VOLUME 20 NO. 6
JUNE, 1957

Journal of

MILK and FOOD TECHNOLOGY

Official Publication

International Association of Milk and Food Sanitarians, Inc.

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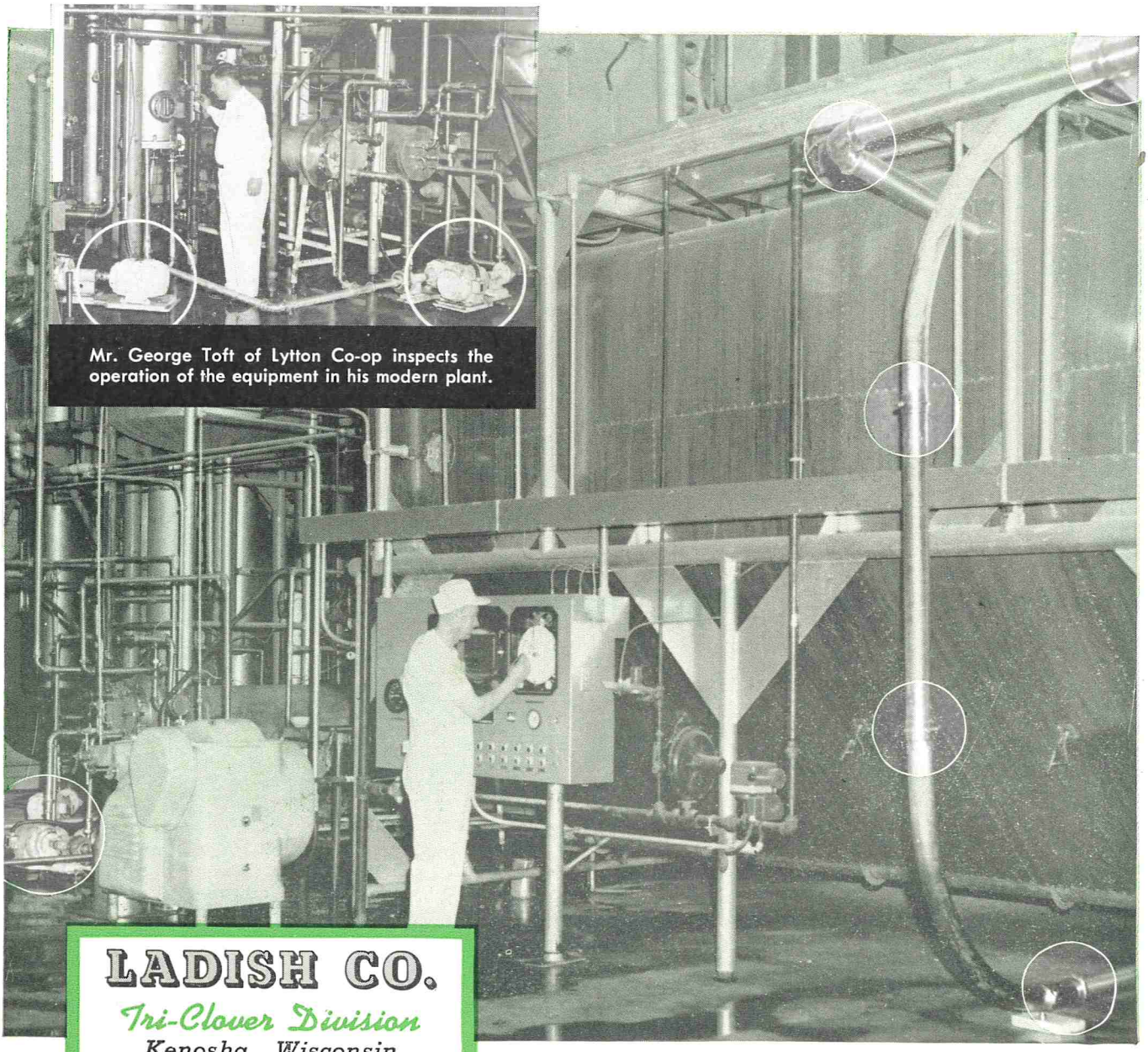

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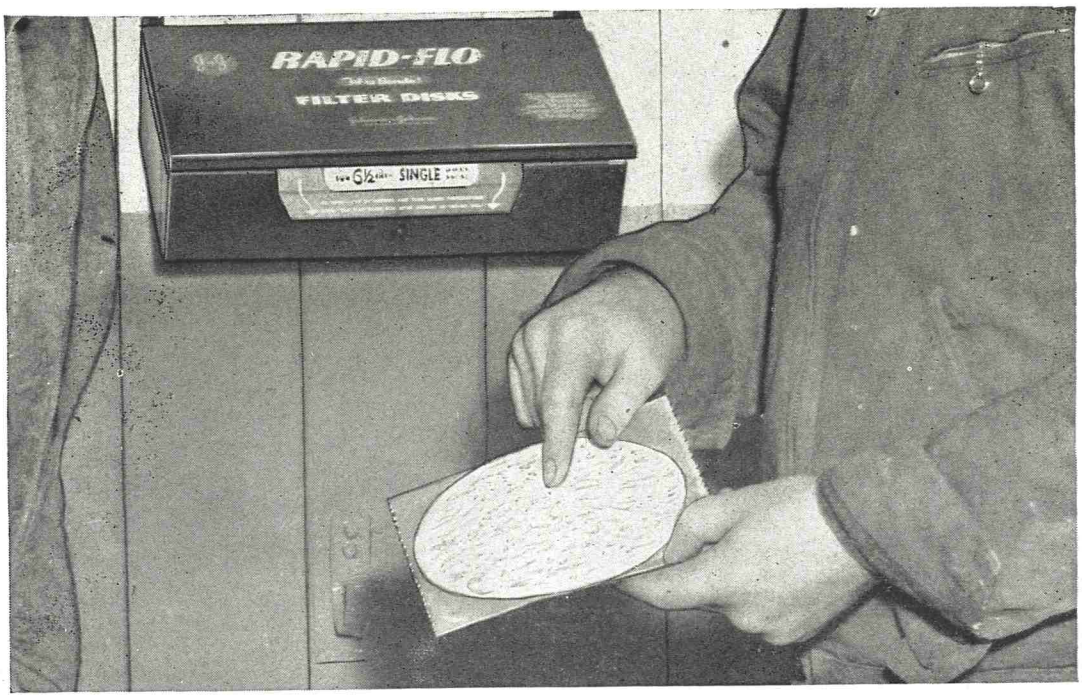

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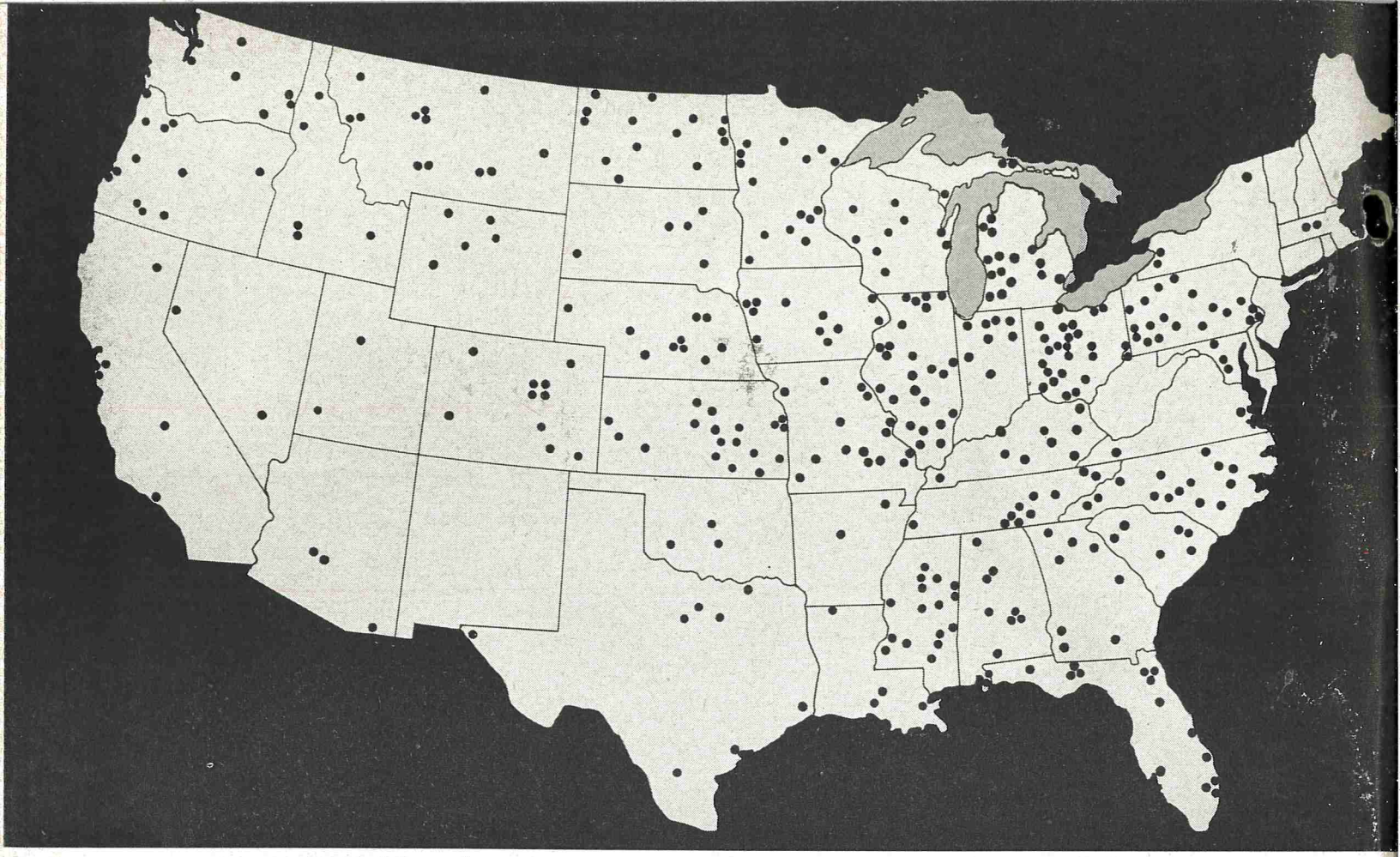

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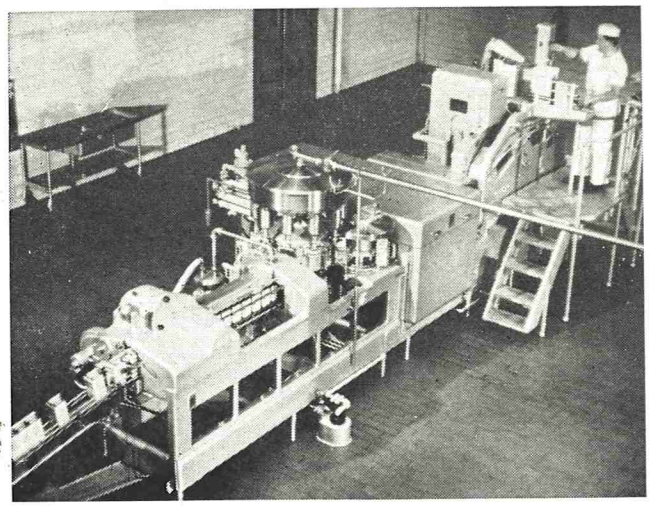

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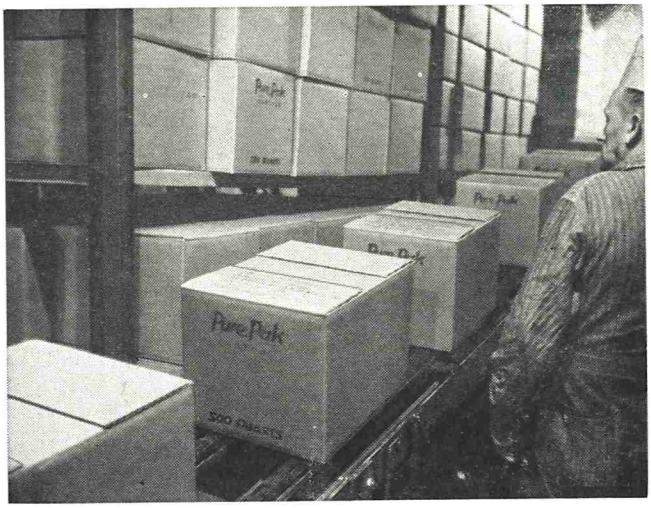

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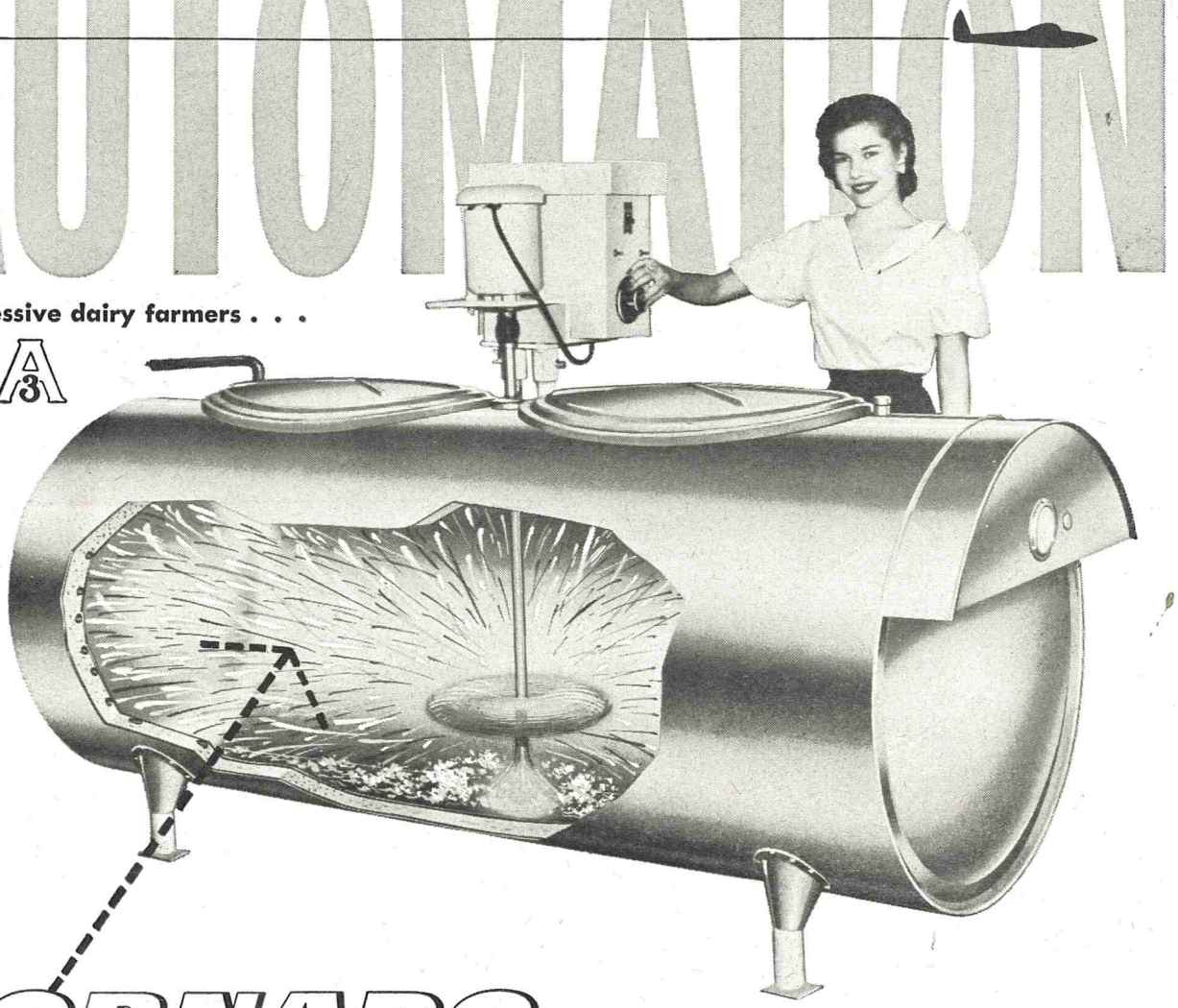

