced to baked goods infected by a bakery man peddling his wares to the citizens.

From the University of Illinois, Parker went to the University of Indiana as a lecturer on municipal sanitation. Here his lecture work was not confined to the University alone since he travelled over the state lecturing to various groups in different cities. Thus, he became a pioneer in adult education and one of the early disciples of health education.

Due to his wide knowledge of water and milk in particular and municipal sanitation in general, Mrs. Honore Willsie, Editor of the *Delineator*, chose Parker as the bacteriologist in her "Save the Seventh Baby" campaign which she carried on so successfully in 1917-18. This campaign took

its name from the fact that in the United States due to the lack of vaccination, inoculation, ignorance of proper sanitation, sterility, improper diet, and diarrhea (summer complaint), one out of every seven infants died before they reached their second year. During this time Parker travelled throughout many sections of the United States, making temperature readings at the time the milk was delivered to the consumers, making bacteria counts, and scoring the milk supply. This campaign under his able leadership did much to educate the people to the necessity of a clean milk supply and its relation to healthy babies as well as adults.

After Parker had finished his work with the *Delineator*, he went to Jacksonville, Florida, as bacteriologist and chemist for the city health department where he has remained until his retirement at the end of 1945. To this position he brought a wealth of experience which he had gained during the previous twenty-five years serving in the many capacities which it had been his good fortune to occupy. Soon Jacksonville became noted for its municipal sanitation program and its sanitary control over food, water, milk and dairy products. Jacksonville today, through the experience, wisdom, and breadth of vision of Parker is the outstanding city of the South and ranks foremost among cities of its size in the United States in its water, food, and dairy sanitation.

To attest the ability and progressiveness of Parker is given herewith a partial list of the many ordinances which he wrote for Jacksonville during his service to the city:

1. An Ordinance Regulating the Keeping, Storing, Manufacturing, Selling and Exposing for Sale of Articles of Food and Drink for Human Beings. Ord. S-39. November 24, 1925.
2. An Ordinance Regulating the Retail Sale of Fresh Fish. Ord. T-143. August 14, 1928.
3. An Ordinance Regulating the Gathering, Storing, Handling and Sale of Shellfish. Ord. T-182. November 17, 1928.
4. An Ordinance Regulating the Keeping, Storing, Handling and Dressing of Poultry. Ord. T-238. June 1, 1929.
5. An Ordinance Regulating the Manufacture and Sale of Ice Cream. August 23, 1932.
6. An Ordinance Regulating the Handling of Waste from Bar Sinks, Soda Fountains, etc. Ord. X-106. December 3, 1936.
7. An Ordinance Regulating the Production, Sale and Pasteurizing of Milk and Milk Products. Ord. Z-248. September 10, 1941.

In addition to these and other ordinances not mentioned here, Parker amended and revised many existing ordinances to keep them up to the scientific advances of the time.

In the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS, Parker has been a tireless worker, having helped found the Association and being one of the few charter members still living. The Association honored him with the Presidency in 1932. In 1940 he compiled an "Index of the Twenty-five Annual Reports of the International Association of Dairy and Milk Inspectors; 1912-1936." This was indeed a labor of love and a very useful tool for members of the Association and others desiring to use the Annual Reports. As Chairman of the Committee on Dairy Farm Methods, he wrote the Committee Report on Method of Cleaning Milking Machines.

Mr. Parker is not only a distinguished scientist and sanitarian but comes from a distinguished ancestry. His family name is mentioned in Burke's Landed Gentry (p. 2854) and "First Families in America" (1, 756; 3, 568; 7, 335). In 1940 he published "Some Descendants of Six Pioneers from Great Britain to America" which

is a genealogy of the Parker, Hall, Newton, Dewolk, Evans, and Irwin families. He is listed in "Who's Who in America," "American Men of Science," "Who's Who and What to See in Florida—1935" and in "The Southerner."

He is a member of a large number of scientific organizations, the principal ones being the American Public Health Association (Fellow), the American Association for Advancement of Science (Fellow), Florida Academy of Sciences, Society of American Bacteriologists, American Chemical Society, American Dairy Science Association, International Association Milk Sanitarians (President 1932-33), Association of Food and Drug Officials of the U. S. Association of Food and Drug Officials of the Southeastern States (President 1924), New England Water Works Association, and Florida Public Health Association (President 1931-32).

