TWENTY-FOURTH ANNUAL REPORT

OF THE

International Association of Dairy and Milk Inspectors

INCLUDING PAPERS READ AT THE ANNUAL
CONVENTION IN MILWAUKEE, WISCONSIN
OCTOBER 10, 11 AND 12
1935

COMPILED BY

PAUL B. BROOKS, M.D.
Secretary-Treasurer
STATE DEPARTMENT OF HEALTH
ALBANY, N. Y.

1936

De Laval Separators and Milkers for Every Need and Purse

The world's best separators—made in four series, in 17 styles and sizes, with prices and terms for every need and purse. Sold on payments as little as $1.00 a week, so that they will pay for themselves.

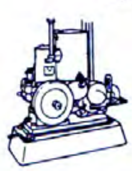
The Best Way to Standardize Milk

De Laval Multi-Purpose Separators —specially designed for standardizing milk; many now in use giving excellent satisfaction. Also clarifies milk and can be used as a regular cream separator.

De Laval Milkers

The world's best milkers—used on thousands of farms to milk the world's best cows. Sold on easy terms so that they pay for themselves.

The Cheapest Power with Free Hot Water



Alpha Dairy Power Plants provide the best and most economical power for operating milkers, and heat water for cleaning the milker and other dairy utensils at no extra cost.

DE LAVAL
THE WORLD'S BEST SEPARATORS and MILKERS

THERE never was a time in the 58 years of De Laval's leadership when buyers obtained so much value as they do in the De Laval Separators and Milkers of today.

In skimming efficiency, ease of operation and handling, and length of life, there is nothing that can compare with a De Laval Cream Separator.

And when it comes to the milking of cows, De Laval Milkers do better, faster, cleaner work and are more economical to own and operate than any other make.

More than 3,000,000 cows the world over are now milked the De Laval way, and many of the world's highest production records have been made with De Laval milking. There is nothing which will give a dairyman more profit or satisfaction than a De Laval Milker.

The De Laval Separator Co.

NEW YORK 165 Broadway **CHICAGO** 427 Randolph St. **SAN FRANCISCO** 61 Beale St.

CHARLES J. STEFFEN
MILWAUKEE, WIS.

Elected first president of the Association at a meeting in Milwaukee in 1911.

TWENTY-FOURTH ANNUAL REPORT

OF THE

International Association of Dairy and Milk Inspectors

INCLUDING PAPERS READ AT THE ANNUAL
CONVENTION IN MILWAUKEE, WISCONSIN
OCTOBER 10, 11 AND 12

1935

"What do we live for, if it is not to make life less difficult for others?"

COMPILED BY
PAUL B. BROOKS, M.D.
Secretary-Treasurer
STATE DEPARTMENT OF HEALTH
ALBANY, N. Y.
1936

International Association of Dairy and Milk Inspectors

OFFICERS 1934-1935

President, C. K. JOHNS .... Ottawa, Ont.
First Vice-President, GEORGE W. GRIM .... Ardmore, Pa.
Second Vice-President, JOHN G. HARDENBERGH
Plainsboro, N. J.
Third Vice-President, ALEXANDER R. TOLLAND .... Boston, Mass.
Secretary-Treasurer, PAUL B. BROOKS .... Albany, N. Y.
Auditors: J. R. JENNINGS .... Louisville, Ky.
F. D. HOLFORD .... New York City

CONTENTS

INDEX TO ADVERTISERS

JOINT SESSION

WITH

ASSOCIATION OF

DAIRY, FOOD AND DRUGS OFFICIALS

OF THE UNITED STATES

AND

PUBLIC HEALTH ENGINEERING SECTION

OF THE

AMERICAN PUBLIC HEALTH

ASSOCIATION

THE COORDINATION OF AMERICAN MILK CONTROL EFFORT

LESLIE C. FRANK

United States Public Health Service, Washington, D. C.

THE coordination of American milk control effort is imperative if we are to arrive at a satisfactory solution of the two principal milk problems which confront us today, one a consumer problem, the other an industry problem.

The problem which is confronting the consumer is that much of the milk offered for sale is still of inferior quality and is causing thirty to fifty outbreaks of milk-borne disease per year and that it is impossible for him to distinguish high quality safe milk from low quality unsafe milk. The traveler is more keenly aware of this problem than is the local citizen. The latter usually has a certain confidence in its quality, often undeserved, which is based upon the fact that he has used it for years with no apparent ill effect.

Not so the traveler. When he buys a bottle of milk he is confronted by the entirely unknown. This fact becomes particularly impressive to parents who take their children on a trip. They are in foreign territory with no reason whatever to have confidence in the milk control exercised by the local health department. Inspecting the bottle caps for grade labels offers little information. Last summer on a long motor trip my family and I encountered each of the following labels:—Grade A Pasteurized, Grade A Raw, Selected Pasteurized, Selected Raw, Standard Pasteurized, Standard Raw, Special Pasteurized, Special Raw, Certified, Special Baby Milk, Pasteurized Milk, Raw Milk, and finally, simply "wash and return."

Can there be any wonder that there is confusion in the public mind as to the meaning, if any, of the many local milk grades, or that there is an insistently growing demand for some means of bringing order out of this chaos?

The milk industry is also confronted with a serious problem. In many areas it is producing more milk than it can sell at a sufficiently profitable price. This problem is largely born of the depression, of course.

A number of solutions have been offered. First, as in many other industries, came price fixing. Many dairy farmers and milk distributors were fascinated by the thought that if it were possible to determine the cost of production, add a fair profit, and fix the selling price at that level, the problem would be solved.

Events proved that the solution is not so simple. In many areas of the country the attempt has been made and milk prices have actually been fixed. The Federal Government tried it in its first milk agreements. Certain states are still trying it through the mechanism of state milk control boards. It seems to me that the fundamental weakness of the price fixing formula as a remedy for low income is that income does not depend upon price alone, *but instead upon price times sales volume.* If price is artificially maintained at a level above that which supply and demand will normally sustain, sales volume will inevitably shrink. Indeed, it is a well known elementary economic fact that price can easily be boosted to a point which will actually reduce the total income.

Price fixing brought with it a number of vexing problems. How much of the total price should be retained by the distributor, how much given to the producer? Again, since even fixed prices must be different in different sales areas because of the differences in cost, how shall sales areas be defined? What about the constitutionality of saying to an individual: "You may not sell your milk below a certain price," or even: "You may not give away your milk?"

And so the Federal Government long ago wisely abandoned resale price fixing in its milk agreements. It has contented itself with payment schedules between distributors and producers, which do not really represent price fixing at all, but merely a plan for promoting equal treatment to all producers supplying a given area.

The next solution which was considered in the attempt of the industry to save itself from its plight was curtailment of production. Since this plan has been less seriously contemplated in the case of milk than in the case of cotton, tobacco, etc., discussion of it will be limited. Whether curtailment of production will be successful even in the case of cotton and tobacco is still not certain. In order really to increase the income of the farmer, curtailment of production of any commodity must result in an increase in price so great as to neutralize a possible simultaneous decrease in demand or must permit the farmer to apply his released acreage to other crops, if any, which will be more profitable. Here again, total income must be kept in mind as representing price times volume, not price alone.

At any rate, in the case of milk, one fundamental fact should be considered, namely, that while we may be producing more milk than the consumer is willing to buy at a price pleasing to the farmer, *we are not producing more milk than the consumer should consume.* If we base our figures upon the amount of milk which should preferably be included in the American diet, there is actually a shortage of milk, not a surplus. It is unbelievable that serious consideration should be given to the curtailment of production of a commodity which is so vital an element in the national health.

And so we come to the third proposed solution for the problem of the industry, and the one which is as we shall see intimately related to the previously discussed problem of the consumer. This is that the maximum effort be directed *to promote and increase the consumption of milk*. Here we have a device with which no one will quarrel. The industry certainly will not, and practically all health authorities agree that optimum consumption of milk and milk products is about as important from the public health point of view as is safety.

Now what is the first thing that any manufacturer does to increase consumption or sales volume? Two things:— First, he increases the *desirability* of his product as much as he can, and second, he brings his price down to the lowest possible level consistent with the maintenance of financial security. Note that he does not *increase* price, which is the aim of most price fixing schemes. He holds price down to the lowest possible level.

But in this paper we are primarily concerned with the first of his two measures, namely, that of increasing to the maximum the desirability of the product. How can the desirability of milk as a food be best promoted in the mind of the milk consumer? Obviously, by improving the appearance of the package, the flavor of the contents, and last, but not least, by increasing to the maximum the confidence of the consumer in its safety and quality.

The problem of flavor is largely solved in most instances by the same device which solves the safety problem, namely, proper sanitary production and processing methods. Collateral to these, of course, is the necessity for giving the proper feed at the proper time to avoid feed flavors.

Now how can the industry best increase the confidence of the consumer in the safety of milk? I think the answer is self-evident. It must first actually produce and process the milk in accordance with sanitary methods which will yield the maximum practicable degree of safety. Then, since the consumer will instinctively know that there will be violations of these sanitary requirements by certain producers and distributors, and that not all health officers will remove from the market by permit revocation all milk which is found to violate sanitation requirements, it is necessary to provide the consumer with some mechanism by which he can distinguish the milk supplies which comply with the requirements from those which do not. The simplest device which instantly comes to mind for this purpose is grade labeling.

But if we are really going to solve this problem satisfactorily, we must agree upon a nationally standard grade labeling procedure. It will not be sufficient to have one standard for Chicago and another for Dallas. It will not do to have the highest grade of milk called "standard pasteurized" in Chicago, "grade A pasteurized" in Dallas, "selected pasteurized" in Birmingham, and "inspected pasteurized" in Baltimore. In that way lies a continuation of the present consumer confusion. For the sake of the millions of Americans who travel every year, if not the other millions who remain at home, we must set our shoulders to the task of realizing an actual standardization not only of grade requirements, but also of grade labels, and this brings us immediately to the uniform milk ordinance movement inaugurated in 1923 by the United States Public Health Service. To understand the significance of this it may be well to outline the fundamental principles which should underly such a uniform milk ordinance. They are not complicated.

1 Definition of terms

2 A statement of the farm and pasteurization plant, items of sanitation which must be satisfactory before a milk distributor shall be permitted to use the high grade label which represents quality and safety

3 A statement as to how and how often inspections and analysis shall be made in order to determine whether the items of sanitation listed under (2) are actually being applied by a given producer or distributor

4 A statement of the punishment which shall be applied if any given milk producer or distributor violates any of the requirements of sanitation.

Little need be said about 1. A definition of terms is necessary in any well written ordinance for the sake of economy in language, and in order to avoid misunderstandings and legal snarls in the enforcement of the ordinance.

Item 2 requires some amplification. The safest grade of milk defined in the Public Health Service Milk Ordinance is Grade A Pasteurized Milk. This grade represents milk which complies with all practicable public health and esthetic requirements, that is, it is both properly produced and properly pasteurized. It is as safe as any milk can be made.