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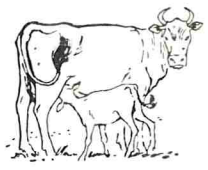

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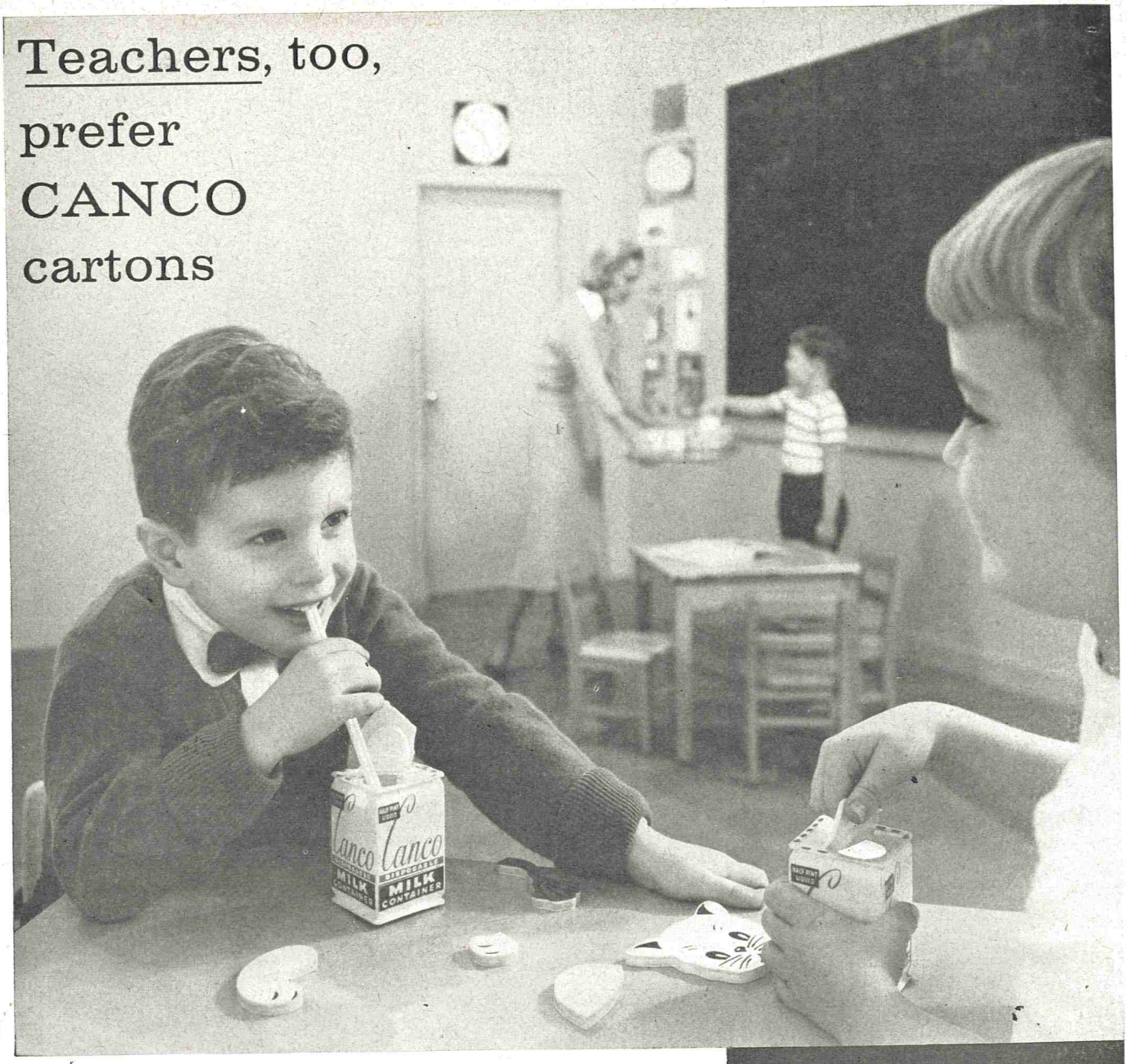

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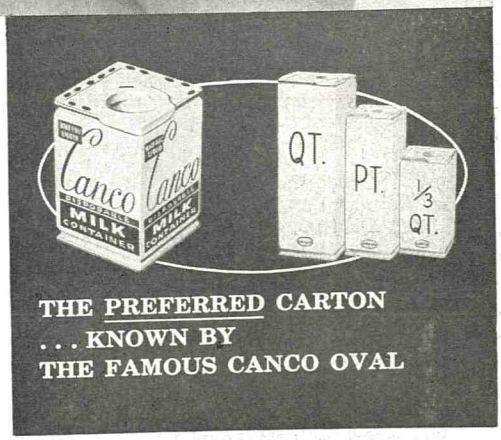

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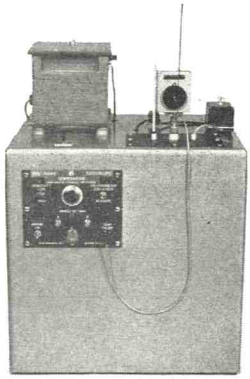

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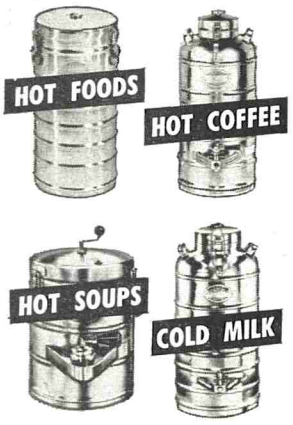

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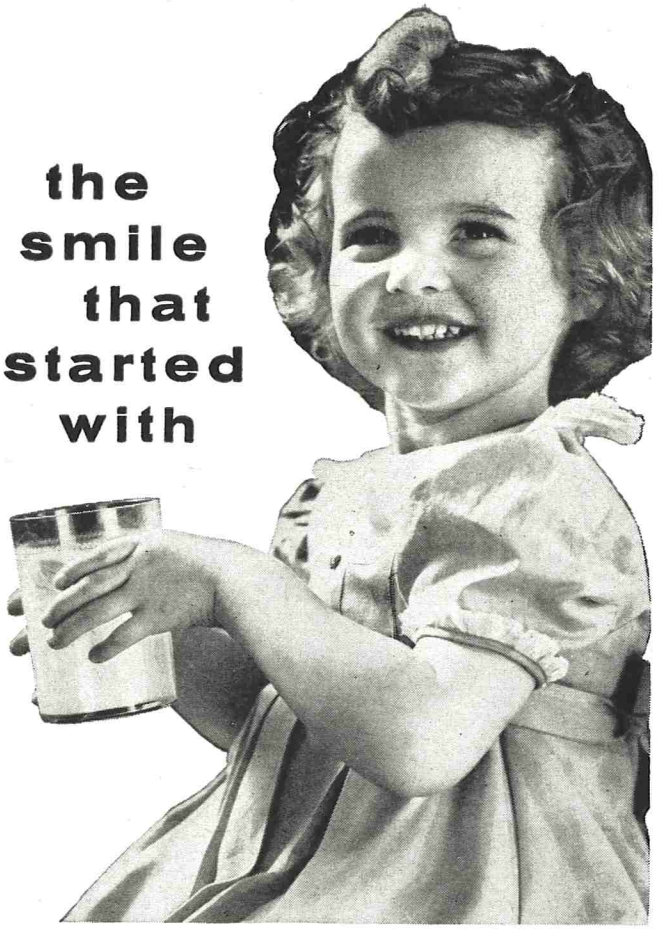

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SANITATION PROBLEMS IN THE MANUFACTURE OF COTTAGE CHEESE[1]

J. C. Boyd

Department of Dairy Husbandry

University of Idaho

Moscow, Idaho

Cottage cheese is the result of a controlled bacteriological fermentation. Its successful manufacture and distribution is, therefore, largely a matter of controlling certain bacteriological and sanitation problems. These problems are discussed under three catagories: namely, those that affect the manufacturing procedure; those that affect the shelf life or keeping quality of the finished product; and those that affect the spread of disease.

Cottage cheese is an easily digested, high-quality protein food which builds, repairs and maintains body tissue. It is economical and easily used by the housewife in the preparation of many attractive dishes. Thus, it is hard to understand why the per capita consumption of cottage cheese in the United States is only about 4.0 pounds per year, while in some areas, notably the Pacific Northwest, it is over 14 pounds per person per year, or 3.5 times as great as for the nation as a whole.

Sanitarians are not only interested in preventing the spread of disease through contaminated food, but are also interested in improving the public's health by promoting the use of those foods which build strong, healthy bodies. Cottage cheese, properly manufactured, is one of those foods. However, when improperly manufactured, it often lacks uniformity from day to day; it may be off flavored, or it may develop an unsightly appearance before being finally consumed. When these conditions exist, consumer acceptance is discouraged.

Cottage cheese is the result of a controlled bacteriological fermentation; therefore, its successful manufacture and distribution is largely a matter of overcoming certain bacteriological or sanitation problems.

Most of the sanitation procedures that are common in the processing of bottled milk, if applied to cottage cheese, would go a long way toward improving its quality and consumer acceptance. Sanitarians have a golden opportunity to help the dairy industry produce and sell a better cottage cheese, just as, over the years, they have helped produce and sell a better bottle of milk.

For the purpose of this discussion, the sanitation problems associated with the manufacture and distribution of cottage cheese have been divided into three catagories; namely, those that affect the manufacturing processes, those that affect the shelf life and keeping quality of the finished product, and those that affect the spread of disease.

Sanitation Problems That Affect the Manufacture of Cottage Cheese

Cottage cheese is a fermented dairy product, which means that a controlled fermentation is necessary in its manufacture. This is accomplished by first pasteurizing the milk to destroy the undesirable types of bacteria, both pathogenic and non-pathogenic and then adding a pure culture of organisms known as starter.

This starter is of utmost importance, as it assists in the coagulation of milk, affects the characteristics of the coagulated milk, the flavor and other characteristics of the finished cheese. Thus, to be successful, adequate personnel and facilities must be available to carry on from day to day contamination-free starters. Poor sanitation and bacteriological techniques used in the handling of starters invariably results in a poor quality cheese.

As a great deal of cottage cheese is made in small plants where persons trained in bacteriology are not available, sanitarians, all of whom have had some bacteriological training, could aid materially by making suggestions and giving some instruction in the basic bacteriological procedures necessary to prevent the contamination of starters.

Aside from the problem of gross contamination of starters, a condition which can be temporarily corrected by discarding the contaminated starter and starting a new one, there are other problems which may be even more troublesome. It has been pointed out (2) for example, that milk from cows infected with mastitis will not support good starter growth. The control of mastitis, however, by the use of antibiotics, and the improper handling of the milk from animals treated with these drugs, may be even more damaging than the mastitis milk, as the residual antibiotics given off in the milk supply may completely destroy the starter organisms. In addition, the presence of certain sanitizing agents, as for example, quaternary ammonium compounds (10, 5) or the growth

[1]Presented at the 43rd Annual Meeting of the International Association of Milk and Food Sanitarians, Inc., at Seattle, Washington, September 5-7, 1956.

of certain bacteria may result in the production of substances which inhibit the growth of starter organisms (*1*).

An analysis of over 2,000 milk samples gathered throughout the cheese producing areas of the state of Idaho (*3*) has shown that approximately 5 per cent of the samples analysed would not support the growth of lactic acid starters when added at the 1 per cent level. A breakdown of these samples showed that most of those which would not support bacterial growth came from small lots of milk. However, when 1,000 to 1,500 gallon lots of milk were sampled, practically none of these samples failed to support growth. This means that the presence of antibiotics or growth inhibiting substances in milk is a much greater problem for the small manufacturer than for the large one where the milk from a large number of cows is mixed together.

Continued efforts on the part of the dairy plants, sanitarians and fieldmen in preventing contamination of milk with these materials is necessary. Our study showed a marked difference between areas and between plants in the percentage of samples containing inhibiting substances. Our study also indicated that a routine testing program accompanied with field work was effective in keeping down, at least, the amount of such milk received.

As a result of this problem, we have recommended a routine testing program for our cheese plants and also recommended that a reconstituted, low-heat, nonfat milk powder, that had been previously tested for starter activity, be used in the preparation of the mother cultures as well as the bulk cultures for the manufacture of cheese. This eliminates the possibility of losing all of the starters in a plant because of the presence of growth inhibiting substances in the farmers' milk supply that may be used for starter preparation.

In addition to the problem of growth inhibiting substances in the milk supply, further investigations in Idaho have shown that bacteriophage infections could be detected in approximately 80 per cent of the vats of cheese showing poor starter activity.

Bacteriophages are viruses which destroy starter organisms. They are more or less specific in their activity (*6*). They are more resistant to heat than bacteria and may survive ordinary pasteurization temperatures (*13*). They survive drying (*12*), and being very small are easily carried on air currents.

The control of bacteriophage is strictly a sanitation and management problem. Once a plant becomes infected only the initiation and continued use of a complete cleaning and sterilizing program will correct the difficulty. This means washing and sterilizing with some bactericidal agent, such as chlorine, all equipment, walls, ceilings, floors, drains, etc. In addition, it is usually recommended that a starter preparation room be provided and located so as to be away from the making room and whey separation area in cases where American type cheese is also made and the whey separated. It is undesirable to have any air contact or any equipment moved from the cheese making room to the starter preparation room without it first being thoroughly sterilized.