In Jacksonville he belongs to the Torch and Civitan Clubs (President

1940), is a prominent Episcopalian, and Mason (Knight Templar).

In the twilight of life Mr. Parker can look back upon a long life of usefulness and can view with satisfaction his past achievements in the field of public health. It was his good fortune to have been born just one year after (1871) Pasteur enunciated the germ theory of disease, to have come under the influence of one of the great biologists of America in William Thompson Sedwick at Massachusetts Institute of Technology, and finally to have come into the field of public health at practically its beginning in America. This combination of circumstances was ideal for one of Mr. Parker's intellect and character. The INTERNATIONAL ASSOCIATION OF MILK SANITARIANS is indeed honored to claim him as one of them and gratified to know that it was through this Association that he was able to give expression to much of his constructive work and ideas in this particular field of his endeavors.

F.W.F.

ILLINOIS DAIRY MANUFACTURERS' CONFERENCE

The annual University of Illinois Dairy Manufacturers' Conference will be held at Urbana, November 5-7, 1946. The first day will be devoted to topics of interest to field men and others concerned with the problem of milk procurement. On the second and third days, problems related to the manufacture and distribution of dairy products will be discussed. Some of the important topics scheduled are:

1. A Milk Quality Program
2. The "Self Cleaning" Separator
3. Germicidal Effect of Quaternary Ammonium Compounds
4. Ice Cream Stabilizers and Whipping Agents
5. Manufacture of Cottage Cheese
6. Frozen Whole Milk
7. Powdered Milk and Mix
8. Milk Can Washing

9. Recent Advances in Heating Engineering
10. Insect and Rodent Control in Food Plants

A limited number of out-of-town visitors can be accommodated by local hotels. Reservations should be made early by writing directly to the hotel. Where possible, two or more persons should arrange to occupy the same room. The addresses of the larger hotels are as follows:

Inman—University and Walnut
Hamilton—110 West Park, Champaign
Tilden Hall—Weil and Mill, Champaign
Urbana Lincoln—Broadway at Green,
Urbana.

For further information regarding the conference, write Professor P. H. Tracy, Department of Dairy Husbandry, University of Illinois, Urbana, Illinois.

Correspondence

George H. Conn, B.S.A.H., D.V.M.

Freeport, Illinois

July 17, 1946.

Journal of Milk Technology,
374 Broadway,
Albany, N. Y.

Gentlemen:

In late 1945 or early 1946 you evidently carried some material carrying information on two lawsuits against individuals supplying raw milk to individuals who contracted undulant fever, in which these individuals secured substantial judgments against the suppliers of the milk consumed by them.

The latest and most reliable information on undulant fever in the human is to the effect that it is very seldom caused by milk, but is quite commonly caused from contacts with infected cows and more particularly in contact with swine and probably other animals.

This article or comment of yours is very misleading and we wonder if you would have an extra copy that you would send us for our files and whether you would be interested in condensing an article submitted by me to The Stockman that gives the latest information on undulant fever. While I have been preparing articles of this type for the agricultural press for 32 years, I am quite busy now and do not know that I would care to take the time to prepare a special article on this subject, providing you could use the material in the article mentioned above.

Yours, very truly

(Signed) GEORGE H. CONN.

REPLY

The following reply has been prepared, at the editor's request, by Dr. Paul B. Brooks, former deputy commissioner of health of the State of New York, for many years an officer of the INTERNATIONAL and one of our associate editors:

A review of the issues of the JOURNAL from the beginning of 1945

to the date of writing has not revealed the article or comment which Dr. Conn says it "evidently carried." There are, however, published records of awards of damages to persons who have contracted brucellosis, attributed to use of raw milk. Dr. Harold J. Harris, in his book on brucellosis, published in 1941, cites two such cases.