It will be noted, however, that the Public Health Service Milk Ordinance defines two other grades of high quality milk, namely, Certified Milk and Grade A Raw Milk. Certified Milk has been defined because historically this grade has been an important factor in the development of milk quality and most health authorities consider it unwise to bar it from sale. Furthermore, since the permissive pasteurization of Certified Milk has recently been approved by the American Association of Medical Milk Commissions, and by the producers, it is important that such an extremely high grade milk supply be encouraged by inclusion in a national standard. Grade A Raw Milk has been included because the sentiment for pasteurization in American cities is still far from universal, and the number of cities which would be willing to pass an ordinance requiring all milk to be either pasteurized or certified would be very small. Furthermore it is considered unwise to attempt to secure universal pasteurization by compulsion. For most cities it is much wiser to attain the desired result by education.

Therefore, Certified Milk and Grade A Raw Milk have been defined in the ordinance as grades of milk which are as *safe as any raw milk can practically be made*. In cities which pass such an ordinance the choice lies with the consumer. There is no compulsion, but the insistent advice of health officers should be that the consumer either purchase Grade A Pasteurized Milk or Certified Pasteurized Milk, or in lieu thereof purchase Certified Raw or Grade A Raw Milk for home pasteurization or boiling.

The last subdivision, 4, also requires some discussion. The measures for punishing violations which immediately come to mind are (a) to stop the violator from selling milk, that is, to revoke his permit, and (b) to penalize him by lowering his standing in the eyes of his consumers, that is, by "degrading" his milk and requiring him to label it with a lower grade label.

Both of these punishment devices are valuable and both have been incorporated in the Public Health Service Milk Ordinance. However, because here, as in the case of pasteurization, there is an honest difference of opinion, the Public Health Service plan provides that a city may adopt either device or both devices. In either event the consumer is protected if the ordinance is strictly enforced. However, the Public Health Service always advises that *both* punishment devices be incorporated in the ordinance, since it is sometimes more difficult to revoke permits than simply to "degrade" the product. Juries and judges have frequently felt that taking away a distributor's right to do business at all because of the violation of what may be only a moderately important item of sanitation, is too severe a punishment, and that warning the consumer by means of a lower grade label is punishment enough.

Of course, if the violation is of a very serious nature, instant permit revocation is justifiable and would probably be supported in the courts. But since for even serious violations "degrading" nearly always secures the desired result without the trouble and expense of court cases, the Public Health Service recommends that both punishment devices be incorporated in the ordinance.

Now if the degrading principle is to be applied, it is necessary that lower grades be defined in the ordinance, otherwise there are no lower grades to which a milk distributor can be degraded. For this reason, the Public Health Service Milk Ordinance defines not only Grade A and Certified milks, but also certain lower grades which are defined according to the nature of the violation involved.

During the past twelve years approximately 600 American communities have adopted the uniform milk ordinance recommended by the United States Public Health Service. They are distributed over approximately thirty of the forty-eight states, although the majority of municipalities are located in the southeastern, south central, southwestern, and northwestern states. The communities range in size from very small towns to the second largest American city, namely, Chicago.

It will be realized, however, that the universal adoption of one uniform ordinance by all American municipalities is still far from realization. There are probably at least 1,500 to 2,000 American municipalities in which milk control would be both practicable and profitable. Many of these still have no milk ordinance of any kind. Others have nonstandard ordinances of varying degrees of excellence from the crudest to the best. A number of cities have ordinances which, though not standard, are excellent in conception and enforcement. The principal argument which can be advanced for the adoption of the Standard Ordinance by these cities is that there is no profit in difference for mere difference sake and that it would be helpful to the general national program for unification if such cities were to lend themselves to it and adopt the standard. Such cooperation would serve as a potent inspiration to all other cities. Of course, if any city actually has a better ordinance than the standard it should make a special report to the Public Health Service Milk Sanitation Advisory Board and present clearly evidence on the points of superiority. If these are established the Advisory Board will, without question, approve the revision of the Standard to embrace the additional points of superiority.

But suppose now that the time has arrived when all American municipalities will have adopted one uniform milk ordinance. Will we then have attained our final objective; that is, will all consumers then be able to purchase milk with entire confidence?

Obviously not, since there is nothing in what has thus far been said which insures *strict enforcement* of the ordinance, or which enables the traveler to differentiate between cities which do enforce the ordinance strictly and those which do not. A city which passes the ordinance but permits all milk distributors to label their milk bottles Grade A irrespective of whether they satisfy all grade A requirements or not, leaves the milk consumer in as bad a dilemma as before.

This brings us to the next and final part of the national plan of milk control recommended by the Public Health Service, namely, the periodic rating of the milk control work of American municipalities by the state boards of health, and the periodic publication by the Public Health Service of the results of these ratings.

Since January, 1934, the Public Health Service has issued semi-annually a list of American municipalities which have been reported by their respective state boards of health as having been awarded ratings of ninety per cent or more, based upon the standard Public Health Service milk sanitation rating method.

A detailed description of this rating method would be too long to permit inclusion in this paper. Suffice it to say that the final rating figures represent the percentages

of compliance in the milk shed in question with the items of sanitation required for Grade A Pasteurized and Grade A Raw milk, respectively. The percentages are weighted both with respect to the relative sanitary importance of the various requirements, and with respect to the volume of milk sold by the respective milk distributors. Hence, if a given municipality receives a rating of ninety per cent or more milk consumers will have good reason to believe that any milk distributor whose milk is labeled Grade A Pasteurized is complying in very large measure with the items of sanitation required for Grade A Pasteurized Milk by the Public Health Service Milk Ordinance.

The following conclusions therefore become immediately apparent:

(a) Every American municipality should exert itself to the utmost to deserve a ninety per cent rating and thus deserve inclusion in the ninety per cent list published by the Public Health Service. It is obvious that such a rating will be facilitated by making legal in a local ordinance the requirements upon which the rating method is based, namely, the Grade A requirements of the Public Health Service Milk Ordinance.

(b) Every milk distributor should demand the early adoption and strict enforcement of the Public Health Service Milk Ordinance in order that his products may attain the consumer prestige which would accompany the inclusion of his city in the federally approved list.

(c) Having secured admission to the approved list a municipality should then organize an educational program which will repeatedly call to the attention of every milk consumer in the city the food value and the safety of milk. The milk distributors could well afford, either individually or as a group, to distribute to all milk consumers such articles as "What Every Person Should Know About Milk," which appeared in Public Health

Reports in December, 1934, and is now available in reprint form at a price of $5.00 per thousand. Many other articles can also be secured from other sources.

If now we redirect our attention to the first part of this paper it will be evident that the national milk control program recommended by the Public Health Service offers a solution not only for the problem confronting the milk consumer, namely, his present uncertainty in most areas as to when he is receiving and when not receiving an approved milk supply, but also offers the most sensible and practicable solution of the problem of the milk industry, namely, its present inability to dispose of enough of its product at a sufficiently attractive price.

Here we have a method by means of which not only the "stay-at-homes," but also travelers may by reference to the Public Health Service list of approved cities buy milk with confidence, and a method by means of which the prestige of milk in the eyes of the consumer can be so enhanced as to result in a material increase in the demand for it and consequently an increase in the prosperity of the milk industry.

There are only three factors which can imperil the full success of the program, namely, poverty, lethargy, and deliberate opposition. It is impossible to believe that poverty can be a real factor. The entire cost of converting low grade into high grade milk will on the average amount to less than one cent per quart of milk. What makes the other two factors possible is the voluntary, democratic nature of the plan. There is no compulsion, no dictatorship about it. The precise nature of the plan is subject to frequent revision on the part of a representative, technical body, the Public Health Service Milk Sanitation Advisory Board. The adoption of the plan is subject to the will of each individual locality. This is essentially the principle of the American form of government. We have here, therefore, one test of the soundness of that form. I am quite certain the test will confirm its soundness. To make it doubly certain every member of the industry and every city official who evinces either lethargy or deliberate, nonconstructive opposition should be held strictly to account. Those who are merely lethargic should receive short shrift, and those who deliberately oppose the plan should give convincing and defensible reasons for their opposition. If these two factors, lethargy and deliberate opposition, are not permitted to imperil the plan, this country will be able to make the proud claim that it has succeeded in safeguarding by means of a uniform, nationwide, but nevertheless democratic and voluntary plan its most important foodstuff, and that in so doing it has also promoted the economic welfare of the industry which produces and distributes it.

Discussion

J. R. Jennings

Chief, Division of Milk Control
City Health Department, Louisville, Kentucky

In the discussion of this paper there are two paramount questions which seem to merit special emphasis. The first has to do with matters of enforcement and the other relates to factors which imperil the success of the program.

In the enforcement of the public health service program provision is made for penalizing the violation by (a) the revocation of the permit and (b) the lowering of the grade of the milk or "degrading" the product. Several years of enforcement work indicates definitely to me that the permit revocation principle should and can be used satisfactorily only in *extreme* cases. In all routine inspection work the "degrading" principle should most definitely be used. The violations that occur in routine inspection do not warrant the revocation of the permit. Yet, if the lower grades are not provided so that the distributor's grade may be lowered there is nothing left for the health officer to do but revoke the permit—or ignore the violation and permit the distributor to use the grade "A" label on lower grade milk. In most cases it would be impossible to revoke the permits of the big companies in our larger cities. Along with a number of other reasons the courts would not permit it, because it is not reasonable and just. However, the courts will sustain the lowering of the grade, thus, sustaining the enforcement of the ordinance.

The public health service milk ordinance requires that at least one inspection per grading period be made. Our experience indicates that no municipality will ever be able to enjoy an approved milk supply with as little as one inspection per grading period. A tabulation of our records shows, when making farm inspections monthly that no violations have been found on ten per cent of our farms in the period from May 1, 1934 to August 25, 1935, while two or less violations have been found on thirty per cent of our farms. In other words 70 per cent of our milk producers were found to be violating sanitary features of the ordinance on more than two inspections. During the same period, of our 1,100 producers, 197 have had their grades lowered once because of violating sanitary items on the farm, fifty-one have had their grades lowered twice, fourteen have been lowered three times and one four times. For excessive bacterial counts in the same interval 305 have had their grades lowered once, ninety-seven twice, twenty, three times and two, four times. The grading period ending between two farm inspections saved 200 farms from having their grade lowered. This indicates, clearly, that frequent farm inspection is necessary if a satisfactory milk supply is maintained. It also appears that producers of poor milk need help more than punishment and this calls for frequent inspections.

In considering the factors which imperil the success of this program we are reminded in the July 26 issue of "Public Health Reports" that only approximately 13½ per cent of the 600 American municipalities having the public health service milk ordinances have a rating of 90 per cent or better. What is the reason? Certainly it is not the ordinance itself. In some of the cities no rating was made in the past two years. Some state health authorities do not know how to make a rating according to public health service standards.

The factors mentioned by Mr. Frank are important, of course, but there is one factor abating progress that this Association should deal with definitely and firmly. I refer to the custom of paying political debts with public health positions. The lack of confidence in the health department causes numerous difficulties in the adoption and enforcement of an ordinance. In many cases the milk industry would welcome and support such a program as the public health service milk ordinance were it not for the fear, and justly so, that the positions it creates would be filled with incompetent "ward heelers." Legitimate industry has opposed milk control programs because it is unwilling to place its investment at the mercy of politicians and the spoils system.