Because of the fact that the virus is specific and requires the presence of a host organism susceptable to the bacteriophage, proper management of starters has been found to be helpful in controlling the infection. The carrying of 4 mother starters, each from a different source, and the use of a different one each day until each strain has been used has been found to be helpful. This allows an infection that may start against one strain to go through 3 additional clean-up and sanitizing processes before that strain, against which the bacteriophage can work, is again used. Some people recommend carrying several mother cultures from different sources and then mixing them in preparing the bulk culture. This often prevents a complete failure in case of infection as some, possibly one-half, of the cultures will probably not be affected by the particular virus and its activity will be more or less normal. *Regardless of the method of starter management, however, the only permanent solution to the control of bacteriophage is continued strict sanitation.*

SANITATION PROBLEMS THAT AFFECT THE SHELF LIFE OR KEEPING QUALITY OF COTTAGE CHEESE

The spoilage of cottage cheese is for the most part the result of bacteriological decomposition. The organisms most commonly responsible are psychrophilic bacteria, yeasts and mold.

The growth of psychrophilic bacteria results in the development of fruity, or unclean flavors and odors. Also, it may result in the development of what is known as the tapioca or translucent curd, a condition which causes a shiny, translucent surface on each curd particle. The development of a pink or yellow pigment is also quite common. Yeast and mold growth result in the development of off flavors and often the presence of visible mold colonies on the surface of the cheese.

As all of these organisms are killed by proper pasteurization temperatures and as the temperatures of 120° to 135° F. reached in cooking cottage cheese, plus the acid condition of the cheese provides some further protection, their presence in the product is considered to be the result of post-pasteurization, and in many cases, post-cooking contamination.

These organisms are widely distributed throughout

nature and they gain entrance to the product by unsanitary procedures. Aside from improperly washed and sterilized equipment, the water used to wash the cheese may be a source of psychrophilic bacteria. Water which meets the requirements for drinking and domestic use may still be unsuitable for use in washing cottage cheese. Thus, it is recommended that cottage cheese wash water be treated by chlorination (*4*), or pasteurized before it is used.

Because the wash water is also used for chilling or cooling the freshly cooked cottage cheese curd, it is recommended that the last wash water be chilled and that sufficient amounts be used so that the finally drained curd is cooled to 45° F. or less.

Whereas, it is true the psychrophilic bacteria grow at low temperatures, 45° F. or less, they also grow much faster at 50° and 60° F. Thus, the colder the cheese curd is kept, the better will be its shelf life.

Generally speaking, the lower the pH of the cheese, the more slowly the psychrophilic organisms will grow. Thus, a finished, creamed cottage cheese, that has a pH of 5.0 or less, is desirable. Various methods have been used to obtain this condition, such as manufacture of the so-called acid type cheese, keeping the number of washings to a minimum, and either acidifying the wash water by the addition of acid (*8*), or the cottage cheese dressing (*9*) by adding starter to the dressing before pasteurizing. When it is desirable to store cottage cheese, storage in a brine solution (3.2 lbs. of salt in 80 lbs. of water) acidified with 34 ml. of a 50% citric acid solution (*7*) is desirable. Acidifying the wash water is particularly important if the water supply is alkaline in reaction. Successive washings in such water will raise the pH of the curd and tend to make the curd slick due to the casein dissolving power of the alkaline salts. Chlorine is also more effective in an acid reaction (*4*).

The creaming mixture used on cottage cheese can be another source of contamination. Here again the contamination that affects keeping quality is post-pasteurization; consequently, it is a plant sanitation problem. If the cream used to cream cottage cheese were handled under the same condition as milk or bottled cream, an important source of contamination would be eliminated and an improvement in keeping quality would no doubt result in a large number of plants.

Good sanitation, proper pH control and good refrigeration are essential for a good shelf life for cottage cheese.

SANITATION PROBLEMS WHICH AFFECT THE SPREAD OF DISEASE

As most cottage cheese is manufactured from pasteurized milk or milk products, inspection of the pasteurizing procedures to insure adequate pasteurization is important.

It should be pointed out, however, that cottage cheese is a product which maybe subjected to a great deal more post-pasteurization contamination possibilities than bottled milk. The milk for cottage cheese is held in open vats for a number of hours; it is often subjected to varying amounts of handling by the hands of the workers; it is often stored in containers, such as metal cans, which would not be considered suitable for pasteurized milk; and it may be creamed and packaged by hand or in packaging machines which lack many of the sanitary safeguards commonly insisted upon in packaging milk.

There is need for improvement in the manufacturing and packaging equipment used in processing cottage cheese. Some progress has been made but until further improvements are forthcoming, the health of the workers engaged in handling this product should be carefully checked. A recent (*7*) report indicates that if coliform counts are an indication of sanitation and safety, then much of the cottage cheese on the market today is certainly on the border line. That cottage cheese can be manufactured with a low coliform count is evident, however, from a report from the Spokane Health Department (*11*) where one company has had only one sample with a positive coliform count, and that was one per gram. In contrast to this, 22 per cent of the samples analysed in the same market had over 1,000 coliform per gram.

The result of a Michigan survey (*7*) on the sanitary qualities of cottage cheese concluded, "judging from the data presented, an unsatisfactory condition exists in the field of cottage cheese manufacture and packaging." There is nothing mysterious about the manufacture of good cottage cheese, and the major shortcomings are simply poor bacteriological procedures and poor sanitation.

Many health departments might well follow the procedure of the city of Spokane which now requires Grade A milk to be used in the manufacture of cottage cheese; prohibits the use of canvas covers for cheese vats; prohibits copper pipes and hand filling of cartons; and requires a more sanitary lip protected carton.

Sanitarians could do a great service to the dairy industry and to the consuming public by working for the same conditions of sanitation in the manufacture of cottage cheese as are now insisted upon in the processing of bottled milk.

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THE LABORATORY ASPECTS OF INVESTIGATING FOODBORNE DISEASE OUTBREAKS[1]

K. R. Berquist

Washington State Department of Health,

Laboratory Section, Seattle, Washington

For years we have made efforts to standardize procedures in the examination of food to detect bacterial incitants of food poisoning in order to obtain some measure of success in our laboratory efforts. This is particularly true of two of the four so-called most common bacterial causes of food poisoning, namely, enterotoxin-producing staphylococci and fecal streptococci (enterococci). Botulism is relatively easy to diagnose by laboratory methods because there are two readily available susceptible animals – the guinea pig and the mouse, and specific antisera to check against. Laboratory procedures are quite well standardized for identification of bacteria in the *Salmonella-Shigella* group.

This discussion will be concerned primarily with these four incitants, with additional brief comment in regard to contamination of meat products with *Clostridium welchii* and contamination of starch foods with *Bacillus cereus.* Time will not allow discussion of other microorganisms that can cause illness when transmitted through food, such as *Brucella* and *Mycobacterium tuberculosis* transmitted through raw milk products, or diphtheria and septic sore throat, transmitted from human carriers to milk or other foods.

The bacterial agents identified most frequently (other than organisms of unproved etiology) from specimens brought to the laboratory are also the most common causes of food poisoning, namely, enterotoxin-producting staphylococci, enterococci, *Clostridium botulinus,* and members of the *Salmonella* and *Shigella* groups. Outbreaks caused by other organisms are quite uncommon. However, it is important to remember that food-borne disease may be caused by these less frequently identified organisms.

Bacterial agents that are implicated in food poisoning fall into two general categories, food intoxications and food-borne infections. Botulism and staphylococcal food poisoning are intoxications resulting from preformed toxin having been elaborated in the food speci, mens, the organisms themselves being harmless when introduced into the intestinal tract. There is some question about the nature of enterococcus food poisoning because the organism has to be present in very large numbers to cause symptoms, yet the clinical manifestations of the illness suggest that it is probably caused by preformed heat stable toxin. *Salmonella* and *Shigella* infections are food-borne and when introduced in sufficient numbers into the intestinal tract cause illness.

Mr. K. R. Berquist has been assistant head of the Laboratory Section, Washington State Department of Health, Seattle, Washington, since 1950. He received the B. A. and M. A. degrees from University of South Dakota. Mr. Berquist served as bacteriologist with South Dakota State Department of Health Laboratory for six years and was a laboratory officer in an Army General Hospital from 1943 to 1946. He also served two years as instructor in microbiology at University of South Dakota.

Laboratory examination of suspected foods must follow two lines of investigation. In botulism and staphylococcal food poisoning, the presence of a preformed toxin must be determined by animal inoculation or feeding experiments. In *Salmonella, Shigella,* and fecal streptococcal food poisoning, the presence of the micro-organisms must be demonstrated by means of cultural examination. In the laboratory diagnosis of staphylococcal food poisoning the ultimate goal is to determine the presence of a preformed toxin (entero-

[1]Presented at the 43rd Annual Meeting of the International Association of Milk and Food Sanitarians, Inc., at Seattle, Washington, September 5-7, 1956.

toxin), yet it is felt that the microorganism itself must be present in the specimen in large numbers. Thus, the laboratory work consists of culturing the staphylococci and determining their relative number, and then determining their ability to produce enterotoxin.

In Part II of the *Suggested Procedure for the Investigation of Foodborne Disease Outbreaks* (*6*) the procedures for collecting and submitting food samples for laboratory examination is given. The procedures are good although somewhat idealistic; however, in order to obtain reliable laboratory results these procedures should be adhered to as closely as possible.

From the point of view of the bacteriologist in a central laboratory receiving most food specimens through the mail, the manner in which the specimen is collected and submitted to the laboratory is of utmost importance. This influences the reliability of the results obtained. Food specimens have been received in everything from cellophane bags to plain wrapping paper, and without benefit of a rigid container. Many times the rigid containers, such as glass jars, have not been sterilized prior to collecting the sample. As a consequence, the specimens are partly or wholly decomposed due to saprophytic contaminants. Collecting and submitting food specimens properly is of extreme importance because the laboratory results can be no better than the specimen submitted. It might be added that if there is a possibility of court proceedings as a result of the outbreak, and since this is often the case, it is imperative that specimens be submitted correctly, that they are sealed, and that the record of the sample is complete, otherwise the laboratory results are of little legal value.

There is one other part of the procedure in submitting specimens that should be mentioned briefly, namely, consult with the laboratory director and inform him that you are sending food specimens. At the same time give him what information you have regarding the outbreak, such as the type of outbreak suspected, the foods being submitted, and by what means of transportation they are being sent. The laboratory director may be able to give you some valuable information on how and what specimens to collect and how to send them. If the laboratory director is forewarned, he can have equipment and the necessary media and animals ready for use when the specimens arrive. This will save some time in obtaining the results and should lead to better working relations with the laboratory.

When one realizes that in 35 to 50 per cent of the food poisoning outbreaks no etiological agent of proved significance is isolated, it is time that we look both at our sampling methods and our laboratory methods. This discussion will be concerned with the laboratory methods of examining food poisoning specimens.

Sanitarians are concerned chiefly with the investigation of the food poisoning outbreaks and the proper sampling of suspected foods. However, it is also important that sanitarians have some understanding of the laboratory diagnosis of food poisoning so that they can be aware of the overall picture. This overall picture applies to bacteriologists, too. Bacteriologists should know what the sanitarian has done in his investigation of the outbreak. We are all prone to think that there is only one aspect of a food poisoning outbreak, and that is the one for which we personally are responsible. The one we are responsible for is the most important to us, and that is as it should be, but let us not forget that we work as a team and as such we want to know what each one is doing.

Food poisoning bacteriology is by no means easy and simple. Examinations must be sufficiently complete so that it is not necessary to report indefinite results such as "alpha hemolytic streptococci isolated," or "a Gram positive sporulating bacillus was isolated" and so on. This is meaningless to the recipient of the report. On the other hand, speed in the examination of the suspected food to determine the incitant is important so that if necessary, proper control measures may be taken immediately. For instance, in a *Salmonella* outbreak, the source of the *Salmonella* must be determined as early as possible in order to sever the chain of infection. The source may be a food handler, it may be meat or poultry, or even a butcher's block.

The Washington State Department of Health Laboratory has developed protocols or flow charts illustrating the laboratory procedures used for detecting groups and species of organisms suspected of being present in foods involved in out breaks.[2]

When food specimens arrive in the laboratory, note is made of the time, the date, the manner in which the specimens were shipped, such as with or without ice, and if with ice, the approximate amount remaining, whether the specimen was sealed, and a short description of the type of food. Specimens are maintained in the refrigerator and are removed only for sampling purposes. All food samples are kept until final report is made, and usually for a few weeks after that, in case of legal action. The history slips accompanying the specimens are reviewed but, as a rule, the information is inadequate. The persons responsible for investigating a food poisoning outbreak and collecting appropriate specimens must be convinced that valuable time can be saved and needless laboratory examinations avoided if a brief history of the outbreak would be sent with the specimens. The history should include

[2]These protocols or flow charts may be requested from the author.

the information called for on the suggested Form "D" — *Sample Collection Report* (*6*) plus the time that elapsed between partaking of the food and onset of symptoms, the symptoms reported by those made ill, and the reason for suspecting the food or foods submitted. A complete and accurate statement of the symptoms experienced by those that became ill, particularly the incubation period, is especially helpful as a guide in the course to be pursued in the laboratory investigation.

If the information sent with the specimen states only that the food was suspected as the vehicle of foodborne disease, the bacteriologist must rely on his own judgment in selecting the type of examinations to carry out; this he can do to a certain extent according to the type of food submitted — but it is very helpful for him to receive information which is more suggestive. He feels more secure about the entire procedure if he receives such information, and greater cooperation prevails on his part.

The foods submitted are given a laboratory number and the first procedure to be carried out is the homogenization of a known weight of the sample if it is a solid food, or the measurement of a known volume, if a fluid food. This step is taken so that plate counts can be made to determine the approximate number of organisms per gram of food. This is the preliminary method used if the specimen is submitted under refrigeration. If the specimen is not submitted under refrigeration, it is useless for the bacteriologist to go through this step of the procedure. For unrefrigerated specimens an unweighed amount may be selected, homogenized and carried on through the other laboratory procedures without attempting to determine relative numbers of organisms. This serves to emphasize the importance of submitting food specimens under refrigeration. If they are not refrigerated, an important link in the chain of laboratory examinations is broken and, in the case of several bacterial incitants, the approximate number of organisms present per gram of food may be the key to the answer.

In any event, a small volume of the homogenate is placed in a sterile test tube and centrifuged at high speed for ten minutes. A Gram stain is made from the sediment and many times, but not always, some idea as to the predominating organisms is obtained. This furnishes a clue as to what course to take. Many times the predominating organism is a saprophyte so not too much reliance should be placed on the findings of the Gram stain.

Laboratory confirmation of botulism is not a difficult laboratory procedure, if appropriate specimens are available. The identification of the toxin is made by animal inoculation, and here an attempt is made to detect the presence of a preformed toxin, also the type of the toxin. Either a portion of the solid food is used or, if available, the fluid portion is examined.