In the State of Washington, in 1937,

Ralph Dean was awarded damages amounting to \$1,946.50 against a milk company and a producer. In England, according to the *London Times* of March 18, 1939, damages in the amount of £195 were awarded to one Harry Harmer. If there have been other awards on the same grounds, information concerning them is not available at the time and place of writing. In any event, it would not seem that a statement of the facts, wherever published, could have been "very misleading."

It is, of course, well known that brucellosis is readily acquired through contact with infected animals. In certain Western and Mid-western areas where cattle and swine raising are predominant industries, such contacts are reported to account for the majority of the known cases. In Iowa, for example, porcine infection has been reported to be predominant. Miss Alice C. Evans, in an article published by the United States Public Health Service in 1945, characterizes brucellosis as an "occupational disease" among veterinarians, farmers, and slaughter-house workers. In fact, brucellosis is so highly infective that it is not uncommon for laboratory workers to become infected. Miss Evans, as we recall, was one of the early victims of such an infection.

It is well known, also, as the late Dr. Theobald Smith pointed out many years ago, that *Brucella suis*, the porcine organism, is more infective for man than its bovine counterpart,

Brucella abortus. Cattle have long been known to be susceptible to infection with *Brucella suis* and to be capable of passing this infection along to man through contact or use of their milk. In New York State, however, studies carried out over a period of a year or more in the State laboratory, on blood specimens from known cases, showed a majority to be due to the bovine organism.

On the question of the transmission of the infection through milk, Miss Evans' article also includes the following quite definite statement: "The consumption of raw infected dairy products is responsible for most of the cases that occur in the general population." She adds: "Because many large cities prohibit the sale of ordinary raw milk, brucellosis is predominantly a rural disease." She indicates, further, that Bangs' disease eradication programs cannot be depended on to provide full protection to consumers since, because of the difficulty of avoiding new infections, no herd "can be assumed to remain free from the disease."

There is ample and available evidence that brucellosis not only may be but frequently is milk-borne. It is well summarized in Miss Evans' statement, however, and her standing as an authority on brucellosis is a sufficient guaranty of the reliability of the information contained in her article. Having been published in 1945, it probably is safe to consider it "the latest information on undulant fever."

P. B. B.

ENVIRONMENTAL FARM SANITATION

(Continued from page 292)

fast and another day". Moving—speaking pictures from the subconscious-mind, projected upon the mental screen of a dream—it was difficult for me to believe that they were not real experiences. And ever since that time,

when I would be confronted with some difficult problem in human relations, I would say to myself, "Gee, people are funny, it is so difficult to play the game with them, because they are living things who can think and reason".

Industrial Notes

WYANDOTTE CHEMICALS ANNOUNCES \$25,000,000 EXPANSION PROGRAM



E. M. FORD
President
WYANDOTTE
CHEMICALS
CORPORATION

Twenty-five million dollars will be spent by Wyandotte Chemicals Corporation in additions and enlargements to its present plants within the next eighteen months, it was announced Saturday by E. M. Ford, president.

The improvements will make Wyandotte, already one of the world's largest manufacturers of industrial inorganic chemicals and specialized cleaning materials, an important factor in the organic field.

One phase of Wyandotte's expansion in the organic field will be the erection of the new synthetic detergent plant. Synthetic detergents, or soapless cleaners, are used both alone and as components of specialized compounds. Another organic unit representing an investment of several millions of dollars,

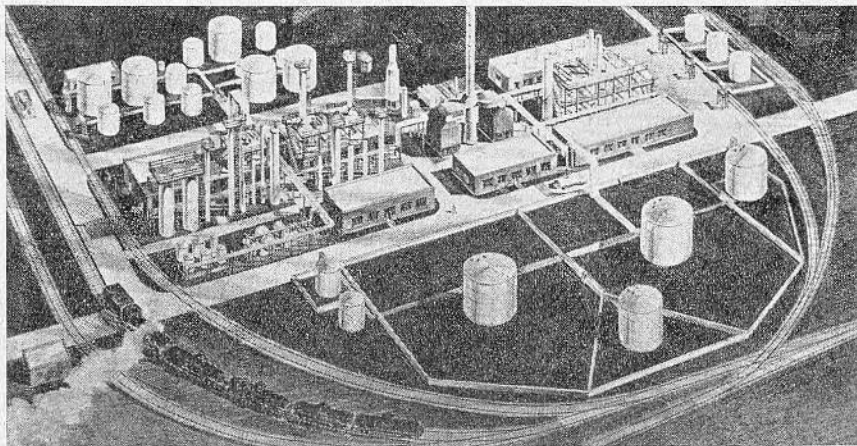
and already under construction, will supply materials to the commercial chemical field.