Whatever the factors that imperil the full success of this program it is the duty of us as public health officials to work for the consummation of a uniform program. The lack of a unified effort on a uniform program is our greatest peril to progress.

Mr. S. V. Layson: I want to thank your organization for the invitation to discuss this matter. It has taken a long time to break the ice in Illinois, but now that Chicago has taken the lead it looks like a number of cities in the state will adopt the ordinance in the near future.

Mr. Frank has not said a thing that I can question nor made a statement with which I can disagree. I wish, though, he had given us more data on the economic side of milk quality improvement work. By that I mean before and after consumption figures and before and after cost of milk to the consumer. Perhaps it is not possible to obtain data on that phase. However, I believe it would be a great help to those engaged in milk quality improvement work as exemplified by the Standard Ordinance if it could be shown in dollars and cents whereby it would repay the producer and distributor to improve the quality. With such figures, provided they were favorable, and I feel sure they would be, it would be much easier to convince city councils and others concerned that it would be very practical from a purely selfish financial standpoint to adopt and enforce the Standard Ordinance.

Mr. Frank has said that we do not produce as much as we should consume. I believe more of it would be consumed if it were of a quality such as it would be if all milk was produced and handled as specified in the requirements of the Standard Ordinance. I am partial to milk as a beverage. I often meet people, however, who have a dislike for it. Upon inquiry it usually is shown that the dislike was engendered at some time in life by having been forced to use milk of a very bad quality or in the case of farm-reared individuals of having seen milk produced and handled under very insanitary conditions. These people offer considerable sales-resistance to milk and, what is worse, children being the mimics that they are, the parents set a very bad example. It is the job of the health officer, of the milk control officials, the milk producer and the milk distributor to re-sell those people on the inherent goodness and food value of milk, but first they must have a quality product to sell. Someone has said that milk receives more free publicity than any other single food product. This should not be difficult to prove because practically every national magazine which carries food advertising will have one or more space users who mention or feature milk in connection with their own product. The mention of "Grade A" milk is becoming more frequent in such publicity. To those national advertisers "Grade A Milk" means something more than just "milk." They know they are in the best company when they mention "Grade A Milk" along with whatever food product they may be featuring. I would like to go on record as being in favor of anything that will unify the milk control system of the country, and I am particularly interested in the state of Illinois, of course.

Chairman Johns: Mr. Layson, I would like you to accept our thanks for having come here to discuss this paper. Dr. Frank's paper is now open for general discussion from the floor.

Mr. Fowler: I do not like to inject any dissenting note into this discussion, but I should like to ask Mr. Frank what, he thinks, are the reasons why the standard ordinance program has gone so well in the southern, southwestern and northwestern states and whether those regions have any significance with respect to the ultimate adoption of that program in the band of states running along the northern part of our country. I should like to ask also whether he thinks that the degrading feature recommended, or a part of it, can be successfully used in a rural health district where the matter of competition is of less importance.

Mr. W. B. Palmer: I was interested in reading the United States Public Health Service reports for July 26, 1935 in which the ratings for the municipalities operating under the standard milk ordinance were listed. Mr. Frank has referred to the rating system in his paper. Briefly, the report states: . . . the cities which are enforcing the Public Health Service Milk Ordinance and which have none-the-less failed to achieve ratings of ninety per cent or over should determine whether their failure is due to not bringing their ordinance up-to-date. The ratings on which the table is based applies only to market milk. The inclusion of a city in this list means the pasteurized milk sold in the city, if any, is of such a degree of excellence that the average percentage of compliance to the various items of sanitation required for grade A pasteurized milk is ninety per cent or more. That, similarly, the raw milk sold in the city is of such a degree of excellence . . . the percentage of compliance of the various items of sanitation required for graded raw milk is ninety per cent or more. However, high grade pasteurized milk is safer than high grade raw milk because of the added protection of pasteurization. To secure this added protection for high grade raw milk, dairies need not discontinue their patronage, for milk can be pasteurized at home—"place the milk in an aluminum vessel by a hot flame and heat to 150 degrees Fahrenheit, stirring constantly. Then immediately set the vessel in cold water and constantly stir until cool."

The reason that I read that is because it emphasizes the fact that high grade pasteurized milk is safer than high grade raw milk, and that those persons who can not secure the pasteurized milk, or those who desire to continue patronage with a raw milk dealer may pasteurize the milk at home after purchase.

It seems to me that under the program of the United States Public Health Service, and the programs of the various states and municipalities and health departments throughout the country, in urging the adoption of pasteurization requirements that this method of rating cities does not encourage such a program.

An analysis of these rated cities shows that out of a total of fifty-five, fourteen had no pasteurized milk; ten had twenty-five per cent; thirteen had between twenty-six and fifty per cent; and eleven had between fifty-one and seventy-five per cent; and seven had between seventy-six and one-hundred per cent.

That system of rating gives absolutely no credit to a municipality for obtaining pasteurization of its milk supply. That rating system is just the opposite to that employed by the American Public Health Association, which is a method in which the rating is scored on points for various items of sanitation, and percentages are given on the amount of milk produced by cows which are tuberculin tested.

So it would seem to me that if the United States Public Health Service is going to encourage pasteurization that there should be at least some deduction made in those municipalities where there is no pasteurized milk or there is as little as fifty per cent pasteurized. That can be worked out on a sliding scale in percentages, but they certainly should be penalized in some way for not carrying out the progressive public health measure. Attention is directed to the fact that the organized medical profession endorses pasteurization and there is now on the market Certified Milk—Pasteurized.

Dr. Brooks: I probably should keep still, but this is a matter in which I am very much interested. Mr. Frank and I have had a good many friendly discussions but we are absolutely agreed on one thing and that is the desirability of having uniform standard grades of milk, providing we can get together on what they should be—and how many. But, carrying Mr. Palmer's point a little further, I would like to point out what seems to me to be a distinct inconsistency in Mr. Frank's argument. He bases his argument for a planned milk control on the desirability of establishing the confidence of the consumers, setting up grades which they can accept with confidence as being safe and then he includes Grade A Raw.

The requirements for the standard ordinance Grade A Raw are practically identical, as I recall, with those for our New York State Grade A Raw, and the inconsistency lies in the fact that we know—at least, we know in New York State—and I think Leslie Frank agrees, that is not a safe grade of milk. It is responsible for most of our numerous milk-borne outbreaks in New York State and it comes from herds that are not required to be free from abortion. It seems to me that if we do anything to create the impression that that is a grade of milk that people can use with confidence, and people will feel it is safe, we may be boosting the sale of milk but we will definitely be misleading the consumer.

Chairman Johns: Gentlemen, we have heard considerable pros and cons in the discussion of Mr. Frank's paper, and as the time is getting along I think perhaps we had better call upon Mr. Frank to sum up the discussion.

Mr. Frank: With reference first to Mr. Layson's discussion, it is very difficult to determine the increase in milk consumption which is truly the result of increased standards, because consumption fluctuates so much with price, and is so much affected by depressions such as the recent one.

I am inclined to believe that we will just have to take for granted, without trying to prove it, that if you increase the desirability of a product you will at the same time tend to increase the consumption of that product.

Mr. Fowler asked why the ordinance has been adopted most frequently in the southeast, southwest, and northwest. I am not sure that I know. The work started in the southeast and this probably accounts for its popularity there. Undoubtedly, there then followed a natural radial advance. Adoption is, as you see, gradually creeping north, and has now reached Chicago, but I do not know all of the factors which may be involved in the progress of adoption.

With reference to his second question, two economic factors, among others, are involved in milk control: The financial condition of the industry and atmospheric temperature. In the south, where adoption has been most rapid, the farmers are in general not so prosperous as in the north, and the temperature is certainly higher, thus requiring more ice. So I can not believe that this is the proper explanation of why adoption has been more rapid in the south than in the north.

And then he asked another question—Can the degrading feature be successfully used in a rural district where competition is of less importance? Milk ordinances are practically never used except in communities at least large enough to have a dairy industry. The Standard Milk Ordinance has been adopted on a county-wide basis, however, in many areas. In such areas the county health department inspector has to supervise the sanitation of milk supplies in a great many small communities.

Mr. Fowler: I have in mind towns and villages ranging in size from 4500 down to 1500.

Mr. Frank: There are many examples of such communities in which the ordinance has been successfully applied.

Mr. Fowler: I am interested in that.

Mr. Frank: Next the feeling was expressed that the percentage of pasteurization should enter into the rating given a city. We initially thought so too and in computing the earlier ratings incorporated in them the percentage of pasteurization. We found, however, that the health officers of many of the smaller communities in which the percentage of milk pasteurized is still less than 50 per cent, objected that they were not primarily responsible for the percentage of pasteurization since it was impossible despite their best efforts to have passed a compulsory pasteurization ordinance; and that the proposed rating system incorporating the percentage of pasteurization gave insufficient encouragement for the improvement of raw milk in such towns.

Another consideration was that an important use of any rating list is to enable residents and travelers to know whether, in a given community, milk can be bought with confidence. Obviously we could not limit the rating list to communities in which all milk was Grade A Pasteurized, namely, to communities in which customers could buy blindly any milk offered for sale. That would be ideal, of course, but not practical. There would be too few towns on the list. Therefore we decided that the best plan would be to include all communities in which the pasteurized milk was practically equivalent to Grade A Pasteurized, as shown by a 90 per cent compliance rating, and in which the raw milk sold to final consumers was at least properly produced, as shown by a 90 per cent compliance rating; and in the explanatory material accompanying the list recommend that all raw milk should be pasteurized or boiled before it was consumed.

There may be some question as to why there should be included any community in which all milk is properly produced but in which no milk is pasteurized. Our reason for including such communities is that there are still unbelievably many people who have not yet been convinced by the arguments of health authorities that pasteurization of all milk is advisable, and who deliberately seek out raw milk. Now if this is inevitable for some time to come, it seemed to us that a broad public health statesmanship demanded that we at least protect these people so far as they could be protected by listing for them the communities in which raw milk was safeguarded at least as far as the Grade A Raw milk standards permit.

This was the course of our reasoning which underlies the present rating system. That system is subject to change, however, and if the majority of the members of our Milk Sanitation Advisory Board, upon which six of the state boards of health are represented, can be convinced that a change should be made in the rating method, I am sure the change will be made.

STUDIES WITH A "DIFFERENT METHOD" OF APPRAISING STANDARD PLATE COUNTS

C. SIDNEY LEETE, B.S.

Associate Milk Sanitarian, Bureau of Milk Sanitation, New York State Department of Health

AS A result of criticisms of the arithmetic average and logarithmic average methods of appraising the value of a series of standard plate counts when used in determining grades of milk, degrading and in revoking milk permits, a study was made of the application of these two methods to 1912 standard plate counts, together with the application of a method which it is believed may prove to be more satisfactory. The latter method consists of determining the number of standard plate counts which are within a grade and also those above the maximum count allowed for the grade of milk by ordinance. In principle, this method is similar to the method adopted by the United States Public Health Service in determining the bacteriological quality of drinking water. That method is based upon the percentage of samples in a series which do or do not contain organisms of the *B. coli* group. You are all more or less familiar with this standard.