The number of animals to use will vary depending upon the amount of the sample. If the sample is of sufficient quantity, each test is done in duplicate. Two animals receive the food sample with no protection, two animals receive the food sample plus protection with Type A antitoxin, and two animals receive the food sample plus protection with Type B antitoxin. In the event of death of the control animals receiving Type A and B antitoxin, further protection tests are done using Type E antitoxin. The condition of the animals is watched. If a strong toxin, is involved the appropriate animals often die within a few hours. With weak toxins, death may not occur for three or four days or longer. If botulism toxin is present in the food sample, the unprotected animals die, and one of the two sets of animals protected with antitoxin survive, depending upon the type of toxin present. If the sample was badly contaminated and not filtered prior to injection, the animals may die by invasion with contaminating bacteria and not by botulism toxin. Hence, controls are used with heated material and with antitoxin. Occasionally botulism toxin may not be detected in the food sample, particularly if the sample submitted is scanty or other wise unsatisfactory. In this case, washings from the container can be examined culturally in appropriate media under anaerobic conditions and toxicity tests of filtrates may be carried out on animals as has already been discussed. In the case of botulism, toxin sometimes can be detected in the blood serum or in the bowel contents by animal injection.

In the laboratory diagnosis of botulism, it is possible to obtain direct evidence of the causative agent. This is not true in the case of enterotoxin-producing staphylococci. The ideal and conclusive test for identifying staphylococcal food poisoning would be the detection of the enterotoxin directly from the contaminated food, such as is done in botulism; but as yet, such a test has not been developed. True, much work has been done to find a laboratory animal that will react to the enterotoxin with a useful degree of reliability. Dolman (*2*) and his co-workers have had some success with the kitten test and also with the human volunteer, and Hammon (*3*) has had some success with the intravenous injection of enterotoxin filtrates into adult cats. Monkeys have also been used, but in all instances resistance to the enterotoxin has been encountered in a certain proportion of the animals and human volunteers.

Several other criteria are used in lieu of a satisfactory animal test as follows: The food sample is

streaked onto blood agar plates and serial dilutions are made onto tellurite-glycine agar plates. Tellurite-glycine agar is a relatively new plating medium. This medium was developed by Zebovitz *et. al.* (7) who concluded that it is superior to other media currently in use for the quantitative detection of coagulase positive staphylococci. A surface plating technic is employed, and coagulase positive staphylococci produce black colonies within 24 hours at 37 degrees C. Other microorganisms fail to produce visible growth within this time, with the exception of an occasional colony of coagulase negative staphylococci. Most of the latter strains produce small gray colonies that are distinct from the type of colony produced by most coagulase positive strains. This medium was used by Zebovitz in the examination of sixteen food samples allegedly involved in cases of food poisoning. Six of these samples were found to contain large numbers of coagulase positive staphylococci. The tellurite-glycine agar provided quantitative detection of these organisms.

Although tellurite-glycine agar does not agree 100 per cent with the coagulase test, it is of sufficient value to be included as a plating medium for the detection and enumeration of staphylococci. Besides blood agar plates to detect hemolysis and tellurite-glycine agar for approximate numbers of staphylococci in the food specimen, Chapman-Stone medium is used for pigment formation and gelatin liquefaction, and the coagulase test for coagulase activity. Many workers feel that coagulase activity is one of the best indicators of the pathogenicity of the staphylococci, and in the final analysis in our laboratory it is used in that manner.

One other laboratory procedure valuable for epidemiological reasons is the phage typing of the staphylococcal isolates. This examination is not performed in our laboratory but when desired, we call for the assistance of one of the few laboratories that is engaged in this type of work. Our laboratory also examines specimens from the nose and throat and from the skin lesions of food handlers according to the same method used for food specimens. This is done as an aid in the detection of the source of the contamination.

Interpretation and reporting of results must be done with great care. Not all staphylococci are capable of producing enterotoxin. The staphylococci isolated may have gained access to the food specimen before or during the process of collection of the food samples. Unless specimen has been collected immediately after the outbreak and kept under refrigeration until the time of laboratory examination, gross numbers are of little significance.

Of the food-borne bacterial incitants that cause food poisoning, the *Salmonella-Shigella* group is of great importance. Two types of specimens are important for this group of organisms; they are the suspected food, and stool specimens from those made ill, or from food handlers. Speed in the collection of specimens and the laboratory examination is of great importance because an outbreak can become widespread in a short time.

Buchbinder (1) and his group have done a great deal of work in the investigation of the enterococci as incitants of food poisoning. They feel that food poisoning may be more commonly caused by this organism than has been hitherto believed. They concluded that the reasons enterococci have not been sought for or implicated more frequently is because; (*a*) there might be an inclination to regard the enterococcus as a saprophyte whose presence in suspected foods is considered of little significance, (*b*) if enteric pathogens or staphylococci are not found, the tendency is to look no further and consider the outbreak as one of unknown etiology, and (*c*) failure to use a fairly rigid quantitative technic in the isolation of bacteria from suspected foods may result in misinterpretation of the significance of those organisms which are actually recovered. Our method of examining for enterococci in food specimens has been adopted practically in toto from that recommended by the Bureau of Laboratories, City of New York Department of Health. The method was revised slightly, primarily to obtain the final results more quickly. The laboratory examination for the detection of enterococci is very time consuming. By far the most significant finding is the relative number of the streptococci. As a matter of fact, the examination is not continued if it is determined from the original plating media that there is not approximately a count of 750,000 colonies per gram of food or greater. If the examination is continued, then ten separate colonies are picked and must meet three criteria before being classed as enterococci, namely, growth in Todd-Hewitt broth after having been heated at 60 degrees C. for one-half hour (the so-called heat test), growth at pH 9.6 in broth, and growth in 6.5 per cent sodium chloride broth; then, by calculation, the number of enterococci per gram of food is estimated. Here interpretation of results must be made with extreme caution. It is here that submitting of specimens in the proper manner influences the results almost entirely. The relative number of enterococci per gram of food is the basis upon which the organism is implicated.

There are two miscellaneous organisms that have received attention as bacterial agents in food poisoning, *Clostridium welchii* and *Bacillus cereus*. Hobbs, *et al.* (5) feel that a large proportion of food poisoning incidents hitherto unclassified may be due to heat

resistant *Clostridium welchii*. The infection is almost invariably due to meat which had been boiled, steamed, braised, stewed, or insufficiently roasted and then allowed to cool slowly and eaten the next day either cold or reheated.

Bacillus cereus has been thought to be the causative agent in several outbreaks of food poisoning, and just recently the organism was isolated in our laboratory from a food specimen (macaroni salad) that was implicated in a family outbreak. Hauge (*4*) has investigated several outbreaks which were thought to be caused by *B. cereus*. Hauge considers potatoes and corn starch to be naturally contaminated with *B. cereus* and warns against leaving foods prepared with these products at incubator temperature for a period of time before serving.

The last two organisms are mentioned to show that we are continually obtaining evidence to suggest that bacteria never before suspected may have potentialities as incitants of food poisoning. We must evaluate the significance of those bacterial agents that are found in food poisoning outbreaks and which are usually not implicated.

In conclusion, reiteration of a few points that would apply to those that are charged with investigating a food-borne disease outbreak are given and which, in turn, would lead to greater success in isolating food poisoning incitants in the laboratory: (*a*) collect those specimens that appear the most likely to be involved in the outbreak as soon as possible and submit to the laboratory immediately under refrigeration; (*b*) call the laboratory director and tell him of the outbreak so that he can plan and prepare accordingly; and (*c*) send as much information about the outbreak as is readily available with the food specimens.

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PRESENT STATUS OF STATE-FEDERAL BRUCELLOSIS ERADICATION[1]

A. F. Ranney

Animal Disease Eradication Branch

United States Department of Agriculture

Encouraging progress has been made in the eradication of brucellosis in dairy herds of the United States. The notable gains have come in the past 10 years although the State-Federal program to bring this costly disease under control goes back to the early thirties. At that time, a number of States had brucellosis eradication programs but a relatively small amount of money was being spent.

The State-Federal cooperative eradication program was devised to reduce the serious losses from the disease, first as part of a cattle reduction program, and later as a straight disease eradication program. The basis of the program in the beginning was testing herds for brucellosis and disposing of the reactors. In 1934, when the program was begun, slightly more than 8 million cattle were tested and of these almost a half a million were reactors. Infection rate for the country as a whole was 11 percent. Here in the Northeast and in some other areas it was much higher.

Gradual progress was made through these measures. Beginning in 1940, the vaccination of calves was initiated. This has been responsible for building up resistance in millions of animals and has been of great value in the efforts to eradicate the disease.

North Carolina was the first State to achieve the standing of modified certified brucellosis-free, meaning that widespread testing shows less than one percent infection among cattle, in not more than 5% of the herds. The goal was reached in North Carolina in 1942.

About that time many veterinarians were called into service with the armed forces and there was a serious shortage of people qualified to work in the eradication program. The level of infection across the country went up again.

It was just 10 years ago, in 1947, that the United States Livestock Sanitary Association unanimously adopted Uniform Methods and Rules for the Establishment and Maintenance of Certified Brucellosis-Free Herds of Cattle and Modified Certified Areas. These Uniform Methods and Rules have had minor revisions since first adopted and have served as a guide for the states in setting up their programs.

National, State, and County brucellosis committees have done outstanding work in promoting the brucellosis programs at all levels from the "grass roots to the top." The Agricultural Extension Service has worked closely with all brucellosis committees and agencies interested in the program in disseminating information in regard to the disease and the essential features of the programs whether they are of local, State, or National significance. These educational groups have been especially helpful in keeping the livestock industry and the public fully informed.

One of the greatest assets to the program was the adoption of the milk ring test as an official part of the program in 1952. This makes it possible to screen a whole dairy herd at a very low cost to determine whether brucellosis exists in the herd. Herds giving a suspicious reaction to the ring test are blood tested to pick out the one or more infected animals. The ring

Dr. Albert F. Ranney was appointed Chief of the Tuberculosis Eradication Section, Animal Disease Eradication Branch, Agricultural Research Service, United States Department of Agriculture, and Area Director of Branch activities carried on in New York and the six New England States in 1954. He received his degree of doctor of veterinary medicine from New York State Veterinary College at Cornell University in 1932 and his master's degree from Cornell Graduate School in 1934. Dr. Ranney spent five years in the Army Veterinary Corps during World War II. He has devoted a major part of his efforts while in Federal service to the eradication of brucellosis and tuberculosis in livestock.

[1]Presented at the Tenth Annual Meeting of the Dairy Products Improvement Institute, Inc., New York, New York, February 14, 1957.

test is made approximately once every six months in order to include animals not included at the time of a prior test.

Progress in use of the milk ring test has been good. It was used on less than half a million herds in 1952, the first year it was an official part of the eradication program. In 1956, approximately 1¾ million herds were so tested. It is interesting to note that as the number of herds tested increased, the percentage of herds showing a reaction to the test declined from almost 30 percent to just under 15 percent during this same period.

In fiscal year 1955, the brucellosis eradication program was accelerated. This has resulted in gratifying increases in the number of calves vaccinated, cattle tested, and reactors removed. We are moving ahead.

For example, the number of calves from 4 through 8 months of age vaccinated has increased annually from 1940. Only 21,000 were vaccinated in 1940 as compared with more than 4.7 million in 1956. This program progressed slowly at first, but accelerated rapidly after the close of World War II. Even so, a little less than 1/3 of the eligible calves were vaccinated last year. Even in a herd certified brucellosis-free, calf vaccination is an extra precaution that helps protect against reinfection of the herd from outside sources.

World War II interrupted gains being made in the fight against brucellosis. In 1935, close to 40 percent of the herds blood-tested revealed some degree of infection. Just before the war, the percent of herds infected reached a low point of 10.5 percent. But by the end of the War, the percent of herds infected rose to 20.4 percent. Except for a slight increase in 1952, there has been a general decrease. The slight rise in 1952 and the limited decline since is in part due to the extensive use of the ring test and the follow-up of the ring suspicious herds with the blood serum agglutination test.

Figures 1, 2, 3, and 4 show some of the progress that is being made and illustrate the current status of the program.

As shown in Figure 1, in 1935, when the eradication program began, 3.3 million cattle were tested; the percentage of reactors was 11.5. In 1941, the percentage of infection had dropped to 2.4. Due to a shortage of personnel and other factors that occurred as a result of World War II, the infection took a climb to 5 percent in 1946. In 1956, 16.7 million cattle were blood tested with 2.19 percent reactors.

It does little good to locate infected animals unless they are handled in a manner to prevent the spread of infection. Figure 2 shows that during the period, 1948 – 1953, less than half of the reactors found were slaughtered, while in 1956 the percent slaughtered was

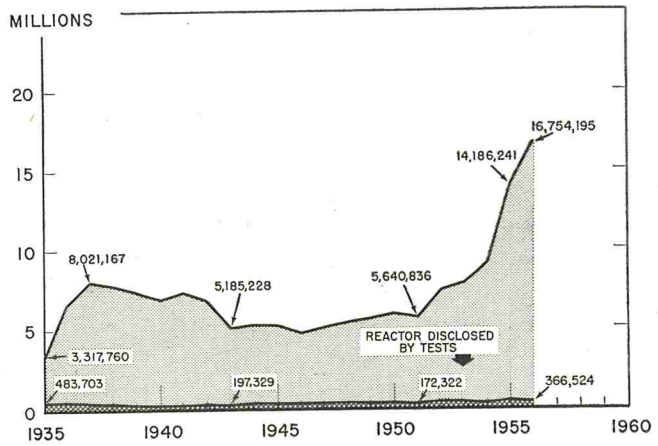

FIGURE 1. Bovine Brucellosis
U. S. A. Official Blood Serum Agglutiuation Tests.

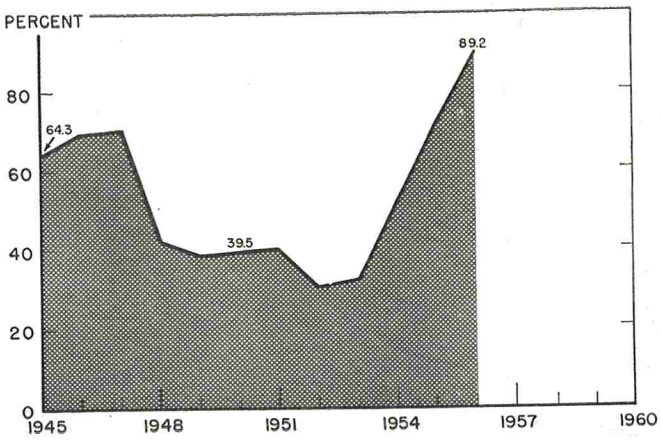

FIGURE 2. Bovine Brucellosis.
U. S. A., Reactors Slaughtered

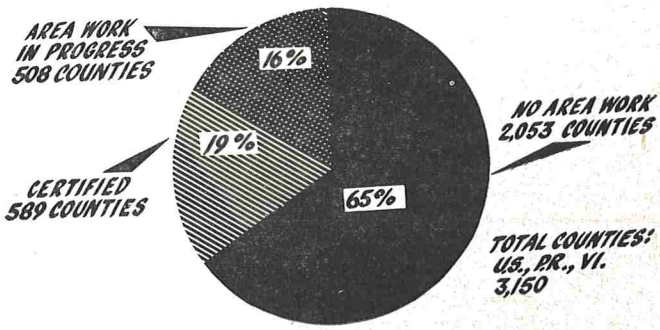

FIGURE 3. Bovine Brucellosis.
Certification Status, Dec. 31, 1956

almost 90. This increase was due in a large degree to the accelerated program with added incentive of indemnity for the removal of reactors.