In addition to the installation of these facilities for production of new products by Wyandotte, there will be new plants erected to increase production of chlorine, calcium carbonate, and soda ash.

Soda ash is an important ingredient in many of the specialized cleaning and washing compounds used by the dairy, hospital, laundry, building and food serving industries.

Improvements in the present method of producing caustic soda will also be a feature of the expansion program and will increase the output of this chemical which is an essential ingredient in products used for milk and beverage bottle washing, fruit and vegetable peeling, and in certain tanning, textile and metal cleaning processes.

Expansion of staff is proceeding hand in hand with plant enlargement. Important additions to personnel have been made in the J. B. Ford Division headed by Vice-President C. B. Robinson, and the Michigan Alkali Division under Vice-President Bert Cremers. Technical Service, the department concerned with customer guidance in the use of industrial chemicals, has been expanded. Research and Development staffs, as well as the Engineering Department, have also been increased.



SKETCH OF GLYCOL PLANT

Part of Wyandotte Chemicals \$25,000,000 Expansion Program

New Members

ACTIVE

- Brannon, C. B., Sanitarian, Volosia Co. Health Dept., 506 S. Riverside Drive, New Smyrna, Beach, Fla.
- Carson, Robert B., S. A. Sanitarian (R), U.S.P.H. Service, 23 Charlton St. E., Savannah, Ga.
- Chaffee, Lyle L., Dairy Inspector, Sanitation Dept., City Hall, St. Petersburg, Fla.
- Chalker, S. T., Jr.,* 2708 St. Johns Ave., Jacksonville, Fla.
- Champion, Horace M.,† Bay County Health Department, Panama City, Fla.
- Harris, S. F., Sanitarian, Baker Co. Health Dept., McClenny, Fla.
- Hubbard, Dr. H. E., Director of Dairy Division, City Health Dept., Lincoln, Neb.
- Hulst, Edward M., Box 202, North Lawrence, N. Y.
- Johns, L. E., Milk Inspector, Broward Co. Health Dept., 704 Coconut Drive, Fort Lauderdale, Fla.
- Larson, R. A., Asst. Professor, Department of Dairy Technology, Ohio State University, Columbus 10, Ohio
- McCaffrey, Joseph C., Bacteriologist, State Department of Public Health, 1800 W. Fillmore St., Chicago 12, Ill.
- Mull, L. E., Asst. in Dairy Technology, Agricultural Experiment Station, Gainesville, Fla.
- Nisson, Leonard E., Milk Inspector, City of Eureka, 2707 "L" St., Eureka, Cal.
- Noles, Samuel O., Sanitary Officer, Leny Co. Health Unit, 517 E. Mechanic St., Gainesville, Fla.
- Owen, B. Jay, Chemist Inspector, State Dept. of Agriculture, P. O. Box 1111, Tallahassee, Fla.
- Pollard, Joseph, Jr., Cooklyn Milk Co., Dairy Products, 3228 Dickinson St., Philadelphia 46, Pa.
- Quillin, Frank D., Milk Sanitarian, Oak Ridge Health Department, 241 Corning Hall, Oak Ridge, Tenn.
- Ratzlaff, Alfred, 549 Montrose Lane, St. Paul 5, Minn.
- Sanborn, Prof. J. R., Professor of Bacteriology, Room 207, Lyman Hall, Syracuse University, Syracuse 10, N. Y.
- Scatterday, J. E., Sanitary Consultant, Alachua Co. Health Unit, Box 633, Gainesville, Fla.
- Shirley, Prue D., Milk Sanitarian, Hillsborough Co. Unit, 122 W. Minnehaha St., Tampa 4, Fla.
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ASSOCIATE