When applied to this study the method may be described as follows: If three out of a series of four consecutive standard plate counts are within a grade (or comply with sanitary or milk code requirements) no official action should be taken relative to degrading that supply or revoking the permit of such dealer. In other words if "three out of four" counts in a series comply with the Code the supply is officially satisfactory. For want of a better name, this method will be referred to hereafter as the three out of four method. Possibly the term "percentage compliance" would be more accurate in designating this method.

Four consecutive counts comprise a "series" in this study. This number was chosen as a matter of convenience and is not based on any scientific data or mathematical hypothesis. Many milk codes state that four consecutive counts should be used in determining averages—other codes specify three. In this study we are not concerned with the question as to the proper number of counts to be used as a series.

In drawing conclusions relative to the advantages and disadvantages of these three methods of appraising a series of standard plate counts, it is believed that severity, together with fairness both to control officials and to the producer or distributor of the milk, should be considered.

Due to the nature of the standard plate count, we will agree, I believe, that the "count" is not the exact measure of all the bacteria which may be found in one cc. of milk, but the number which develop under certain conditions of food supply, time, temperature, et cetera. Probably due to these conditions which effect growth, variations in counts, even of the same sample do occur. For these reasons we are not justified, as control officials, in interpreting counts as having more significance than is warranted. Certain latitude should be tolerated. Irrespective of this lack of mathematical exactness of standard plate counts, the usefulness of such counts is not questioned. From the standpoint of the producer it should be remembered that an occasional high count should not be dealt with too harshly. Usually, when such counts occur, there has been a "slip" in methods used. However, in many cases it is accidental even though avoidable.

These facts should be kept in mind when judging the value of any method used in appraising counts.

One thousand nine hundred twelve official standard plate counts made in approved laboratories in New York State were studied. These counts represent samples collected on the street and at the platform by the inspectors of several cities. No attempt has been made to select counts which would prove any particular theory. The counts are "run of the mine" so to speak with the exception that hundreds of series of counts were not included because all of the individual counts in such series were below the maximum of the grade and therefore useless in this study. In determining the number of sets or series of four consecutive counts progressive combinations of these counts have been used. As *example 1*, the first four counts 1,000; 2,000; 7,000; 240,000 comprise a series. The next series is made up of the second, third, fourth and fifth consecutive counts obtained from this supply, namely 2,000; 7,000; 240,000; 220,000. All counts were recorded in the order in which they were made and are official counts. By using this method, there were available 1405 sets of four consecutive standard plate counts.

From a study of these counts in a series it is definitely established that the arithmetic average is the most severe method, that is, this method placed more supplies out of grade than either the logarithmic average or the three out of four method. It is believed, however, that the use of the arithmetic method is unfair both from the standpoints of the official and the dealer. It is too severe. It also requires many low counts to bring down a high average caused by a single high count. It gives little if any consideration to the one who occasionally slips. It appears that there is no logical justification for the use of the arithmetic average as a method for determining compliance or non-compliance with sanitary code regulations insofar as the standard plate count is concerned. Perhaps its widespread adoption is based upon "precedent."

Table 1 presents a summary of the studies of the various methods. A comparison of these methods reveals that the logarithmic average method is the least severe. Of the 304 sets of counts indicating non-compliance, by any one of the three methods, 107 (35 per cent) were so classed by the logarithmic average method, 186 (61 per cent) by the three out of four method and 277 (91 per cent) by the arithmetic method. This relationship holds in general with each of the three grades studied, *i.e.*

Grade A Past. with a maximum count of 30,000
Grade B Past. with a maximum count of 50,000 and
Raw milk entering into Grade A Past. with a maximum count of 100,000.

A discussion of the results obtained by the application of the logarithmic method and the three out of four method to actual cases will be helpful in presenting the case for the three out of four method. The following examples serve to indicate why it is believed that the three out of four method is more reasonable and fair than the arithmetic and logarithmic average methods.

Example 2. The maximum count for this grade is 50,000. The individual counts are 2,000; 7,000; 240,000 and 220,000, the logarithmic average being 30,000. It is seen that by using the logarithmic average method this dealer would not be penalized even though two counts of the series are considerable above the maximum allowed for the grade. This is because there appear in the series two very low counts. In this case the so-called dampening effect of the logarithmic method is effective. This series with 50 per cent of the counts out of grade would be "out" by the three out of four method.

Before continuing with more illustrations it should be stated that the premise upon which this work is based is that any count within the grade is officially satisfactory. Personally we all desire to reach that state in milk control when all counts are low—well below the maximum. But, irrespective of the ideal, I believe, that we must accept as satisfactory any count below the maximum allowed by law. If the maximum is too high, it should be lowered—but that, again is a subject with which we are not dealing at this time. To continue with *example 3*. The maximum count for this grade is 50,000. The individual counts are 5,000; 180,000; 6,000; 1,000,000. The logarithmic average being 49,000. This is a striking example of the difference in effect of the two methods. Every other count is low—6000 or below, one of the high counts is 1,000,000. The three out of four method indicates official action should be taken. By applying the logarithmic average method this supply is satisfactory, with 50 per cent of the counts out of grade.

The series of standard plate counts obtained from the supply of Dealer A is another example of the difference in severity and fairness between the two methods.

Example 4. The maximum count for this grade is 30,000. The individual counts are

190,000; 13,000; 6,000; 37,000; 110,000; 14,000; 12,000; 5,000; 66,000; 54,000; 5,000; 120,000; 65,000; 10,000; 6,000; 8,000; 84,000; 8,000; 7,000; 14,000;

There are twenty counts comprising seventeen series of four counts each. The application of the logarithmic average throws two series out of grade, even though of the twenty counts, eight are above the maximum for the grade. This producer apparently is not one who produces Grade A Raw milk consistently. Under the three out of four method, ten of the 17 series would be "out."

An interesting example occurred with Dealer B.

Example 5. The maximum count for this grade is 30,000. The individual counts are 100,000; 50,000; 2,000;

31,000. Logarithmic average 24,000. Three standard plate counts are above the maximum. One of these was a border line count and the fourth count, within the grade, was low. This supply was "out" under the three out of four method and "in" under the logarithmic average method. It is believed that if three out of four counts or 75 per cent of the counts are above the maximum and but one count is in compliance that that supply should be "out."

The effect upon a series, of a count within a grade but somewhat higher than another low count within the same grade which it has replaced is illustrated in the following example.

Example 6. The maximum count for this grade is 30,000. The individual counts are

(a) 1300; 62,000; 35,000; 51,000; Log. average 22,000
(b) 62,000; 35,000; 51,000; 13,000. Log. average 35,000.

Series 6-a is officially satisfactory when the logarithmic average is used, although three counts are above the maximum. The next count from this same supply was 13,000, well under the grade limit. However, series 6-b by the addition of this satisfactory count under the logarithmic method is out. There seems little if any justification or logic in treating these two series differently. By using the three out of four method series A and B are both out—both treated the same.

A similar series of counts was observed with Dealer B—the counts were as follows:

Example 7. The maximum count for this grade is 100,000. The individual counts are—

(a) 3,000; 18,000; 310,000; 1,400,000. Log. average 70,000.
(b) 18,000; 310,000; 1,400,000; 28,000. Log. average 130,000.

The substitution of a count of 28,000 (max. for grade 100,000) in Series B for the count of 3,000 in Series A requires that the series be treated differently under the logarithmic average. Both series are treated the same with the three out of four method. It seems unfair that a producer be penalized or degraded when the addition of a count to a series is well within the grade. It is believed that when a count which is within the grade is added to a series and that the series has previously been within the grade such addition of a legal count should not be cause for degrading or revocation of permit.

The next *illustration 8.* The maximum count for this grade is 30,000. The individual counts are—

220,000; 165,000; 30,000; 1000. Log. average 32,000
165,000; 30,000; 1000; 40,000. Log. average 21,000

showing that the addition of a count which is out of grade may place a series which was also out of grade back into its former grade, when the logarithmic average is applied. Again it does not seem logical nor reasonable that a supply which has been declared unsatisfactory or out of grade should be accepted as satisfactory or returned to its former grade by the addition to the series of a count which shows that the supply is still not within the grade. In other words, when the logarithmic average method is applied to this particular supply a continued violation of bacterial requirements restores the dealer to good standing. When the three out of four method is applied the dealer would be obliged to meet bacterial requirements before his supply would be restored to grade or accepted. Under this method a dealer can not continue to produce or sell milk with a count out of grade and be restored to good standing at the same time.

Examples 9, 10 and *11* illustrate how one high count will throw a series "out" under the logarithmic average method. The maximum count for this grade is 30,000. The individual counts are—

(9)	8,000;	29,000;	1,600,000;	4,000.	Log. average 36,000
(10)	19,000;	350,000;	11,000;	21,000.	Log. average 36,000
(11)	19,000;	16,000;	16,000;	650,000.	Log. average 43,000

All of these series are satisfactory if the three out of four method is used. These show that under certain conditions the logarithmic average method is more severe than the three out of four method. Whether or not such severity is justified is a matter of opinion. Perhaps the dealers or producers slipped once—without knowing it, perhaps the laboratory made a slip. The reason for such counts probably was due to an accident—although it was avoidable. Under these conditions it is believed latitude should be given. The three out of four method gives that latitude.

An extreme example, yet an actual one of the "dampening" effect of logarithmic averages upon counts is illustrated in—

Example 12. The maximum count for this grade is 30,000. The individual counts are 70,000; 50,000; 65,000; 1,000. Logarithmic average 22,000. The extreme low count of 1,000 is responsible for this series being within grade. From practical control it does not seem logical for this supply to be classed in the same grade as one which shows four counts or even three counts of 30,000 or less.

These illustrations point out quite clearly some of the reasons why it is believed that the logarithmic average method is not as fair as the three out of four method in appraising a milk supply. The three out of four method is much simpler in its application. No "mathematical skill" is needed in arriving at the proper decision regarding a series of counts.

There is one more phase of this study which must necessarily be considered. How do these two methods compare in severity and fairness in allowing a supply to resume its former grade, after degrading or revocation of permit. In the series studied in all but unusual cases it was possible for a series which was out of grade to be restored to grade by the addition of one low count to the series when the logarithmic average method was applied. However, due to the almost innumerable combinations of successive counts no definite statement can be made as to how many counts one, two or three would be required before a revision upward could be made. It is true though, that in some instances even though a count was secured which was above the maximum for the grade —the series would be officially satisfactory. If this count above the grade was considerably lower than the count which it displaced, the series would be acceptable. It is believed that any count over the maximum of the grade, should not be responsible for bringing that series within the grade.

However, in most cases a supply which is unsatisfactory as determined by the logarithmic average method, may be made satisfactory by a successful effort on the part of the dairyman in producing milk of an extremely low standard plate count.

When the three out of four method is applied the dairyman under the same conditions as just stated, must produce milk within the grade for a definite period or a definite number of times. In every case the milk must have a count within the grade.