While we may be encouraged with the progress that is being made toward reaching our goal we should take into consideration that there are 81 percent of the counties in the United States and Territories yet to be certified (See Figure 3). At the end of December 1956, 19 percent of the counties were certified and 16 percent carrying on area work.

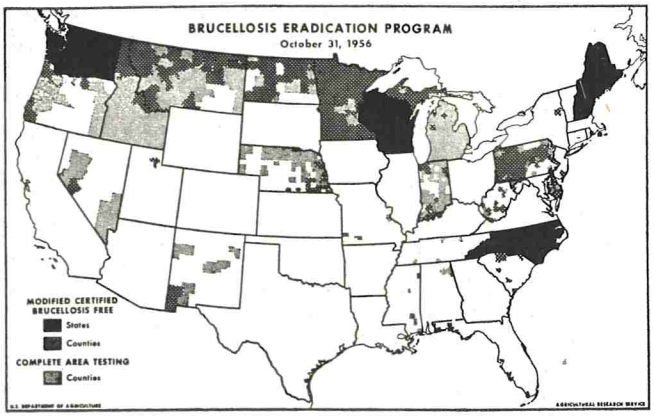

FIGURE 4. Current status of Brucellosis eradication program.

From Figure 4, we can rather quickly see where the greatest progress has been made as well as those areas where much is yet to be accomplished. In the Northeastern States, in which this group is most interested, we have two of the six modified certified brucellosis-free States. While Figure 4 does not show that some of the other States in this section of the country are nearing a certified status, you may be assured that there are many counties that should be placed on the certified list within a very few months. In addition to the six States already certified there are 351 counties in 27 other States and Puerto Rico which have been designated modified certified brucellosis-free. Several of the States are fast approaching a Statewide certified status.

Even though the accelerated eradication program has sharply reduced cattle losses due to brucellosis, the disease still causes noticeable annual losses. Recent gains have been dramatic. Total dollar losses due to the disease in 1955 were estimated at $45.6 million, or 50 percent less than the $91.9 million in 1947.

More than half of these losses were in milk production. Milk production losses dropped from $51.1 million in 1947 to an estimated $27.1 million in 1955. In 1947, it was necessary to replace 522,000 cows because of the disease, as compared with less than half that number — 244,000 — in 1955. Costs of cow replacements in 1947 were $32.4 million. They dropped to $14.4 million in 1955. Calf losses dropped about 50 percent — from $8.5 million in 1947 to $4.2 million in 1955.

Brucellosis Status of Northeastern States:

It may be of interest to review briefly the progress toward brucellosis eradication in the Northeast and the local requirements that are presently in effect relative to milk originating from herds tested for brucellosis or already free.

MAINE has maintained a modified certified brucellosis-free status since July 1, 1950. This was the third State to be certified; the second in the Northeast. This status was gained following a concentrated test-and-slaughter program. The vaccination of calves has not played as prominent a part in the eradication program here as has been true in many of the Northeastern States. An effort is being made to trace the origin of each reacting animal and to determine the source of infection in an effort to further reduce the incidence of infection. There are no laws or regulations that specifically apply to the brucellosis status of animals producing milk for sale within the State.

NEW HAMPSHIRE became a modified certified brucellosis-free State in August 1949, the second in the Nation to reach this goal. The disease was attacked through a test-and-slaughter program from the early years of the organized program. All herds in New Hampshire are blood tested annually. Three municipalities — Claremont, Laconia, and Manchester — have ordinances that require that milk used in these cities originate from brucellosis-free herds.

VERMONT has a very active brucellosis eradication program and anticipates having all herds enrolled under a blood testing plan with removal of reactors by April 1 of this year. For more than ten years, a very high percentage of the female calves raised in the State have been vaccinated. In view of the attention being given to the program in Vermont the State should reach a certified status in the near future. The milk ring test is being used to good advantage in the eradication efforts.

MASSACHUSETTS is carrying on an energetic program. State funds for indemnity became available for reactors in October 1956. This is stimulating interest in the project. For many years, prior to the accelerated program, a relatively high percentage of the calves raised were vaccinated. One county in the State has met the requirements of a certified status. The present program demands that all herds be enrolled under a testing program by January 1, 1958. The present law, however, permits reactors to be maintained on the premises until January 1, 1960.

In CONNECTICUT it has been mandatory, since April 1, 1956, that all herds producing milk for sale be enrolled under a blood testing program. After April 1, 1957, all milk sold in the State must originate from brucellosis-free herds. This state has had a compulsory calf vaccination program for many years. It may be anticipated that several counties will become certified within the next few months. State or Federal indemnity payments are not presently being made in Connecticut for reactors found.

In RHODE ISLAND the program calls for a test of all cattle annually except steers, calves under 6 months, and calf-vaccinated females under 24 months of age. The State law provides for the slaughter of all brucel-

losis reactors after 85 percent of the total cattle of the State, excepting steers and calves under 6 months of age, are free from brucellosis. In view of this provision of the law now in effect, it seems reasonable to anticipate that the State may reach certification status by the end of 1958. Animals producing milk for shipment into the State must be of equal or higher health status in regard to brucellosis as those animals located within Rhode Island. Presently herds from which milk is shipped into Rhode Island must be under a testing program.

NEW YORK has annually vaccinated a very high percentage of the female calves raised. While only two counties can presently boast of a certified status, there is reason to believe that several others will soon reach this goal. A study of county records is presently being made to determine how close the various counties come toward meeting the certified area requirements.

The milk ring test is a very important part of the brucellosis eradication program in New York State. This test is applied to all milk-producing herds at six-month intervals.

July 1, 1959, has been agreed upon jointly by the New York State and New York City Departments of Health as the date after which all milk sold in the State must come from brucellosis-free herds.

NEW JERSEY is making good progress toward brucellosis eradication. Two counties are designated as modified-certified brucellosis certified areas. The provisions of the State Public Health Code provide that after April 1, 1958, milk being sold within the State must be obtained from brucellosis-free animals.

PENNSYLVANIA has had a very active eradication program for many years and is making noteworthy progress toward becoming a modified certified brucellosis-free State. Forty-seven of the 67 counties are presently certified; 15 were certified during 1956. Several more are rapidly approaching that status. Pennsylvania's Secretary of Agriculture has set early 1958 for statewide certification.

Uniformity in sanitation standards for production of milk as they relate to brucellosis, tuberculosis, or any other infectious or contagious disease of cattle, are of particular interest to those of us concerned with the eradication of these diseases. It is, of course, important that the milk sanitation requirements be realistic in their approach and be coordinated with the progress that is being made toward eradication of the specific disease. Those of us who work in the Animal Disease Eradication Branch are happy to have an opportunity to work closely with members of the Public Health Service in considering suggested requirements for the health of cows producing milk for human use.

The Milk Ordinance and Code — 1953 Recommendations of the Public Health Service — has, as this group knows, been drawn up as a model ordinance which may be considered for adoption by States and communities as a measure for the control of milk-borne diseases. At present, States or communities may be operating under the provisions of the Code and permit the use of pasteurized milk from herds in which all reactors are not immediately removed. However, the Code states, ". . . Ultimately, this Ordinance will be revised to require all milk producing herds to be under Plan A; therefore, a dairyman who has brucellosis reactors in his herd is urged to eliminate a sufficient number of such reactors each year so that all reactors will have been removed from the herd within a period of 3 years after his entry into Plan B." ". . . In the case of milk not for pasteurization, all herds and additions thereto shall be tested and found free of brucellosis before any milk therefrom is sold, and all herds shall be retested at least every 12 months thereafter . . ."

Plan 'A' refers to a herd in which brucellosis reactors are removed promptly. Plan 'B' refers to a herd where reactors may be retained for a temporary period usually not to exceed three years.

Procedures have been set up whereby approved milk ring tests may qualify herds as being considered under Plan 'A'.

As States and municipalities adopt requirements that milk sold originate from brucellosis-free herds, producers are urged to adopt measures that will insure the elimination of brucellosis from their herds.

The impact of these requirements already adopted or anticipated in the Northeastern States has had a noticeable effect in promoting interest in brucellosis eradication in this and other areas generally.

As more and more areas are certified, it becomes increasingly necessary to protect the gains we have made. To maintain gains in the brucellosis campaign, interstate movement of all cattle except steers, spayed heifers, and calves under eight months old came under strict Federal control January 1, 1957. These interstate regulations relating to brucellosis were placed in effect after several years of effort and study on the part of livestock groups and others interested in the program. The regulations are designed to control the movement of affected or potentially exposed animals to prevent the spread of brucellosis and thus protect the investments that have been made toward brucellosis eradication.

EFFECT OF INGREDIENTS ON BACTERIAL GROWTH IN SOUPS

KARLA LONGREE, ROSE F. PADHAM, JAMES C. WHITE AND BRENDA A. WEISMAN

Department of Institution Management, and Laboratory of Bacteriology, Cornell University, Ithaca, New York

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Soups are popular items in institution food service, especially when inexpensive and hot menu items are in demand. Certain soups have become classics in this country, for example, vegetable, chicken, clam chowder, split pea, navy bean and consomme.

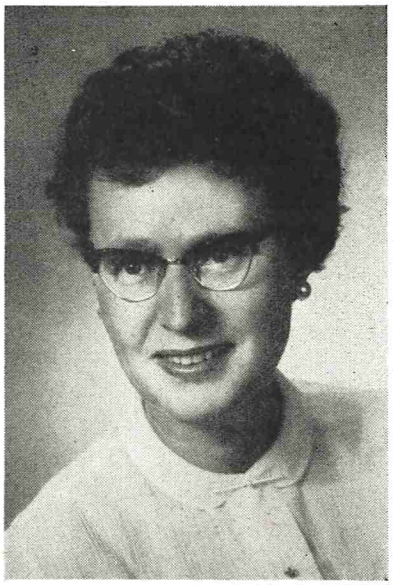
Little is known about the keeping quality of different soups and the contribution of each ingredient to the keeping quality. Soups are often served in food establishments with limited refrigeration facilities and are also widely marketed as a frozen product.

Most soups are either made from a stock or a milk base, both of which are excellent media for bacterial growth. Combined with the base are various ingredients, such as cereals, legumes, vegetables, potatoes, meat, poultry, fish, and various seasonings.

The purpose of this investigation was to study the effect on bacterial growth of some selected main ingredients commonly used in preparing soups. The aim was to obtain a basis for offering recommendations for preparing palatable soups that are poor supporters of bacterial growth.

The investigation was divided into two parts. Part I was devoted to obtaining basic information on the effect on bacterial counts of adding various ingredients to a liquid base. The ingredients were chosen on the basis of a preliminary study in which it was found that some food materials were more active than others in affecting bacterial growth, either favorably or unfavorably. In the main study, finely pureed meats, clams, and vegetables were added in varying amounts to a base of stock, white sauce, or to milk. The mixtures were autoclaved, inoculated with *Micrococcus pyogenes* var. *aureus*, and incubated at a temperature favorable to the growth of the organism. Determinations of pH were made before and after autoclaving.

In Part II, the information gained from the results of Part I was used in developing formulas for soups that were poor supporters of bacterial growth. As a first step, soups routinely prepared in the Home Economics Cafeteria were tested for their ability to support growth of *Micrococcus pyogenes* var. *aureus*. On the basis of the information gained from these tests, a number of soups were selected for experimentation in the laboratory. The proportion of ingredients found to discourage the growth of this organism was increased and the new formulas were subjected to organoleptic and bacteriological testing; pH determinations also were made.



Karla Longree is Professor of Institution Management at Cornell University. She has studied at Berlin and Bonn, Germany and received the degree Dr. of Agriculture from the College of Agriculture at Berlin, and the Ph. D. degree from Cornell. She has been a member of the staff at Hampton Institute, Va. and her special field is research in quantity foods.

EXPERIMENTAL PROCEDURES

SOURCE AND PREPARATION OF FOOD

PART I: STUDY OF INGREDIENTS

Preparation of Base.

Chicken and beef stock were prepared from fabricated extracts[1]. The directions for preparation were followed as stated on the containers.

Medium-thin white sauce was prepared from water and a mix consisting of nonfat dry milk solids, flour, and margarine. The milk was reconstituted from nonfat dry milk solids. One gm. salt was added to 100 gm. milk or white sauce.

[1]"Torex"; Lipton beef broth; and Lipton chicken broth.

Preparation of Purées.

Fine purées were prepared from beef and veal and from canned clams. The following fresh vegetables were used for puréeing: carrots, eggplant, onions, sweet green peppers, tomatoes, and white potatoes. The varieties of carrots were: Gold Spike, Imperator, Morses Bunching and Waltham Hi-Color. The varieties of tomatoes were: Solid Red A, John Bear, Valient, Rutgers and Longred. These varieties were grown on the same field under the same conditions of planting, cultivation, and harvesting. The tomato and carrot varieties were supplied by the Department of Vegetable Crops. Cornell University.

Frozen vegetables puréed were green beans, peas, and spinach.

The following canned vegetables were puréed: asparagus, carrots, cream style yellow corn, mushrooms, okra, sweet green peppers, and tomatoes.

Before puréeing, the fresh meats were steamed to a pink color; the fresh and frozen vegetables were steamed to doneness; the liquor was incorporated into the purée.

Canned items were not cooked further before puréeing. In the case of cream style corn and tomatoes, all of the liquor was incorporated. In the other canned items, just enough of the liquor was used to facilitate the passing of the solid foods through the sieve.

Salt was added to all purées made from fresh and frozen items; 1 gm. salt was used for 100 gm. purée. The saltiness of the final product was similar to that of the base stock, white sauce, or milk. To the canned items sufficient amounts of salt were added to approximate the saltiness of the base. The pH of the purées was recorded.

The purées were poured into 1-qt. and 1-pt. paper containers, frozen at – 15° to – 20° F. and stored at this temperature until needed.

Preparation of Mixtures.

The base, which was either stock, white sauce, or milk, was made fresh each time samples were prepared. The purées were allowed to thaw overnight in a refrigerator. Needed amounts were weighed into sterilized, 600-ml. widemouthed Erlenmeyer flasks. From 0 to 150 gm. were used. Enough base was added to bring the total weight of the sample to 300 gm. pH determinations were made. The samples were transported to the Laboratory of Bacteriology for further treatment.

PART II: STUDY ON SOUPS

Case Studies.

Soups prepared routinely in the cafeteria of the College of Home Economics were tested for their ability to support growth of *Micrococcus pyogenes* var. *aureus*. The soups were chosen on the basis of their popularity and ease of preparation. The recipes for their preparation were those used in teaching quantity cookery classes. The soups were prepared in large quantity by the personnel of the cafeteria kitchen. Three hundred-gm. samples were removed, pH determinations made, and the samples taken to the Laboratory of Bacteriology for autoclaving, inoculation, incubation, and plating. pH determinations were made again after autoclaving. In two instances, soups were also prepared in 1-gal. quantities in the laboratory.