- Anderson, Fred S. Menominee County Health Department, Menominee, Mich.
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- Ballarin, O., Sub-Director, Cia. Ind. e Com. de Produtos Alimentares (Nestlé's Products), Caixa Postal 760, Rio de Janeiro, Brazil
- Bartle, E. R., Supervisor-Quality Control, Lakeside Butter Co., 300 No. 5th St., Minneapolis, Minn.
- Brown, Carl Stores, Chief Engineer, Glasco Products, Inc., 20900 St. Clair Ave., Cleveland 17, Ohio
- Bicknell, W. S., Cass County Health Department, Cassopolis, Mich.
- Bullard, Earl D., Plant Mgr., Dairymen's League, 36 Elm St., Cooperstown, N. Y.
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- Childs, Dale H., Flint Health Department, Flint, Mich.
- Calver, Homer N., Secy., Public Health Committee of the Paper Cup and Container Institute, Room 806, 1790 Broadway, New York 19, N. Y.
- Conway, Stephen J., Dairy Inspector, Chicago Board of Health, 8107 So. Wood St., Chicago 20, Ill.
- Crowley, Eric W., Government Dairy Supervisor, Department of Agriculture, 22 Hollyburton Grove, Warragal, Victoria, Australia
- Farrell, Jay, Dairy Inspector, Chicago Board of Health, 7806 S. Winchester St., Chicago 20, Ill.
- Foltz, Floyd R., Milk Inspector, Decatur Health Department, 1037 E. Prairie St., Decatur 6, Ill.
- Hansen, Carl N., Manager, Beatrice Creamery Co., 132 So. Market St., Champaign, Ill.

* Milk Sanitarian, City Health.

† Senior Inspector.

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- Heusing, George, Fieldman, Momence Coop. Milk Co., Grant Park, Ill.
- Irwin, E. E., Department of Health, Flint, Mich.
- Kotwas, Matt, Supervising Dairy Inspector, Chicago Board of Health, 5015 So. Kildare Ave., Chicago 32, Ill.
- Lawton, Edward A., Owner, Lawton Bros. Dairy, 114 No. Peoria Ave., Dixon, Ill.
- Littlefield, J. L., State Department of Agriculture, Lake, Mich.
- Maher, Ernestine, Laboratory Technician, Champaign Sanitary Milk Div., 713 So. State St., Champaign, Ill.
- Marquardt, Louis, Fieldman, Dairyland Coop., Cambria, Wis.
- Mead, Start, Laboratory Technician, J. D. Roszell Co., 736 S. Washington St., Peoria, Ill.
- McEwen, E. L., Muskegon City Health Department, Muskegon, Mich.
- McInerney, T., 12786 Rosemary St., Detroit 5, Mich.
- Miller, A. C., 306 S. Foster Ave., Lansing, Mich.
- Munson, F. Gordon, Fieldman, Dairyland Coop., R. F. D. 1, Watertown, Wis.
- Murray, Dr. Stewart, Senior Medical Health Officer, City Hall, Vancouver, B. C.
- Neuendorf, Louis, Fieldman, Oatman Bros., Inc., 325 Sunset Ave., Aurora, Ill.
- Okarna, Theodore Joseph, Manager, Dairy Farm, R. F. D. 1, Warwick, N. Y.
- Pfeffer, John C., Production Supt., Illinois Valley Ice Cream Co., 1209 N. Park St., Streator, Ill.
- Rajewski, Peter W., Dairy Inspector, Chicago Board of Health, 2838 Addison St., Chicago 18, Ill.
- St. Clair, A. V., McDonald Dairy, Flint, Mich.
- Simmons, S. L., 6116 John R. St., Detroit 2, Mich.
- Smith, Gail, 19346 Lesure St., Detroit 21, Mich.
- Smith, Gerald F., Supervisor of Field, Mead & Johnson Co., Zeeland, Mich.
- Tanner, Robert S., Managing Director, Model Dairy, Ltd., 131 Cotham Rd., Kew, Victoria, Australia
- Tibbetts, H. V., Flint Health Department, Flint, Mich.
- Veatch, J. A., Supt., Normal Sanitary Dairy, 405 Broadway, Normal, Ill.
- Wade, Wm., McDonald Dairy, Flint, Mich.
- Williams, F. E., 2004 Rundle St., Lansing, Mich.