When a supply is out because of repeated high counts, this supply, under the three out of four method can only be restored to grade when several successive counts within the grade are obtained. In other words that supply which is penalized because of repeated high counts may not be restored because the next count is low. Rather the producer or dealer must show he is capable of producing a supply which is satisfactory over a period of time, as judged by continuous compliance with bacterial requirements.

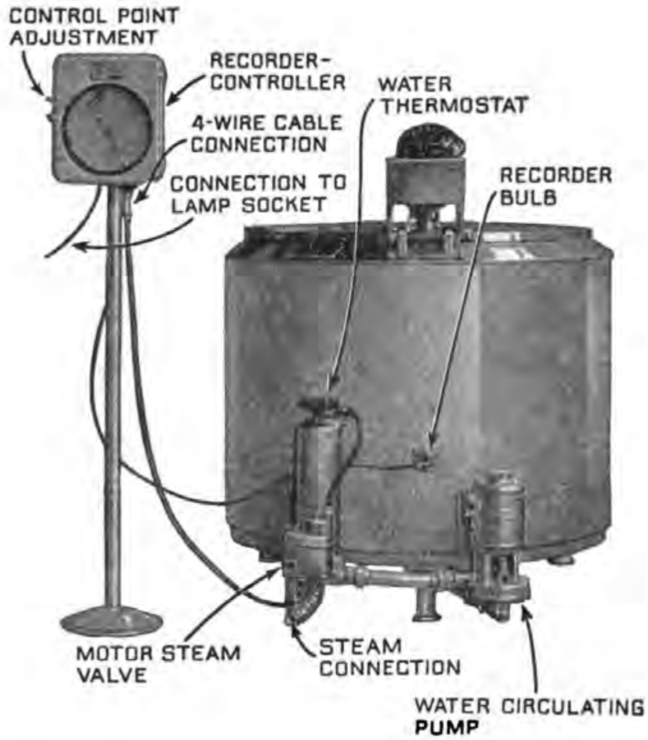
A study of all the series (1405) indicates that usually the application of the three out of four method takes cognizance of a poor supply sooner than the logarithmic average method—and that more time is needed to get a degraded supply back into grade, or to restore a permit after revocation.

Of the three methods of appraising a series of standard plate counts, the so-called three out of four method is simpler in its application, fairer to officials and dairymen, more severe than the logarithmic average method, and less so than the arithmetic method when applied to degrading a supply or revocation of permit and is in some cases more severe than either of the other methods in restoring a supply to its former grade. The three out of four method is open to the same criticisms that apply to other methods when border line counts are found.

This method moderates and in some cases entirely eliminates some of the inconsistencies of the logarithmic average and arithmetic average methods. It virtually admits that almost 25 per cent of the milk may be over ordinance standards and still be acceptable. However, the logarithmic average and arithmetic average methods in practice, accept as satisfactory a still greater percentage of milk with counts above grade. The application of this method to a series of standard plate counts secured for the purpose of milk control, will give, I believe a truer picture of what we are after than either the arithmetic or logarithmic average method.

The three out of four method is adaptable for milk control administration and can be recommended to health officers or other officials charged with milk control where either the grading and degrading system or the permit and revocation system is employed.

Precision Pasteurization



—the answer to the small dealer's problem!

For the small dealer, pasteurization has always been a problem due to his dependency on human accuracy. That is why CP pioneered Auto-Pasteurizer Control and brought Precision Pasteurization within the reach of all dairies, large or small.

Model B Film-Heat Pasteurizers equipped with Circulating Pump and exclusive CP Auto-Pasteurizer Control eliminate the "human factor." Operator simply sets the thermostat for desired pasteurizing temperature; heating and holding are automatically controlled without further attention.

Get ALL the facts—Send for Bulletin B-463

THE CREAMERY PACKAGE MFG. COMPANY

General Office: 1243 W. Washington Blvd., Chicago

SALES BRANCHES IN PRINCIPAL CITIES

"When Writing Mention This Report"

Table 1

SUMMARY OF VARIOUS METHODS FOR DETERMINING COMPLIANCE OF A SERIES OF STANDARD PLATE COUNTS WITH SANITARY CODE REQUIREMENTS. FIGURES IN PARENTHESES REPRESENT PER CENT OF TOTAL SERIES INVOLVED

	Total	*Maximum S.P.C.*[1] *of grade*		
		30,000	50,000	100,000
Number of S.P.C.[1]	1912	1254	458	200
Number of sets of 4 consecutive S.P.C.	1405	922	341	143
Number of sets "out" by any method	304(21)	244(26)	23(7)	37(26)
By Arithmetic method	277(91)	224(91)	19(83)	34(92)
By Arithmetic method only	101(33)	77(31)	7(30)	17(46)
By "Three out of Four" method[2]	186(61)	150(67)	16(70)	20(59)
By "Three out of Four" method only	26(9)	19(8)	4(17)	3(8)
By "Logarithmic method"	107(35)	95(42)	4(17)	8(22)
By "Logarithmic method" only	0	0	0	0
By Arithmetic and "three out of four" methods	69(22)	52(21)	8(34)	9(24)
By Arithmetic and Logarithmic methods	15(5)	15(6)	0	0
By Logarithmic and "three out of four" methods	0	0	0	0
By all 3 methods	95(31)	83(34)	4(17)	8(22)

[1] S.P.C.=Standard Plate Count.
[2] Three out of four method=If three out of four S.P.C. in a series of four consecutive S.P.C. are as low as or less than the maximum S.P.C. for the grade the series is considered satisfactory.

Discussion

Chairman Johns: I am sure we have to thank Mr. Leete for his very valuable contribution to the whole question of the appraising of bacteriological counts. Those of us who have been wearing out logarithmic tables will be particularly interested in a method which appears to give a fair and satisfactory index of the general quality of a given milk supply. I will now call upon Mr. V. M. Ehlers to open the discussion on this paper.

Mr. Ehlers: Since Mr. Pearl assembled most of the material upon which this data is based, I think it fair to have him present it.

E. H. Pearl, (District Sanitary Engineer, State Department of Health, Austin, Texas): I would like to preface the written discusssion with some remarks that were brought out in discussion with Mr. Leete in the early part of the afternoon. We find that we agree in general on all arguments. We with Mr. Leete in his and he with us in ours. However, the premises upon which most of the argument is based are different. We hold that the maximum count stated is an average rather than a limiting maximum. Further, that the principal arguments in favor of the logarithmic average are that it gives proper credit to a low count and a not excessive penalty to a high count.

I will continue with the reading of the paper.

In searching for a method of evaluating plate counts, our primary concern is to find one that will be fair to consumers, milk handlers, and dairymen and that will more nearly accurately portray the milk supply. In considering the relative fairness of the various methods it is first necessary to consider the standard that has been set and then the method by which this standard may be more closely reached.

We agree with Mr. Leete that "we are not justified, as control officials, in interpreting counts as having more significance than is warranted. Certain latitude should be tolerated." We believe that those men formulating the Standard Milk Ordinance had this same thought in mind and that as stated in the code the standard set for plate counts is an average value. It is not the intent of the code that a limiting value be placed on the plate count above which no test would be acceptable but rather that a value limiting the average of a number of counts be set. It seems to us that the three out of four method tends to set up such an arbitrary limit and that of the two methods only the logarithmic average is truly an average, and as such presents a better picture of the quality of the milk.

This arbitrary limiting value set by the three out of four method may be more easily realized when we consider that by this method every plate count must stand on its own feet. No credit is given for a low count. A count of 49,000 is as acceptable and given the same weight as a count of 2,000 just so it is within the grade. With the three out of four method a series may run consistently high with three values just below the limit and the fourth as high as you please and yet be in grade.

The following hypothetical series shows the extreme possible:
Maximum—50,000

49,000; 49,000; 49,000; 1,000,000

This series is in by the three out of four method yet by the logarithmic average method any fourth count above 54,000 would throw it out.

If we consider a similar series with a grade maximum of 30,000

29,000; 29,000; 29,000; 500,000

We see again that this series would be in by the three out of four method but by the logarithmic average any value for the fourth count above 35,000 would throw the series out of grade.

The extreme examples given show graphically what we mean by setting a limiting value. The three out of four method means that three out of four counts must be below a given value, 25 per cent of all counts may be high without limit.

The three out of four method gives no credit for real low counts as shown in Mr. Leete's example (2) and (3). This is also illustrated in the following series—Maximum 50,000:

5,000; 75,000; 7,000; 90,000; Log 22,000

3,000; 51,000; 5,000; 55,000; Log 15,000

While two counts of each of the above series are very low and none very high the grade would be out by the three out of four method. The same applies to Mr. Leete's example (4) listing twenty counts. While eight are above the maximum, twelve are below, and of the eight above, only one exceeds 120,000 and six are not much above the maximum. The twelve below the required maximum are very low. It seems that a true picture of this series would be more accurately portrayed by the logarithmic average method.

Inconsistencies pointed out by Mr. Leete in example (6), satisfactory count throws series out, and in example (8), unsatisfactory count restores grade appear only as such when one considers the maximum for the grade as a limiting value rather than as an average. Whereas in the three out of four method each additional count may be considered individually, in an averaging method it is necessary that all counts to be averaged be considered collectively.

Although the code states that the last four counts in a series shall be used in grading, in practice at least as far as Texas is concerned in regrading, an additional series of four counts is used rather than the series formed by the last three counts of the existing series and one additional count. In other words Mr. Leete's arguments based on examples indicating the effect of one additional count on a series would have no particular significance in regrading of supplies as far as practice in Texas is concerned.

The logarithmic average method is sometimes criticized because it is not a "true average" or what we think of in ordinary terms as an average. On the contrary the logarithmic average method portrays a truer picture of the count series in that it gives to each count a proportionate value. The logarithmic average gives a reward for low counts and a not excessive penalty for occasional high counts, which we believe is as it should be for the one indicates extreme care in handling and the occasional high count may possibly be the result of a so-called accident or slip.

With reference to the relative severity of the methods, studies were made of a large number of bacterial plate counts secured from the records of Standard Milk Ordinance cities in six states: namely, Alabama, Illinois, Kentucky, Mississippi, Tennessee, and Texas. The total number of groups of four plate counts included in the Studies were 10,678. Following were the findings:

For Grade A Pasteurized Milk 9.5 per cent of the sets of four were found to be above a limit of 30,000 when judged by the logarithmic average method, 14.6 per cent when judged by the three out of four method and 18.1 per cent when judged by the arithmetic average method.

For raw milk to be delivered to pasteurizing plants, 3.2 per cent were found to be above a limit of 200,000 when measured by the logarithmic average method, 10.5 per cent when measured by the three out of four method, and 19.6 per cent when measured by the arithmetic average method.

These studies confirm Mr. Leete's findings, namely that the three out of four method is more severe than the logarithmic method, but not as severe as the arithmetic average method.

Before it would be safe to change over from the logarithmic average method to the three out of four method, however, we must decide whether the three out of four method would be too severe. By using the logarithmic average method for Grade A Pasteurized Milk, the mean frequency with which cause for degrading or permit revocation occurs in Standard Ordinance Cities is 9.5 per cent. As computed from Mr. Leete's figures 10.3 per cent would be the mean frequency of degrading or permit revocation in New York State cities. If the three out of four method were used the mean frequency of degrading or permit revocation in Standard Ordinance cities would be 14.6 per cent, and in New York State cities would be 16.3 per cent. Is this frequency so high that it would lead to lax enforcement? Do we want to degrade or to revoke permits once for every six laboratory findings in the case of Grade A Pasteurized Milk?