Experimental Soups.

The soup formulas were adjusted in one or several of the following ways: omission of peas, increase of tomatoes, addition or increase of carrots, and addition or increase of sweet green peppers.

In the laboratory, the soups were prepared in 1-gal. batches. They were cooked on top of the stove. The materials used for the liquid base were the same type as used for the purée mixtures (Part I).

The same fresh and frozen vegetables used in Part I were used here, plus fresh apples. The meats used were: freshly ground raw beef (approximately 75 per cent lean), cooked chicken, ham, and turkey; raw bacon; and canned clams.

Acceptability of the products was determined by a panel of judges.

From each batch of soup, two 500-gm. samples were preserved by freezing at approximately – 15° to – 20° F. until needed for inoculation. Determination of pH was made of the finished soups.

Palatability.

The soups were rated as "very acceptable," "acceptable," or "not acceptable" by four members of the Department of Institution Management. Not more than two soups were tasted at one time. When two levels of acidity were compared, the less acid soup was tasted first.

Preparation of samples for inoculation.

A 500-gm. sample of each soup to be tested bacteriologically was removed from the freezer and partially thawed at room temperature for approximately 6 hr. A 300-gm. sample was weighed into a sterile 600-ml. beaker, covered with aluminum foil,

TABLE I. — BACTERIAL GROWTH AND pH IN CHICKEN BROTH-PUREE MIXTURES AS AFFECTED BY KIND AND AMOUNTS OF PUREE

Puree	pH of puree	Log final count per ml. (No puree in broth) pH		Log final count per ml. (3.3% puree in mixture) pH		Log final count per ml. (10.0% puree in mixture) pH		Log final count per ml. (16.6% puree in mixture) pH		Log final count per ml. (25.0% puree in mixture) pH		Log final count per ml. (33.3% puree in mixture) pH		Log final count per ml. (50.0% puree in mixture) pH	
Carrot, canned	6.1[a]	6.7	7.5	6.1	7.6	5.5	6.5	5.3	5.5						
Carrot, fresh	5.6[b]	7.2_6	7.6_6	5.9_6	7.4_5	5.4_7	6.1_7	5.3_7	5.1_7	5.2_7	4.4_4	5.2_7	3.6_3	5.3_7	3.8
Sweet green pepper	4.4[a]	7.3_4	7.4_4	6.1_2	7.2_2	5.5_2	5.3_2	5.3_2	4.3_2	5.1_2	<4.1	5.0_2	$<2.1_2$	4.9_2	$<2.1_2$
	5.2[b]	7.6_4	7.3_3	6.8_2	7.6_2	5.8_2	7.1_2	5.6_2	5.2_2	5.7_2	4.3	5.4_2	4.2	5.3_2	4.7_2
Okra	4.1[a]	7.0_2	7.2_2			5.2_2	6.2_2	4.9_2	4.5_2	4.8_2	$<3.1_2$				
Tomato	4.3[a]	7.1_4	7.5_2	5.7	7.4	5.1_2	6.5_2	5.0	5.8	5.0	4.2				
	4.3[b]	7.5_8	7.5_6	5.4_5	8.2_3	4.8_{10}	7.1_{10}	4.5_{15}	5.6_{14}	4.3_{10}	3.3_5	4.3_{10}	3.3_5		
Onion	5.5[b]	7.3_3	7.5_4	6.4	8.1_2	5.8	6.8_2	5.6	7.5_2	5.3_3	6.4_3	5.5	4.9	5.4	4.2
Asparagus	5.6[a]	7.8_2	7.2	6.2_2	7.4_2	5.8_2	7.1_2	5.6_2	6.5_2	5.5_2	6.4_2	5.5_2	6.2_2	5.3_2	<6.1
Eggplant	5.5[b]	7.0_2	7.2_2			6.5_2	7.2	6.2_2	6.5_2	5.9_2	6.1_2				
Potato	6.3[b]	6.7	7.5	6.3	7.3			5.9	6.9	5.9	6.6	5.8	6.2	5.8	<6.1
Spinach	6.8[c]	7.1_2	7.2_2			7.0_2	7.2_2	6.8_2	7.2_2	7.0_2	6.3_2				
Veal	5.9[b]	7.5	6.5_2	6.7	8.1	6.1	7.8	6.1	6.1		6.8		6.2		
Green bean	5.8[c]	7.0_2	8.0_2	6.1	7.8	5.5	7.2	5.4	7.2	5.2	7.7			5.1	<5.1
Mushroom	6.1[a]	7.9_2	7.2	7.0_2	7.6_2	6.6_2	7.8_2	6.4_2	7.5_2	6.3_2	7.3_2	6.2_2	7.2_2	6.0_2	6.6_2
Pea	6.8[c]	6.7_2	7.6_2	6.8	8.2	6.5_2	8.1_2	6.4_2	7.7_2	6.4_2	8.1_2	6.3	7.5	6.4	6.9

[a]Canned purée.

[b]Fresh purée.

[c]Frozen purée.

Note: Sub-script figures indicate number of replicates; < = less than.

TABLE 2 — BACTERIAL GROWTH AND pH IN SOUPS PREPARED IN QUANTITY (CASE STUDIES)

Soup	Source[a]	Proportion of selected ingredients: Canned tomato	Fresh carrot	Fresh green pepper	Frozen peas	pH after autoclaving[b]	Log final count per ml.[b]	Palatability[c]
Group I		(%)	(%)	(%)	(%)			
Consomme madrilene	C	24.0				4.6	<2.1	2
Cream of tomato	C	46.2				5.1_2	$<2.1_2$	2
Cream of tomato and mushroom	C	47.3				5.1_2	$<2.1_2$	2
Creole	C	25.5		2.0		4.7	<2.1	2
Mulligatawny	C					5.5_2	4.3_2	2
	L					5.6_2	4.4_2	2
Stockless vegetable	C	28.6	5.0			4.8_2	$<2.1_2$	2
Tomato bouillon	C	51.0				4.2	<2.1	2
Tomato-clam bisque	C	22.4				5.7_2	4.5_2	2
Group II								
Crabmeat gumbo	C	18.2		2.7		5.3	6.1	2
Cream of spinach	C					6.4_2	2.5_2	2
	L					6.3_4	6.3_4	2
Cream of vegetable	C		8.4			6.5_2	7.4_2	2
French onion	C					5.9_2	6.2_2	2
Washington chowder	C	23.0		0.8		5.6	6.2	2

[a]C means sample prepared in cafeteria; L means sample prepared in laboratory.

[b]Sub-script figures indicate number of replicates; < = less than.

[c]2 = very acceptable; 1 = acceptable; 0 = unacceptable.

and taped. A sub-sample, approximately 80 to 100 ml., was placed in a 250-ml. beaker and also covered with aluminum foil; this sample was used for determining pH before and after autoclaving.

BACTERIOLOGICAL MATERIALS AND METHODS

Fluid samples (Part I) were treated in cotton-plugged Erlenmeyer flasks. Solid-containing soups (Part II) were placed in beakers to which an aluminum foil covering had been taped. The samples were autoclaved for 20 to 30 min. at 121° C. After cooling to room temperature overnight, the samples were inoculated with 1 cc. of a 10^{-6} dilution of *Micrococcus pyogenes* var. *aureus* S209 which was being maintained in meat infusion broth. The inoculum was also plated on meat infusion agar for determination of numbers of organisms. In general, from 4 to 40 organisms per ml. were found in freshly inoculated batches. To inoculate the material contained in beakers, the surface of the foil was washed with 95 per cent ethanol and flamed. The inoculating pipette was punched through the foil and the resultant hole covered with ordinary transparent tape.

The foods were incubated for 24 hr. at 30° C. A 1-ml. aliquot of each sample was removed, appropriately diluted and plated in duplicate on meat infusion agar. Food mixtures containing large pieces were Waring-blended for 1 min. before aliquots were removed. The plates were incubated at 30° C. for 48 hr. before counting.

RESULTS

PART I: pH AND BACTERIAL COUNTS OF BASE-PUREE MIXTURES

Effect of adding purée of vegetables and veal to chicken broth on pH and bacterial counts (Table 1).

Chicken broth was used as a base. The pH of

chicken broth was approximately 7. In general, bacterial counts were over 10^6 per ml.

Carrot.

Purées prepared from fresh and canned carrots were used. The pH of fresh carrot purée was 5.6, and purée made of the canned vegetable was 6.1. With the smallest addition of carrot, 3.3 per cent of total mixture, the pH of the broth was lowered considerably; little further change was noted when the proportion of carrot in the mixture was increased to 50 per cent. Bacterial counts decreased as the proportion of carrot in the mixture was increased. Final counts were less than 10^6 per ml. when the mixture contained 16.6 per cent carrot purée and below 10^5 per ml. at the 25 per cent-carrot level. For comparable concentrations, pH and bacterial counts were similar, regardless of whether the purées from fresh or canned vegetables were involved.

Sweet green pepper.

Purées prepared from fresh and canned peppers were used. The pH of purée prepared from canned peppers was 4.4 and that of the fresh was 5.2. Greater decreases in pH and lower bacterial counts were noted in the mixtures made with the canned vegetable. Final counts were less than 10^6 per ml. in broth-pepper mixtures containing 10 per cent of the canned vegetable or 16.6 per cent of the fresh vegetable. Counts were less than 10^5 per ml. in mixtures containing 25 per cent of the vegetable.

Okra.

The pH of purée prepared from canned okra was 4.1. This was somewhat lower than that of sweet green peppers and considerably lower than that of carrots.

Bacterial counts decreased as the proportion of okra in the mixture was increased. Final counts were less than 10^5 per ml. when the broth-okra mixture contained 16.6 per cent okra purée.

Tomato.

Purées prepared from fresh and canned tomatoes were used. The pH (4.3) was the same for both kinds. pH and bacterial counts decreased as the proportion of tomato in the mixture was increased. Final counts were less than 10^6 per ml. in the broth-tomato mixture with 16.6 per cent tomato, canned or fresh. Bacterial counts were below 10^5 per ml. when it contained 33.3 per cent of purée made from fresh tomatoes.

Onion.

The pH of purée prepared from onion was 5.5. Final counts were above 10^6 per ml. when the mixture contained 25 per cent of the vegetable. Counts below 10^5 per ml. were found when one-third of the mixture consisted of onion purée.

Asparagus, Eggplant, Irish Potato, Spinach, and Veal.

pH values for the purées made from the four vegetables and the meat were 5.6, 5.5, 6.3, 6.8, and 5.9, respectively. Considerably higher counts were found in the mixtures prepared with these purées than in those containing carrot, green pepper, okra, and tomato. In samples containing 25 per cent of any of these purées, counts were above 10^6 per ml.

Green Bean, Mushroom, and Pea.

The pH values of the purées were 5.8, 6.1, and 6.8. Bacterial counts were extremely high in mixtures containing puree of pea. Incorporation into chicken broth of 3.3 per cent to 25 per cent of purée of pea increased the counts above those of broth alone.

Effect of Variety on pH and Bacterial Counts.

Chicken broth was used as a base. Five varieties of tomatoes and six of carrots were compared. Differences in pH and bacterial counts among varieties were slight.

Carrot.

The pH values of the purées ranged from 5.5 to 5.7. In all varieties, final counts were well below 10^6 per ml. in broth-carrot mixtures containing 16.6 per cent purée, and counts were well below 10^5 per ml. in mixtures containing 25 per cent carrot puree. The pH values varied from 5.1 to 5.4 in the latter mixtures.

Tomato.

The pH values of the purées ranged from 4.3 to 4.4. Final bacterial counts were less than 10^6 per ml. when the broth-tomato mixtures contained 16.6 per cent purée, with the exception of Solid Red A. In all instances, counts were well below 10^4 per ml. when the mixtures included 25 per cent purée. The pH values varied from 4.1 to 4.6 in the latter mixtures.

Comparative Bacterial Growth in Broth, Milk, and White Sauce.

TABLE 3 — BACTERIAL COUNTS AND pH IN SOUPS WITH ADJUSTED FORMULAE (EXPERIMENTAL)

Soup	Source[a]	Proportion of selected ingredients: Canned tomato (%)	Fresh carrot (%)	Fresh green pepper (%)	Frozen peas (%)	pH after autoclaving[b]	Log final count per ml.[b]	Palatability[c]
Group III								
Chicken gumbo	C	8.2		0.5		5.3	4.5	2
	L	7.3	5.5	7.3		5.1_3	3.3_3	2
w/ham	L	10.9	4.5	5.5		4.9_2	3.6_2	0
	L	16.4	5.0	6.6		4.8	<3.1	0
Cream of carrot	C		17.2			6.1_3	4.9_3	2
	L		26.8			5.8_3	4.3_3	2
Dixie vegetable	C	14.8	4.5	0.2	1.7	5.1	4.1	2
	L	14.8	4.5	0.2	1.7	4.9_2	3.7_2	2
English beef broth	C	25.0	2.9			5.2_2	5.2_2	2
	L	23.6	5.5	2.7		4.9_3	4.7_3	2
Minestrone	C	11.0				5.5	6.4	2
	L	19.4				5.2_2	5.4_2	1
	L	13.5	4.5	3.0		5.3_2	5.3_2	2
	L	20.6	4.1	2.7		5.0_2	4.5_2	2
Mock turtle	C	14.3	4.7			5.0	4.5	2
	L	14.3	4.7			4.8_2	$<3.1_2$	2
	L	18.6	4.7			4.8_2	3.2_2	1
Navy bean	C	12.5				5.9_3	5.3_3	2
	L	11.4	8.5			6.0_2	4.6_2	2
	L	14.3	8.5			5.6	4.4	0
Pepper pot	C	3.4		3.4		5.5_2	5.1_2	2
	L	5.7	5.7	8.6		5.3_2	4.2_2	2
	L	15.9		5.3		5.2	§4.1	0
	L	7.5	5.7	8.5		5.0	3.4	0
Philadelphia clam chowder	C	21.4	2.2			4.9_2	$<3.1_2$	2
	L	21.4	2.2			5.4_5	6.5_5	2
	L	30.6	1.9			5.1_2	6.3_2	1
Spanish bean	C	24.5				5.1	<4.1	2
	L	24.5				5.0_2	4.2_2	2
	L	30.2				5.0_2	$<2.1_2$	1
Split pea	C	8.3				5.9	6.6	2
	L	14.5	5.4			5.4	5.7	2
	L	14.0	8.7			5.7_2	5.6_2	2
	L	14.9	10.4			5.5	5.2	2
	L	18.6	10.0			5.6_2	5.1_2	2
Vegetable with stock without peas	C	13.8	4.3		2.1	5.5_2	6.1_2	2
	L	13.8	4.3			4.9_2	4.1_2	2
	L	29.0	5.0			4.7_2	2.3_2	0

[a]C means sample prepared in cafeteria; L means sample prepared in laboratory.