CHANGES IN ADDRESS

- Ahl, Martin V., St. Petersburg, Fla., to 2301 N. Ocean Drive, Hollywood, Fla.
- Butterworth, T. H., Chapel Hill, N. C., to Room 338, 19th & Constitution Ave., Washington, D. C.
- Dilsaver, Warren M., Tampa 4, to 1420 Tampa St., Tampa 2, Fla.
- Heafner, S. B., Cortland, N. Y. to 1650 Metropolitan Ave., Bronx, N. Y. City
- Hopson, Robert S., Dept. of Public Health, Zone 19, Richmond, Va., to 822 E. 45th St., Richmond, Va.
- Fuller, J. D., 1155 Collingwood St., Detroit, Mich., to 2680 E. Jefferson St., Detroit 7, Mich.
- Gould, Dr. Ira A., East Lansing, Mich., to Department of Dairy Husbandry, University of Maryland, College Park, Md.
- Kallsen, Al., Cumberland, Wis., to Amery, Wis.
- Kihlstrum, Elmer E., Peoria, Ill., to 10160 South Homan Ave., Evergreen Park, Ill.
- Morley, Lloyd, Box 1495, Anchorage, Alaska, to Box 960, Anchorage, Alaska
- Pumphrey, G., 4987 Maplewood St., Detroit 8, Mich., to 12324 Northlawn St., Detroit 4, Mich.
- Rowland, J. L., Carrollton, Mo., to Box 101, Ocala, Fla.
- Sattell, Irving, APO, San Francisco, Cal., to 34-45 81st St., Jackson Hgts., Queens, New York City
- Shaw, Alex., State Dairy Inspector, Tampa, Fla., to Commissioner of Agriculture, Tallahassee, Fla.
- Tait, H. E., Madison 5, Wis., to Simon Hotel, 107 So. Butler St., Madison 3, Wis.
- Weber, Hiram R., Hartford, Wis., to 723 First Ave., Antigo, Wis.
- Wolcott, Arthur, St. Louis, Mich., to 1929 Allegan St., Saginaw, Mich.
- Zulkowski, Edward, 1036 W. 32nd St., Chicago, Ill., to 3344 So. May St., Chicago, 28, Ill.

“Doctor Jones” Says—*

This quality in people we call “initiative”—well, some of us older folks remember when we used to have to crank our automobiles. And boy! Those old model T’s, some of the cold winter mornings! But, in the course of time, somebody invented the electric starter. Then all we had to do was step on the button and the mechanism did the rest. And, eventually, we got to referring to people that had initiative as “self-starters.” I always thought that application was very appropriate.

There aren’t many of the old hand-cranking autos left. But there’s an awful lot of people—and always will be—that they may have good ideas but they seldom ever put ’em into action unless somebody cranks ’em up and gets ’em started. Whether it’s diffidence, habit (the effect of environment) or what, they lack initiative. If they don’t get ahead in the world the way they’d hoped to, some of ’em lay it to their bad luck. “It runs in the family,” one fellow said. It did. I knew his father. He was one of the most likable men I ever met but he wasn’t a “self-starter” either.

Most of us have been to meetings

or conferences, called to discuss some particular problem, where, after they got together, they’d dawdle around without getting to the point. Then one person’d start asking questions or something and, from then on, he steered the discussion and the others followed along. Probably the word “initiative” didn’t occur to anybody but they were just waiting for someone to start things going.

Yes, sir. Whether it’s public health or some other line (we’ve got to get some public health in this some way) there’s always opportunity and demand for leadership. Folks that never do anything different unless someone tells ’em to—they may be hard workers but they’re trailers, never leaders. Giving thought to their work—getting ideas on how things might be better done and so on—and having the initiative to get moving without being cranked; those qualities, plus horse sense and personality, make leaders.

The other day I saw three dogs arguing over a bone. A homely little mutt, wagging an oversized tail, came along, picked up the bone and, while the others were still arguing, went off up the street with it. That pup had initiative.

PAUL B. BROOKS, M.D.

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