All calculations and summaries of plate count data indicate that the three out of four method throws out a greater number of series than the presently used logarithmic average method and therefore is more severe. It follows that the result of adopting a three out of four method would be to raise the present standard inasmuch as a greater number of series would not be acceptable. If this be desirable it might be wiser that rather than change to a three out four method with the present average value of plate count used as a limiting maximum count, that it be replaced by a lower value and the present logarithmic average method retained.

We will admit that the three out of four presents the greatest simplicity of application and the arithmetic average the next simpler method, and that the logarithmic average method from a mathematical standpoint is the most difficult of the three.

However, we do not believe that the logarithmic average method is particularly difficult, at least as far as the inspector or laboratory technician is concerned, and further why it is necessary that the dairyman be more familiar with the plate count averaging than he is, say, with the laboratory procedure in determining plate counts.

After all we must realize that satisfactory bacterial counts is only one of many requirements in the milk ordinance and that its importance should not be stressed any more, if as much, as the necessity of observing proper care in the production and handling of milk. With this in mind it is my opinion that we should not attempt to act hastily in this matter but rather give it the time and study that it justly deserves. After all the fact that over 600 standard ordinance cities are using the logarithmic average method of evaluating plate counts with little or no complaint that we have heard, seems to us the most eloquent argument that we could produce in favor of the method.

Dr. Harding: I think the last two speakers have given an angle on this question that merits careful thought. We have been dealing in this discussion with values running from 2.000 to 40,000 or 50,000 per cubic centimeter and when we want to get something extreme we say a million

There have been some rather careful studies of the relation of numbers of germ life in the milk as delivered, to transformations which are detectable by taste or smell. These have pretty generally come to the conclusion that five or ten million bacteria per cubic centimeter do not do enough damage in milk so that you can detect the effects.

In conjunction with our good friends at the Department of Health in Detroit we made some studies of the relation of the titrable changes in acidity of milk, held at 70° F., to germ life and found that when the milk was delivered to the consumer at a million per cubic centimeter or ten thousand per cubic centimeter, on the basis of plate counts, there was no correlating difference in connection with keeping quality so far as we could discover from a considerable series of bottles of milk. In other words, this whole discussion has to do with numbers of germ life which have no real significance with regard to things in real life that we are interested in as milk inspectors. It is one of those theoretical laboratory considerations which mathematicians like to play with but which really have mighty little relationship to the things that we are supposed to be busy about. I think it is not a very serious matter whether you take the logarithmic method or the four out of five, or the three out of four method of treating the small variations in counts. After all, whichever way it comes out is all right.

Chairman Johns: I see a gentleman in the hall who has studied this question and I would like to call upon Dr. Thornton of the University of Alberta, Canada.

Dr. Thornton: I hesitate to say anything on this question. When the late Dr. Wright and I reopened the question of the application of statistical analyses to plate counts in Philadelphia, in 1926 I think it was, I little realized that we grasped a red hot poker. I have been asked a number of times as to whether in our area we should use the logarithmic average. Due to the fact that it is being used by health departments in the United States, because it is incorporated in the standard code, there is a good deal of misconception and misunderstanding of that particular method of arriving at averages. The assumption among our workers is that the exceptional high count is due to an inaccuracy in the plate count and that the logarithmic average will automatically rectify that mistake. I can not say that I agree with that point of view. I have never seen any conclusive evidence that the odd high count is due to the inaccuracy in the plate count and though I confess that I am not particularly at home in statistical analysis, I have tried it out somewhat. In cooperation with one of the members of our mathematics department who understands something about biology we have attempted a statistical study and have been unable to find that the logarithmic average will automatically rectify a mistake made by the plate count. As a result of any little thought which we have given to the problem, I am of the opinion that we should stay away from the logarithmic average at the present time. I think it is still in a stage of controversy, not in a stage where it should be incorporated in the standard milk code. I confess I must agree with some of the opinions that have been given this afternoon that it is, to a certain extent, a splitting of hairs. There have been a number of methods proposed in the literature. Some of them have been misused. I think the logarithmic average certainly has been misused in certain research work. That is all that I have to say. Thank you very much.

Chairman Johns: I think you will agree with me that the two gentlemen from Texas certainly have gone into the question very, very thoroughly, and have presented their arguments very effectively in favor of the logarithmic method. The papers are now open for discussion from the floor.

Mr. Jennings: We have long felt that the logarithmic method was not entirely satisfactory. Some months ago we went over a great many of our records and compared the logarithmic method with the three out of four method. We did not go into the matter as thoroughly as our friends from Texas, but as far as we did go, we concluded that the three out of four method was really more satisfactory.

Mr. Frank: The paper by Mr. Leete shows much thought and definitely indicates certain apparent inequalities that result when applying *any* averaging method. It does not seem to me that these apparent inequalities are confined to the logarithmic method of averaging. The studies made by Craig and Ehlers indicate that there are also quite a few apparent inequalities or inconsistencies which result from the application of the three out of four method.

I believe that this whole matter should be given careful study and that we should not jump too quickly either way. Initially I felt in favor of the three out of four method because it was somewhat more severe than the logarithmic average method. However, I have more recently come to believe that we should make sure first that the resultant increase in severity is practical. Furthermore, we should not overemphasize the importance of bacterial counts.

Chairman Johns: Since time is getting along I think we had better call upon Mr. Leete to make his concluding remarks.

Mr. Leete: There is nothing much that I want to say in conclusion, except one statement. In the paper on the discussion there was a statement which said, in effect: "that the logarithmic average is truly an average and as such presents a better picture of the quality of the milk." I do not think any average presents a good picture of the quality of the milk, arithmetic or otherwise. By using averages an extreme low and an extreme high are averaged up and we come to a common level. In those cases I do not believe that the average count is a true picture of the quality of milk. I have no other comments to offer.

EDUCATIONAL WORK AS A FACTOR IN INCREASING THE EXTENT OF PASTEURIZATION

IRA V. HISCOCK

Professor of Public Health, Yale School of Medicine

THE soundness of the objective to increase the use of pasteurized milk is well established. Educational work is probably the most important factor in reaching this objective. This educational work must take several forms, utilize various techniques, and be directed at different groups of the population living under different circumstances.

It is unnecessary in this audience to discuss in detail all of the scientific evidence which has led to the conclusion that pasteurization is the most practical means of securing safe milk on a commercial basis, or even that "All milk consumed should either have been properly pasteurized commercially or should be boiled or pasteurized at home." * It seems appropriate, however, to review briefly the present situation regarding the use of milk by the public.

Milk and its products, butter, cream, cheese, buttermilk, skim milk and ice cream constitute the most important articles used for human food. As a city increases in size, its milk supplies tend to merge more and more until finally thousands of people may be supplied from one plant which received its products from hundreds of farms widely scattered. Even where there is a single dairy, carefully managed, there are possibilities of human carriers or of bovine infections. It is easy to understand

* Committee on Milk, Conference of State and Provincial Health Authorities, 1935.

why milk supplies, unless properly controlled, may be the vehicle of outbreaks of disease, for milk is a natural growing medium for several disease-producing bacteria. It is surprising that more infections do not occur; but the toll of milkborne diseases is significant.* A service is necessary for the control of milk supplies from the source of production to the point of delivery.

Adequate enforcement of sound milk legislation is a basic requirement, but this in itself involves education,—education of producer and distributor, education of employees, and education of inspectors. While police force, or a resort to legal action, may be still necessary to protect the public health in certain instances, such action is rare, and the modern public health administrator relies largely on educational methods. The milk codes and ordinances are educational instruments when properly used. One of the most stimulating factors in the improvement of milk supplies throughout the United States, even in areas where it has not been adopted, is the Standard Milk Ordinance of the United States Public Health Service.

The two essential features to be considered in relation to the milk supply are (a) that production of milk on the farm must be so conducted that the possibility of infection will be reduced to a minimum, and (b) that subsequent pasteurization must be so scientifically applied that any infection which does occur, despite the farm production precautions, will be prevented from reaching the consumer. The meeting of either of these requirements alone is not sufficient, for although pasteurization is the one safeguard, it is not a panacea, and it can not make of unclean milk an ideal food, nor will the most thoroughgoing inspection of the farms prevent the oc-

* The Public Health Relations Service of the American Child Health Association reported forty-four milkborne epidemics, involving 1382 cases and forty-seven deaths in 1934 from data supplied by twenty-one State, Provincial, and Territorial Health Departments. There were forty-one other departments which reported no epidemics for the year. *Child Health Bulletin,* American Child Health Assoc., July, 1935.

casional infection of a raw milk supply with the germs of one of the communicable diseases, or with the germs from diseased udders. Progress in milk control work has been noteworthy since the function of the inspector became recognized as that of an educator rather than a policeman. This requires a higher grade of inspector than was previously considered necessary, one who has been well trained in milk sanitation procedures. Furthermore, the training of plant employees has become an important factor. Special courses for plant operators may be helpful in order to aid in the improvement of the efficiency of pasteurization plants from a public health viewpoint.

In addition to the educational work among employees and inspectors which is associated with the improvement of milk supplies, the major educational problem relates to milk consumption. In general, the per capita milk consumption of the country is lower than minimum standards suggested by nutrition workers. Widespread attention has been given to the problem of adequate feeding of families registered with public and private relief agencies, and it has been recognized that the nutritional needs are best served when adequate amounts of milk are used. That milk is not a luxury, nor even an expensive food, but one which yields a greater return in food essentials for money expended than any other food, needs to be impressed especially upon families of moderate and low economic status. From the standpoint of the public, then, our problem is to give a more complete understanding of (a) the value of an adequate supply of clean, safe milk, and (b) of the necessity of proper care of milk after delivery, in the home, in the school or in the restaurant. Experience indicates that it is desirable to emphasize both the food value and the health value of milk. There is much to be desired in the educational appeals for increased milk consumption if a few cross section studies indicate conditions generally. Personal interviews in some localities have revealed that the outstanding idea registered in the minds of many persons regarding milk drinking is health. At the same time, a large proportion of those who drank one or more glasses of milk daily did so because they said they liked it. Of those drinking little if any milk, the cost was reported as the reason.

The application of scientific knowledge to the preservation of human life contains many dramatic stories. The part played by safe milk as a factor in public health is one of the most interesting. Four basic considerations are necessary in the development of our educational programs. The first task is to define our objective, which in this instance is to increase milk consumption,—more specifically, to increase the consumption of pasteurized milk. The second task is to determine clearly, as Bertrand Brown has so well stated, who the individuals are upon whose mental attitudes and behavior achievement of the proposed objective depends. Once the objective of the health educational effort is defined, it can be pursued only through communicating ideas, images and emotions to individuals upon whose mental attitudes and behavior its attainment depends. There are groups of the population who still use raw milk and for whom the information as to the virtues of pasteurized milk is necessary. There are others who are using inadequate amounts of pasteurized milk for whom the appeals must include the values of milk as a beverage and for health purposes as well as the economy of the product in terms of food value. The formulation and expression of ideas, images and emotional appeals, which will achieve desired objectives with proposed audiences, constitutes a third basic task in the educational process.