[b]Sub-script figures indicate number of replicates; < = less than; § = approximately.

[c]2 = very acceptable; 1 = acceptable; 0 = unacceptable.

Bases With No Purée Added. Chicken broth, beef broth, milk and white sauce were compared. The average pH values were 7.1, 6.1, 6.5 and 6.8. Bacterial counts were highest in chicken broth, above 10^7, closely followed by beef broth. Bacterial counts in milk averaged halfway between 10^6 and 10^7. Counts were lowest in white sauce and averaged close to 10^6.

Base-and-Purée Mixtures. Purées of carrot, tomato, pea, corn, clam, veal, potato, onion and green beans were combined with the various bases in proportion of 3.3, 10, 16.6, 25, 33.3 and 50 per cent.

In mixtures containing 3.3 per cent puree, growth was highest in chicken broth. With higher amounts of purée, the counts were more affected by the kind of purée than by the kind of base. In general, the counts were higher in mixtures containing purée of pea, corn, and clam than in mixtures that involved purée of onion, potato and green bean. Counts were lowest in mixtures involving purée of carrot and tomato.

Counts above 10^8 per ml. were found in: chicken broth-and-pea, at 10 and at 25 per cent; milk-and-veal, at 16.6 and at 25 per cent; and milk-and-clam, at 25 per cent.

PART II: pH AND BACTERIAL COUNTS OF SOUPS

Case Studies.

The soups prepared in the cafeteria were divided into three groups, on the basis of formula and bacterial count.

In Group I were soups in which bacterial counts were low, 5×10^4 per ml. or below. With the exception of Mulligatawny, the formulas were simple and contained high percentages (22.4 per cent to 51 per cent) of tomato (Table 2); no adjustment of formula was deemed necessary. The soups were very acceptable organoleptically. They were: consomme madrilene, cream of tomato, cream of tomato and mushroom (7.2 per cent mushroom), creole, Mulligatawny, stockless vegetable, tomato bouillon, and tomato-clam bisque (10.5 per cent clam).

In Group II were placed soups in which bacterial counts were high, 10^6 per ml. or above (Table 2). These soups were not subjected to formula adjustment. They were: crabmeat gumbo, cream of vegetable, French onion, and Washington chowder. Counts in cream of spinach soup prepared by a quantity formula in the laboratory were high also.

Included in Group III were the soups which, because of the nature of their ingredients, lent themselves to formula adjustment. Counts ranged from 5×10^4 per ml. to 6×10^6 per ml. These soups were: chicken gumbo, cream of carrot, Dixie vegetable, English beef broth, minestrone, mock turtle, navy bean, pepper pot, Philadelphia clam chowder, Spanish bean, split pea, and vegetable (made with beef stock).

Experimental Soups.

Formulas of soups in Group III were adjusted in one or several of the following ways:

(a) Omitting peas.
(b) Increasing tomato.
(c) Adding or increasing carrot.
(d) Adding or increasing sweet green pepper.

The results are presented in Table 3. In Philadelphia clam chowder, counts were above 10^6 per ml. In split pea soup, counts were above 10^5 per ml., but below 10^6 per ml. In the remaining adjusted soups, final counts were below 10^5 per ml.

DISCUSSION

In general, final counts were low when the pH of the mixture was 4.5 or lower. Decrease in pH following incorporation of tomato, green pepper, and okra at least partially explains the decrease in bacterial multiplication. The inhibitory action of carrot purée cannot be explained on the basis of acidity alone. Spoehr *et al.* (1) ascribed antibacterial activity in carrots to fatty acids.

A review of literature on growth-inhibiting substances in other edible plants is presented by Wilson and Brown (2).

The results of the study on effect of variety on bacterial counts in broth-tomato and broth-carrot mixtures point toward the feasibility of recommending carrots and tomatoes in general as bacterial inhibitors in food mixtures. The varietal study will be repeated after another growing season. No varietal study has been made on green peppers and okra. Two sources of peppers were used in Part I, i.e., one brand of canned and one shipment of fresh. For the adjustment of soup formulas (Part II), fresh green peppers from several shipments were used. Canned okra only was available. The pH of the purée was 4.1. Bridges and Mattice (3) reported a pH range of 6.31 to 6.62 for fresh, cooked okra.

SUMMARY

Little is known about the keeping quality of different soups and on the influence of the various ingredients or storage quality. Soups are often served in food establishments with limited refrigeration facilities and are also widely marketed in the frozen state. This investigation was conducted to study the effect on growth of *Micrococcus pyogenes* var. *aureus* of some selected main ingredients that are frequently used in the preparation of soups. The aim was to create a basis for developing formulas for palatable soups that are poor supporters of bacterial growth.

In the first part of the study, finely puréed vegetables, meats, and clams were added in increasing proportion to chicken broth. The mixtures were autoclaved, cooled, inoculated with *Micrococcus pyogenes*

var. *aureus* S209, and incubated at 30° C., for a 24-hr. period. Dilution plates were then poured. pH determinations were made before and after autoclaving.

Purées of carrot, tomato, green pepper, and okra when added in appropriate amounts decreased bacterial growth below counts found in plain broth.

Counts considerably higher than those found in the above mixtures occurred in samples containing comparable amounts of purée of onion, asparagus, eggplant, spinach and veal.

Bacterial counts were highest in mixtures involving purées of green bean, mushroom, corn, and pea. Incorporation into chicken broth of 3.3 per cent to 25 per cent puree of pea increased the final counts above those incurred in plain chicken broth. A comparison was also made of bacterial growth in beef broth, milk, and medium white sauce. Extremely high counts were found in the following mixtures: chicken broth-pea, milk-veal, and milk-clam.

In the second part of the study, twenty-five selected soups, prepared in quantity in the cafeteria of the New York State College of Home Economics, were tested for their ability to support growth of *Micrococcus pyogenes* var. *aureus* S209. The formulas of twelve soups were adjusted on the basis of the findings of Part I of this investigation. Adjustment was made by one or several of the following methods:

(a) Omission of peas.
(b) Increase of tomatoes.
(c) Increase or addition of carrots.
(d) Increase or addition of sweet green peppers.

Eighteen soups found to be poor supporters of *Micrococcus pyogenes* var. *aureus* were listed.

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NEWS AND EVENTS

AUTHORIZATIONS TO USE THE 3-A SYMBOL ISSUED SINCE JUNE 1, 1956

The concerns the names of which are listed below have been granted authorization to affix the 3-A Symbol to the models of equipment listed, by the 3-A Sanitary Standards Symbol Administrative Council. The Council emphasizes that this list is not to be considered a complete roster of concerns which offer equipment conforming to pertinent 3-A Sanitary Standards.

AUTHORIZATION NUMBER — *CONCERN* — *ADDRESS*

Pumps for Milk and Milk Products — 0201

Waukesha Foundry Co.

5 — Waukesha, Wisconsin

Models: 2BB, 10BB, 25BB, 55BB, 100BB, 125BB, #10C/P, #25C/P, #5 Standard and #10 Standard.

———

Girton Manufacturing Co.

9 — Millville, Pa.

Model: Compensating Impeller Pumps, various capacities.

———

Tri-Clover Div.-The Ladish Co.

26 — Kenosha, Wisconsin

Models: 1S, 2S, 3S, 4S, 5S, 6S, OSS, 1SS, 2SS, 3SS, MS, S, 1½EJ, 2EJ, 2EBH, 2½EH, 3EH and 4EH, with carbon rotary seal #105, or water-cooled rotary seal #141.

———

Cherry-Burrell Corporation

29 — Little Falls, N. Y.

Models: ON, O, OH, VA, VAH, VB, VBH, and VCH.

———

Viking Pump Company

52 — Cedar Falls, Iowa

Models: J170 to 178; K178 to 178; KK170 to 178;

and L170 to 177.

———

Pumps For Milk And Milk Products — 0201

Creamery Package Mfg. Co.
63 Chicago, Ill.
Model Nos. 4, 6, 8 and 9.

Homogenizers and High Pressure Pumps of the Plunger Type — 0400

Creamery Package Mfg. Co.
37 Chicago, Ill.
Models: Multi-flo 2, 3, 3DD-1, 3DD-2, 3DD-3, 3DD-4, 3DD-5, and 3DD-6.

———

The Creamery Package Mfg. Co.
63 Chicago, Ill.
Models: 4, 6, 8, and 9.

———

Stainless Steel Automotive Milk Transportation Tanks for Bulk Delivery and/or Farm Pick-Up Service — 0501

Stainless, Inc.
7 *Van Nuys, Calif.*
Models: Standard and Light Flight.

———

Walker Stainless Equipment Co.
25 New Lisbon, Wis.
Models: BPT-756, TT-756, TTRS-756, BPT-1057.

———

Stainless & Steel Products Co.
40 St. Paul, Minn.
Models: PUT-3E and PUT-4E.

———

Damrow Brothers Co.
43 Fond du Lac, Wis.
Models: TF and FF.

———

The Heil Co.
44 Milwaukee, Wis.
Tanks built to order — no model numbers.

———

Standard Steel Works
47 North Kansas City, Mo.
No model numbers.

———

Blackburn Stainless Steel Products
59 Downey, Calif.
No model numbers.

———

Fittings Used on Milk and Milk Products Equipment, and Used on Sanitary Lines Conducting Milk and Milk Products — 0800 and Supplements 2, 3, 4, 5 and 6 — 0802 — 0806

Tri-Clover Div.-The Ladish Co.
34 Kenosha, Wis.
Fittings: Those shown on reprints; in addition: 60CM, 60CMG, 60CR, 60CRG, 60TM, 60-TMG, 60TR, 60TRG, 2CMP, 2FMP-14, 2FMP-15, 2KMP, 7MP, 9MP, 10MP, 11MP, 14RMP, 13MS, 16AMP, 60CMP, 60TMP, 31-14MP, and 32-14MP.

Thermometer Fittings and Connections Used on Milk and Milk Products Equipment — 0900 and Supplement 1 — 0901

Taylor Instruments Companies
32 Rochester, N. Y.
Fittings: Those shown on reprints.

Milk and Milk Products Filters Using Disposable Filter Media — 1000

Tri-Clover Div.-The Ladish Co.
35 Kenosha, Wis.
Models: 100F, 200F, 300F, 600E, 700E, 800E, 900E, 701E, 801E, and 901E, with ¼-inch perforations.

Plate-Type Heat Exchangers for Milk and Milk Products — 1100

York Division — Borg-Warner Corp.
14 York, Pa.
Models: HM, HT, HTES, HTW, and HTWS.

———

Kusel Dairy Equipment Co.
15 Watertown, Wis.
Models: S, C, ER, ET, DH, and J.

———

DeLaval Separator Company
17 Poughkeepsie, N. Y.
Models: P5-RC, P5-EB, P5-VRB, P5-VEB, P14-RC, P14-VRB, and P14-VEB.

———

A.P.V. Company, Inc.
20 Buffalo, New York
Models: HX, HXL-4, HXL-6, HXC, HMB, and HMBT.

———

Cherry-Burrell Corporation
30 Little Falls, N. Y.
Models: SI, SA, SAS, SLS, EOS, EO, and ESI.

———

Creamery Package Mfg. Co.
38 Chicago, Illinois
Models: Crescent, SC Crescent, MS Crescent, Multi-Pass, and Bantam Multi-Pass.

———

A.P.V. (Canada) Equipment, Ltd.
46 Toronto, Ontario
Models: HMBT, HMB, HX, HTA, HXL-4, HXL-6, and HXC

Inlet and Outlet Leak Protector Plug Valves for Batch Pasteurizers — 1400

Tri-Clover Div. — The Ladish Co.
27 *Kenosha, Wisconsin*

Models: 10FL, 10CL, and 7OL.

The four-digit numbers appearing with the names of equipment, are the numbers assigned to the respective 3-A Sanitary Standards and Supplements.

The names of concerns authorized to affix the 3-A symbol to Holding and/or Cooling Tanks, because of the space required, will appear in the July number of the Journal. And the names of concerns authorized to affix the 3-A symbol to Bulk Milk Dispensers may not be published until September, when twelve months from the effective date of the 3-A Sanitary Standard will have elapsed.

21st ANNUAL CONFERENCE NATIONAL ASSOCIATION OF SANITARIANS

Scenic splendor, salt air and salmon may have contributed to Seattle's selection as 1957 education conference site by the National Association of Sanitarians, but major credit for attracting the anticipated 600 sanitarians belongs to Washington's active sanitarians' organization.

Mr. John Bright, Director of Sanitation Seattle and King County Dept. of Public Health, General Conference Chairman.

Mr. Hayes Evans, Supervising Sanatarian Seattle and King County Dept. of Public Health. Pres. Elect N.A.S. Conferring of plans for 21st Annual N.A.S. Conference.

Washington will host sanitarians from this country, territorial possessions and Canada at the four-day conference beginning July 15 at the Olympic Hotel in Seattle. This marks the second time that representatives of the Washington Association of Sanitarians have been successful in obtaining the N.A.S. conference—a signal honor. The first time was 1946.

The 21st Annual Conference will have special meaning for Washington in another way, too. Incoming N. A. S. President will be Hayes Evans, Supervising Sanitarian, Seattle-King County Health Department, who was named President-Elect at the 1956 Conference in Chicago and will succeed E. Russell Jackson, Jacksonville, Florida, present president. Evans has served two years as N.A.S. Vice-President.

One of the highlights of the program will be the realization of the formation of I.F.S.O. (International Federation of Sanitarians' Organizations) to be composed, at this time, of the Canadian Institute of Sanitary Inspectors and the National Association of Sanitarians.

The program will be centered around the theme "Coming of Age, Then and Now" with the keynote speech to be given by Professor Walter Mangold, Department of Environmental Sanitation, University of California. Tentative program planning includes a wide range of sanitation topics and events of interest.

Responsibility for a successful conference lies with the Washington sanitarians group under the leadership of John Bright, Sanitation Director, Seattle-King County Health Department, Conference Chairman.

INTERSTATE MILK SHIPPERS' CONFERENCE ATTRACTS 144; PAPERS, REPORTS ARE HEARD

The Sixth National Conference on Interstate Milk Shipments, held April 23-25 at the Hotel Peabody in Memphis, Tenn., attracted 144 registrants from 29 states and the District of Columbia, who explored

further steps to facilitate the program for interstate movement of high quality milk.

H. L. Hortman, Louisiana Department of Health, New Orleans, Chairman of the Conference, presided over the three day session which heard several formal papers, panel discussions, and reports from committees and task forces. Participating were dairy industry personnel from shipping and receiving areas, state departments of health and agriculture, U. S. Public Health Service and the U. S. Department of Agriculture, and from numerous educational institutions.

"The objective of the Conference," a NCIMS spokesman said, "is the development of procedures which will facilitate the interstate shipment of milk and insure the acceptance of high quality milk in any area where needed. By holding national conferences about every two years, we hope to establish mutual confidence on the part of both shipping and receiving areas, and at the same time, furnish the best possible milk supply for all people in every section of the country."