During recent years, there has been an enormous increase in the use of pasteurized milk. Frank reports

thirty-five cities in the United States in which all of the milk marketed is pasteurized, sixty-four cities in which all milk, except that of certified grade, is pasteurized. In June, 1935, permissive pasteurization of certified milk was voted into the official Methods and Standards for the Production of Certified Milk at the Joint Annual Conference of the American Association of Medical Milk Commissions and the Certified Milk Producers' Association.

The American Public Health Association, the American Child Health Association, and the Conference of State and Provincial Health Authorities of North America have endorsed pasteurization.

The American Medical Association has a committee on foods. This committee has authorized publication of the following general committee decision entitled "The Pasteurization of Milk":*

Milk is an excellent medium for many dangerous bacteria as well as an excellent food for man. Disease germs may enter the milk directly from an ailing cow, be introduced by insects, or be transferred to the milk by the fingers or mouth-spray of persons having to do with the collection or transportation of milk.

Once in the milk, some of the disease germs may multiply enormously. Extensive epidemics of typhoid, scarlatina, diphtheria, septic sore throat and other diseases are sometimes caused by contamination of milk supplies. Numerous cases of tuberculosis and undulant fever have been caused by raw milk.

Even when great care is used in overseeing the health of the cattle and of the milkers and in maintaining the cleanliness of the dairy, there remain many possibilities of contamination. A milker may become overnight an unwitting carrier of some disease germ in his nose or throat; a typhoid carrier might be unknowingly employed in a most carefully conducted dairy.

Since disease germs are readily destroyed by well established methods of pasteurization, all milk for direct human consumption or for use in ice cream, cheese or other milk products should be pasteurized according to officially approved methods. After pasteurization the milk should be so stored and protected that it will not be contaminated. Liquid pasteurized milk should be retailed in sealed bottles.

* Extract of paper on Pasteurization of Certified Milk, W. W. Bauer, M.D., Bureau of Health and Public Instruction, A.M.A., delivered at the meeting of the American Association of Medical Milk Commissions, Inc., and the Certified Milk Producers' Association, June, 1935.

The pasteurization of milk is a public health measure. The public should demand pastuerized milk for drinking and the use of pasteurized milk in milk products. The dairy trade should universally adopt pasteurization in the interest of public health.

There is no cogent evidence that pasteurized milk is significantly inferior nutritionally to raw milk.

These facts may be utilized in our educational work, but they must be developed in a manner that will appeal to the public and will be understood by the man in the street as well as by those with scientific background.

The fourth basic task in this educational process is to select from the many channels available, the media which can be employed most economically and effectively. The "audiences" above mentioned are chosen because they are composed of individuals upon whose cooperation the achievement of the desired objective depends. Any educational effort must be directed toward individuals, according to their accessibility, through established channels of communication of information. These channels include personal contacts, and use of the press, the radio, exhibits, demonstrations and literature.*

Discussion

Chairman Johns: Professor Hiscock has dealt with a subject with which everybody is concerned and in which everyone concerned with milk control and milk sanitation is interested. The discussion on this paper was to have been opened by Dr. Bundesen of Chicago but, unfortunately, on account of the farmers being on the warpath, Dr. Bundesen is not able to be here. Mrs. Sarah Vance Dugan of Louisville will open the discussion in his place.

Mrs. Sarah Vance Dugan, (Director, Bureau Foods, Drugs and Hotels, State Board of Health, Louisville, Kentucky): I was very much interested in Dr. Hiscock's emphasizing the necessity of educational methods in putting across pasteurization. Mr. Frank also mentioned that in his talk. I know when I started out in Food and Milk Control work in Kentucky, I felt that I would not be accomplishing what I should, in helping the public, unless I absolutely required the pasteurization of milk over the entire state. Within a very few

* Timely suggestions may be obtained from the Public Health Education Section of the American Journal of Public Health, from the National Dairy Council, and from State Departments of Health.

weeks, I realized that that sort of an ideal could not possibly be attained. Even at that, in 1925, in the city of Louisville, which had about 93 per cent of the milk supply pasteurized, both Mr. Frank and I decided that an ordinance, the Public Health Service Ordinance of that date, requiring that all milk except certified be pasteurized, could easily be passed, because of the fact that we had such a large percentage of pasteurized milk in Louisville.

Well, we were wrong, and had to wait for a good bit over six years before we could get over the educational process in Louisville that would permit us even to pass the Standard Milk Ordinance. We almost killed the idea completely in Louisville, because we thought that the educational process had been completed, but it had not even begun. Pasteurization had grown up in Louisville. It was the only way to get any kind of milk delivered from those farms to the doorsteps. It was an expedient way to handle milk so that it would not be absolutely rotten by the time it got to the doorsteps.

Of course, that sort of pasteurization is not our ideal by any manner or means. In 1931 when the Standard Milk Ordinance was passed in Louisville, we then had about 96.5 per cent of pasteurized milk; something like eighteen dairies selling only a few hundred gallons of raw milk, including the certified milk that was sold from one farm.

We did not make any attempt in the ordinance that was passed at that time to require that all the milk be pasteurized, but we did start after the ordinance went into effect in 1932, an educational campaign on the value of milk as a food and also on the importance of pasteurization of milk. We used every device possible throughout an intensive period of about six months. Right in the middle of the depression, with unemployment increasing, with the cost of production going up, the price of milk to the farmer increasing, with the increase of retail price of milk, we did not lose any in our total consumption.

We felt that the amount of money which was spent both by producers and dealers in cooperation, and with the educational campaign directed by the city and state departments of health and the local dairy council, that the money was well spent, in that we held our consumption and consumer buying practically to its original point of 1929.

Since that date, 1931, we have continued our educational campaign. When we passed the ordinance in 1931 we really thought that we could limit and prohibit the sale of raw milk gradually, and we thought we would put a very tricky little section in the ordinance that would prevent any milk plant from getting a permit, that is, if it went into existence after the passage of the ordinance, if that dairy was located outside of the city of Louisville, (that prohibition included not only bottle milk plants and pasteurizing plants but a retail raw dairy under the definition of the ordinance). It was really our idea not to limit the inspection area half as much as it was to eliminate eventually those raw dairies and prevent others from coming into existence. Of course, there would always be somebody to fight a thing of that sort. Undoubtedly, it was definitely illegal as proved in our State Court of Appeals decision.

Just this spring, when I first heard the decision, I was absolutely shocked and felt that really all of our work had been done for naught. I am sure that both our City Health Commissioner and Mr. Jennings felt the same way, that now we were going to have a flock of raw dairies coming in because the court said—they can build them any place they want to, if they can get the milk in grade "A" raw into the city of Louisville. Why the milk could be shipped in from Canada, as far as this legal specification went. Just about that time,—and I believe in using anything that happens to come up to further our purpose, we got a report from the Public Health Service of the epidemics that had occurred during the last year. We made use of that in a letter to physicians signed by the city health officer, calling attention to the dangers from unpasteurized milk. We did not mention in that letter anything about the decision of the court; there had been newspaper notices given to it.

The man who won the case against the city, of course, started with the great idea of using lots and lots of raw milk. Rather fortunately or unfortunately, the city was visited a few months later with an epidemic of infantile paralysis, and the City Health Department used that epidemic to call the attention of the citizens to the necessity of using pasteurized milk in the prevention of disease, and so far, and Mr. Jennings will also agree with these figures, we have had no increase in raw milk in the city of Louisville, that is, in the percentage of the amount of milk sold.

But I do believe that the importance of education along those lines can not be over-emphasized. I might tell just another instance of the use of an epidemic to get across pasteurization, and yet that particular point is not going to be held or consolidated unless we can also put education into that community. Just outside of Louisville, not more than thirty miles, a very small town, less than five thousand population —I do not suppose it is more than twenty-four hundred—had an epidemic of typhoid fever. There were one hundred and sixty cases with fourteen deaths during the months of August and September, all of it practically waterborne. The milk supply of the town was from six raw dairies. There was a receiving plant for one of the largest pasteurizing plants of the city of Louisville in that town, but that plant had not attempted to bring any pastuerized milk in that small town for the reason that it was not equipped for retail selling.

In those six raw dairies during the epidemic, four of them had cases of typhoid. One of them was operated by the police judge, one by the mayor of the town, one by the county judge, and one by a member of the city council. The other two were negligible as far as their political influence was concerned. Through the epidemic a full-time county health unit was sold to that community, and we put in there a temporary health officer and inspector, and the state inspector went out to supervise the milk supply together with the city of Louisville inspectors who had to do with that milk going into Louisville. Together they sold to each one of those dairymen the idea that it was extremely dangerous for them to be selling milk at all, and got them all to agree within about less than a week's time to discontinue the sale of milk, and a local man in the community then was to purchase milk from this same plant that had been having the receiving station, and that man is now buying Grade "A" pasteurized milk and is now delivering all the milk sold in that town, except to those families which have cows, which, of course, is considerable.

About one hundred sixty gallons of pasteurized milk, I believe, or something of that sort, are being sold. That town had never had any pasteurized milk. It was not a week after that happened that we put in a short ordinance—we call it that—which adopts the regulations of the State Department of Health in the grading of milk, and included the requirement that no milk could be sold except pasteurized milk. That was the way we recommended it. Well, we did not even get it passed before the health officer came to us and asked if I did not think it was a good thing to allow the sale of grade "A" raw milk. Even, in the face of the epidemic, he was making that suggestion!

We finally compromised because we felt ourselves that the educational program had not been sufficient and allowed grade "A" raw milk to be sold only at the discretion of the County Board of Health and not before a period of three months after the epidemic is over, and at that time, we feel most of them would be out of the notion of producing or selling grade "A" raw milk. I thank you very much.

Russell W. Cunliffe: At the time Sarah Vance Dugan, of the Executive Committee of the Association of Dairy, Food and Drug Officials, requested that this discussion of Dr. Hiscock's paper be undertaken, it was suggested that a brief outline of the history of milk pasteurization in Milwaukee might be of interest. A preliminary copy of Dr. Hiscock's paper not having been received for study it is concluded that my remarks be confined to that experience and an endeavor to ascertain to what extent education played a part.

In 1879 Dr. O. W. Wight, commissioner of health, inaugurated Milwaukee's first milk inspection program by personally traveling between 300 and 400 miles, inspecting 227 stables which housed the 3041 cows supplying the Milwaukee market and making out an inspection card for each stable. On June 9 of that year he submitted a proposed milk inspection ordinance to the Common Council to establish a basis and authority for supervision of the purity of the supply. He reported: "It met with violent opposition from many milkmen at the very outset. Indignation meetings were called and resolutions strangely misrepresenting the measure were passed. It was opposed by the City Attorney and Chairman of the Council Judiciary Committee but supported by private lawyers." The violent opposition caused Dr. Wight to recommend indefinite postponement.

No annual reports of the Health Department were printed from 1880 to 1890.

In 1893 the Commissioner of Health reported: "It is high time that our milk ordinance, which has been tied up in the courts, should be rigidly enforced."