Among the papers presented at the conference was "Status of use of the Program of Conference Agreements in Interstate Shipments of Milk," by Dr. K. G. Weckel, of the University of Wisconsin, who reported that while many dairy industry people are apparently not aware of the machinery already in existence to facilitate interstate milk shipments, some 697 million

H. L. Hortman Conference Chairman, K. G. Weckel, U. of Wis., L. A. Black, Taft Eng. U.S.P.H.S., Cinn., Ohio, and H. B. Robinson, U.S.P.H.S. Wash., D.C. discuss a weighty problem.

pounds of milk were shipped interstate under this program in 1955. This amount may logically be expected to have increased more recently.

A warning that the brucellosis control program is not uniform between areas, and the program of one area is not understood in others, was sounded by W. F. Crighton, General Manager of the Producers Creamery Co., Springfield, Mo., in his paper, "Problems of the Shipper in Interstate Milk Shipments." Further, laboratory tests on milk received at its destination are not always in agreement with tests made at the shipping point. Test results at the point of destination should be surveyed and checked for accuracy as thoroughly as tests made at the shipping point.

Milton Held, U.S.P.H.S., Kansas City, Mo., and L. A. Black, U.S.P.H.S. Taft. Eng. Center, Cinn., Ohio, checks a task committee report.

The Task Force on Channelling Information called attention to the need for accurate information on the condition of milk arriving in receiving areas, and recommended improved procedures by which such information should be regularly forwarded back to the state of the milk's origin.

The Task Force on Laboratory Certification Procedures suggested that the U. S. Public Health Service provide certification of laboratories in the receiving areas, when and if requested. USPHS was also requested to hold periodic training courses for laboratory survey officers at the Public Health Service Center in Cincinnati. The same Task Force expressed the opinion that all states should consider reciprocity in the matter of laboratory certification.

Panel discussions brought forth many points of view, including:

- a national agreement should be reached on requirements concerning the use of potable water for condensers;
- standards for nonfat dry milk to be used in reconstitution into Grade A products are much needed;

Mr. Handorff and helpers, City Health Dept., Memphis, Tenn., giving sales "pitch" for Tenn. milk to neighbor "Woody" Woodard, Arkansas State Health Dept.

● there is some evidence that tuberculosis and brucellosis test programs are so interpreted that they become, in effect, barriers to the interstate shipment of milk.

Participants at the conference called attention to the Interstate Milk Shipper List, published quarterly by the Milk and Food Program of the U. S. Public Health Service. This is a list of interstate milk shippers together with sanitation compliance ratings of their supplies as certified by Milk Sanitation Rating Officers.

Use of the Interstate Milk Shipper List is entirely optional, it was explained. Milk control authorities reported, however, that it is useful to them in obtaining permanent or supplementary supplies of high quality milk which has been produced, handled and inspected to meet established standards.

The Executive Officers of the Conference were reelected at a business meeting which concluded the sessions. Thus, H. L. Hortman, New Orleans, La., will continue as Chairman; H. J. Weavers, Madison, Wisc., will continue as Secretary; and Harold Barnum, Denver, Colo., will continue as Treasurer.

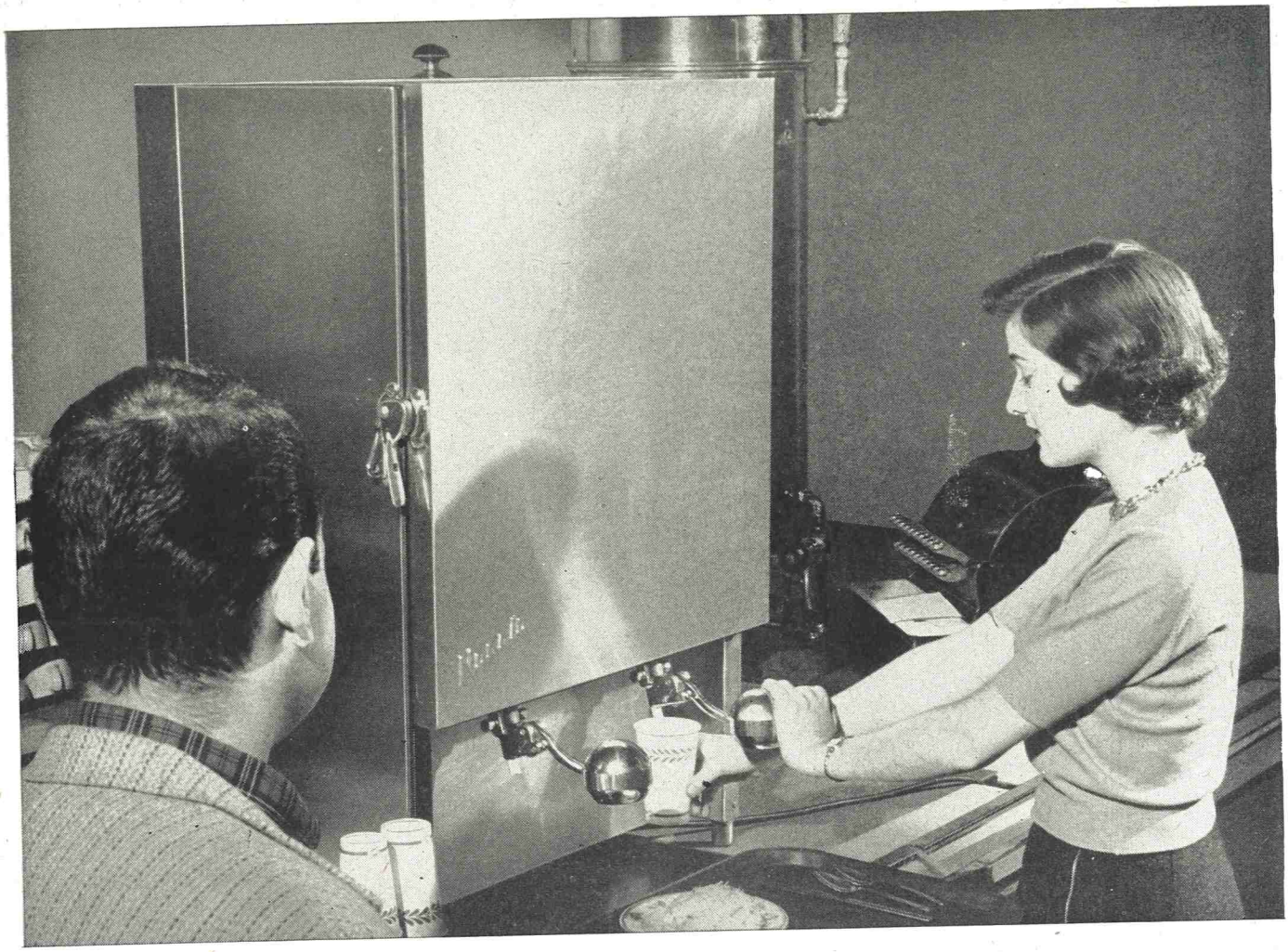
Other members of the Board are:

Region One—J. A. Stalbird, Albany, N.Y.; C. W. Pegram, Raleigh, N.C.; H. W. Anderson, Atlanta, Ga.; Jack Newlin, Tyrone, Pa.; and H. B. Robinson, Washington, D.C.

Region Two—H. L. Hortman, New Orleans, La.; H. J. Weavers, Madison, Wis.; Dr. M. R. Fisher, St. Louis, Mo.; C. H. Mattson, Minneapolis, Minn.; Dr. M. P. Baker, Ames, Iowa; J. C. McCaffrey, Springfield, Ill.

Region Three—Everett Lobb, Bismarck, N. Dak.; V. P. Layton, Council Grove, Kans.; Harold Barnum, Denver, Colo.; J. E. Mapes, Dallas, Texas.

At Large—Dr. K. G. Weckel, Madison, Wisconsin, will continue to serve on the Board as representative at large as past-executive Chairman of the Board.



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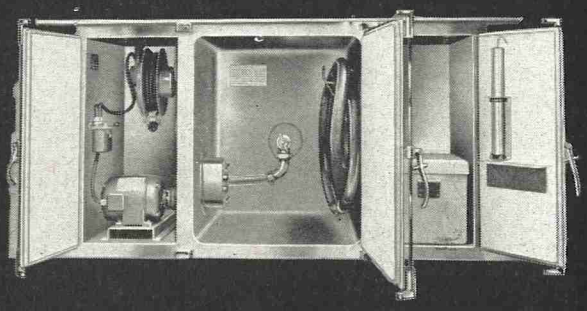

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Super-Thick Guardians

How we build their finer-filtering Wet-Strength . . .

By John F. Stroup, Jr., Chief Chemist
Union Wadding Company

Scientific analysis proves that four primary essentials must be combined to produce an efficient filter for milk: —

1. "Loft", or *thickness* of the filter, to provide *depth* of filtering fibers;
2. Fine, specially-selected *pure* fibers (costlier than substitutes);
3. Thorough cleaning, bleaching, curing, and exacting inspection throughout the manufacturing process;
4. A method of literally *welding* the fibers together to trap sediment even too fine to see, and to assure *wet-strength* that can't be ruptured under the strain of the heaviest milk stream.

Some makes of filters have *some* of these basics. Guardian filters *alone* have them *all!*

The Guardian Micro-Face process is patented. The exclusive techniques which produce Guardian filters are based on 120 years of company research. Cotton from the choicest crops on the market go into them at premium cost. 24 separate manufacturing steps are involved through a processing period of 10 days.

The Micro-finishing process—for wet-strength—involves curing in block-long ovens and a more than a million dollar chain of equipment.

We especially invite you to see with your own eyes this long, laboratory-controlled operation that builds-in *thick*, fast-flowing, fine-filtering *wet-strength* exclusively characteristic of Guardians.

It's the *difference* that *pays you* in sediment-free milk when you recommend Guardians to your dairymen.

Guardian MICRO FILTER DISKS MEAN Laboratory-Controlled Quality!

58% Thicker than average of five leading brands. Thickness of Guardian Disks means the best quality milk every time. Certified tests prove Guardian filters measure 19% thicker than the next leading brand. Extra thickness means finer filtering—and at a fast-flowing rate.

Tap Test Proves Guardians tough, rupture resistant. A simple tap test or warm water immersion demonstration proves their superior strength instantly. Guardians don't burst or fall apart—they gain strength when wet—eliminate rejected milk. They take the strain of the heaviest milk stream, withstand handling abuse.

Remove Finest Particles for sediment-free milk. The best possible milk filtration is guaranteed when you specify Guardians. A fine, high grade cotton is used . . . plus the special fiber construction which removes more sediment. Guardians are THICKER, TOUGHER AND THOROUGH for highest quality results.

Cost No More than ordinary filter disks. You and your producers pay no more for Guardian filters. Yet you get the thickest, strongest and most thorough filtering disk in America. Remember, Guardians are made by the oldest company in the business—founded in 1836.

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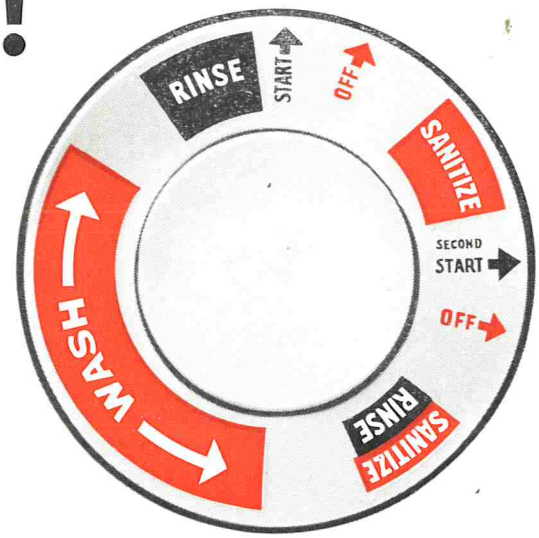
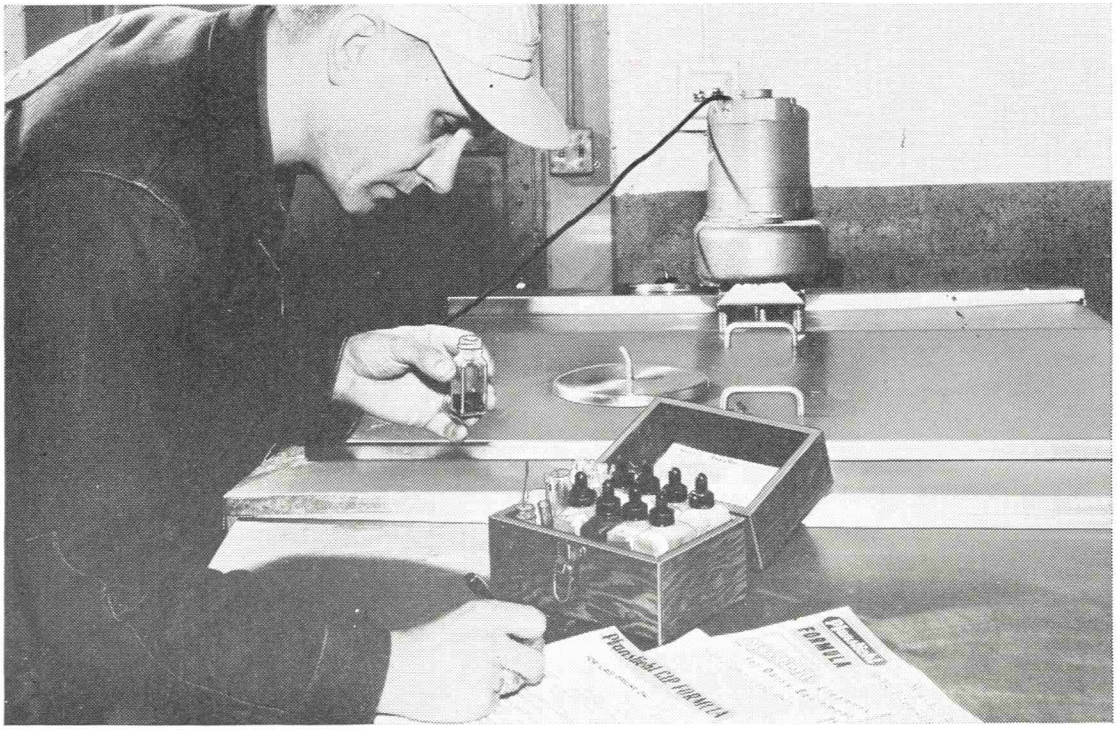


The ELECTROBRAIN automatically washes breaker cups and pipe line while the farmer enjoys his second cup of coffee. The right cleaning routine is locked up in a box without a key.

But no cleaning system—not even the ELECTROBRAIN—can do a good job of pipe line washing with hard well water if just any kind of detergent is used. And soft well water is scarce.

That's why Surge Service Dealers carry a testing kit to determine hardness and iron content of water—right on the farm, free of charge.

That way, Surge Dealers can prescribe detergent compounds which help the ELECTROBRAIN work effectively with any kind of hard water.



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