According to the best information available commercial pasteurization was first undertaken by one of the pioneer dairies in 1896 and a second in 1897, primarily to reduce losses due to souring of the milk. To the best recollection of those in the dairy industry, about 1900 advertising pasteurized milk through leaflets handled by the delivery wagon drivers and the newspapers was resorted to as a means of sales promotion. The medical profession began to become interested and recognized authorities on the subject of pasteurization were brought in to address their meetings.

In the years immediately following there was increasing recognition by the public of pasteurization as an important health factor. In 1905 it was estimated that 65 per cent of the milk supply of Milwaukee was pasteurized.

By 1906 inspection of the production and distribution of milk had been developed. Vendors were licensed, laboratory control put in operation and a maximum bacterial standard of 250,000 per cubic centimeter established. In that year 931 dealers were licensed.

In 1908 an ordinance was passed requiring that all herds supplying the Milwaukee market be tested for tuberculosis, effective April 1, 1909. This ordinance was bitterly contested through the lowest to the highest court in the land, the final affirmation being handed down by the U. S. Supreme Court in 1913. This law was never effectively enforced until 1926. This incident is cited because of the fact that from 1908 to 1926 the Health Department and other organizations put forth a great deal of effort in educating producers with regard to the tuberculin test which unquestionably aided in keeping the whole subject of a pure milk supply before the public.

In the year 1912, 80 per cent of the milk supply of the city was being pasteurized, 52 per cent by the holding and 28 per cent by the flash method, and by 1914 this had been increased to over 90 per cent.

The Health Department up to this time, while advocating properly regulated and controlled pasteurization, had possibly placed greatest emphasis upon the tuberculin test. Finding itself impotent to enforce fully the tuberculin test ordinance for the time being more undivided attention was given the problem of securing the maximum health protection obtainable from pasteurization.

In December 1916 an ordinance was passed requiring that all milk, with the exception of inspected and certified, be pasteurized by the holding or flash method under the supervision of the Department. Although at the time 95 per cent of the milk supply was being pasteurized a few small dealers, representing less than 3 per cent of milk consumption, joined forces, secured an injunction against and succeeded in delaying enforcement until the middle of 1920. Application of the provisions of this ordinance brought the percentage of pasteurized milk to 98 per cent of the entire supply, and 100 per cent if certified and inspected milk is excluded.

It is difficult to estimate how much educational effort accompanied the enactment of the pasteurization law. Milwaukee newspapers do not maintain a subject file and therefore could not furnish condensed information as to amount of space devoted to articles on pasteurization in 1916 and the years immediately preceding. A search of the pages of the leading morning daily for the entire year of 1916 revealed but three articles advocating the use of pasteurized milk. A similar survey of all issues of the leading afternoon paper for three months prior to the passage of the pasteurization ordinance brought to light but one article on the subject which could be classed as of an educational character. It may however safely be stated that, undoubtedly to a very considerable degree through the efforts of the Commissioner of Health, the ordinance was given the support of women's, parent-teacher and other organizations.

On February 20, 1922, the pasteurization ordinance was amended to permit the use of only the holding method and again on May 10, 1930, requiring that milk shall be pasteurized only within the city of Milwaukee.

In conclusion it is believed that Milwaukee's experience in its gradual progress in securing 100 per cent pastuerization of its milk supply, other than certified, justifies the opinion that educational work in this subject is not only important but a necessary factor in increasing the extent of pasteurization. It can only be such when supplementing and coordinated with other intelligent and aggressive work on the part of health authorities able to prepare and secure the enactment of carefully considered and competent legislation related to the subject in mind and attuned to local conditions and when supported by an enlightened and progressive milk distributors organization.

Dr. P. R. Carter: Minnesota is essentially a rural state and we have some problems in education that some of you do not have where the population is more urban in character. For many years we have carried on a moderate program of education in the use of pasteurized milk through pamphlets, talks and demonstrations, but this has been limited mostly to urban communities where pasteurization plants were located or would likely be in the future. Milk used by farm families or other isolated small groups may, of course, be infected with disease organisms and while the spread of large milkborne epidemics is not a problem, we have felt that something should be done to safeguard such milk supplies. I thought this group would be interested in a method we have used to attack this problem in Minnesota.

The State Board of Health first adopted a resolution which described the hazards of using raw milk and urged everyone to use only pasteurized

milk or milk properly heated in the home. A simple method of heat-treating milk in the home was devised and the method and the resolution printed as a leaflet. The leaflets were distributed through local and state public health nurses, actual demonstrations of the method being given whenever possible. The leaflets were also given out to families receiving relief orders of the ERA where pasteurized milk was not available. Reports to date have indicated that this program has had a marked effect in educating people to the use of pasteurized milk.

I might mention a few other factors which have been influential in stimulating the use of pasteurized or heated milk in rural places. Minnesota has many summer resorts and many city people going to them immediately inquire if the milk is pasteurized. If the resort owner is not using pasteurized milk, he soon gets busy and obtains some even if it has to be transported a long distance. Summer camps for Boy Scouts, Girl Scouts, Y.M.C.A., etc., have also insisted upon getting pasteurized milk. The recent establishment of CCC Camps and their requirements for using pasteurized milk has been another factor. These factors have resulted in the establishment of pasteurizing plants in many semi-rural areas where they normally would not have been located.

Mr. A. L. Sullivan: It seems to me that in connection with the educational work in developing the extent of pasteurization, we have to recognize a condition that really exists, and that is a real prejudice among rural people in favor of raw milk. I recall one of the first publications issued by Mr. Frank with reference to milk. I think he very clearly made it plain that in his opinion pasteurized milk was the only safe milk, but I think he soon realized that you cannot force it on the general public against its will. You have to reach the stage where they want it, and by building up a good raw milk supply you can also develop the pasteurized milk and the demand for it.

We had one very severe epidemic of typhoid in a city of about ten thousand people. The milk came from a very good dairy. As a result of this epidemic, the health officer tried to put through an ordinance that all milk should be pasteurized before being sold in the city. Through politics, more or less, and differences among influential people, the proposed ordinance was killed by a public official. He talked to these people and influenced them in turning down the proposition.

Now, the proprietor of this particular dairy put in a pasteurization plant, and he still found that he had to sell that milk two cents a quart cheaper than what he got for his Grade A raw milk.

I would like to make one suggestion which appears to me would be appropriate at this time in connection with trying to promote the consumption of milk, and that is this: with the high prices of meat, pork and beef, and other products, *good milk is extremely cheap.* We are losing sight of the fact that quality milk is very cheap food at the present time. I think that ought to be brought home.

Mr. W. B. Palmer: I was very much interested in the paper by Professor Hiscock, and I would like to know of conditions in those sections that are more or less influenced by some of the bureaus set up by the federal and state governments.

We quite agree that methods and conditions of producing milk depend largely on the proper price return to the dairy farmer. State milk control boards have been established in some states by the legislatures. Their function is to set the prices on milk to the producers, to the dealers, and to the consumers.

We find that there is another bureau which has been set up, known as the ERA, to provide for those in needy circumstances, to see that they receive adequate food supplies. The state milk control boards, which fix the price, have, in many instances, increased the retail price to the consumer, which has a very direct bearing on decreased consumption of milk. The ERA divisions have stated that they will only pay for Grade B milk, and they will furnish the milk to those families where there are infants to be fed. I understand they went so far in our state, about a year ago, to cancel all milk orders, but later resumed the service. That is contrary to all of the work that has been done by public health departments in advancing the use of milk in adequate amounts, and particularly for infants' feeding and young children's feeding.

In contrast to that, another bureau established by the Federal Government, the CCC, demands that their camps shall be furnished with Grade A pasteurized bottled milk. These fellows who are strong and healthy get Grade A pasteurized bottled milk whereas the children of the families who are on relief get very little of it, and when they do get milk, it is Grade B milk.

Just how, under conditions of that sort, are we going to carry on an educational program to the public and how should we proceed to educate? The truth is, those bureaus are set up as emergency bureaus, under emergency legislation, and the educators must recognize that the emergency situation exists, but emergencies are likely to become permanencies.

There is another feature in reference to the effect on milk consumption, and that is, as I understand it, in those sections where the Public Health Service Ordinance is in effect, that it is the policy, or the opinion, that when a milk supply is improved in quality that it should be compulsorily classed and labeled in the next upper grade. That, under official price fixing regulations, would mean that there would be an immediate increase in the retail price of that milk to the consumers, and under present economic conditions it certainly would result in a decreased use of that particular improved supply of milk.

To illustrate this, we find that there is a decrease now in the consumption of so-called Grade A milk. There is a price differential of three cents between A and B milks, and there has been a falling off of approximately thirty-three and one-third per cent in the consumption of the Grade A milk.

All of these things mean that when the milk is sold at lower price levels to the consumer that the dairymen will receive proportionately lower prices for his deliveries to the dealers, and all of these things will tend to reduce milk consumption of the higher grades and will discourage the dairy farmer. So where should education be focused is a very important matter to determine, and I think should be directed to others as well as the consuming public.

Some of the dealers, because of price-fixing and competition, degraded milk, and that sort of procedure means that the consumer after using those particular products will soon learn that there is no real essential difference in the food value, in the values in the cream line, and the keeping quality between A and B milk, and as matter of fact practically all milk irrespective of grade designation comes from tuberculin tested cows, and in many areas cows are being tested for contagious abortion. What does it all lead to, and who should be educated, and why?

Prof. Hiscock: The important point just made needs to be emphasized over and over again. The fact that milk is the most inexpensive food from the standpoint of food values needs to be brought home, especially to the middle-class family and to the borderline economic status groups, in addition to insurance of adequate provision of milk in relief families.

The question that Mr. Palmer raises is very real. The CCC Camp proposition can be handled from the federal end. These relief questions are pretty largely handled from the state end. I have tried to indicate such educational processes as may be adapted to many different groups, but the problem has to be handled in different ways for each different group. I think the proper authorities should be approached on this question of the use of safe milk for those families that are being served through the public channels. This is a problem which is acute in certain sections, including some where I have been working recently.

Incidentally, I was quite thrilled this summer, out in the middle of the Pacific, to find a little island which is a rural island of sugar plantations. Three plantation owners, responsible for the health program for their laborers, installed pasteurizing plants of the modern types and that is the only source of milk for those plantation laborers and their families. The public is gradually becoming pasteurization conscious. I do not know how far you can go in teaching some people to boil or pasteurize their milk in the home.

Over in Brookline the health department uses an interesting educational device. They deliver, every month, through the policemen, a bulletin for every householder. It is an inexpensive but carefully prepared bulletin. A bulletin is not valuable unless it is attractive and well written.

INTERNATIONAL ASSOCIATION OF DAIRY AND MILK INSPECTORS

President Johns: It is indeed fitting that we should be meeting in Milwaukee this year, as it is twenty-three years since the International Association of Dairy and Milk Inspectors organized in this very same city, and of even greater interest to us is the fact that the man who was primarily responsible for the organization of the Association is here with us this evening as a guest. I refer to Mr. C. J. Steffen, of Milwaukee and I would like Mr. Steffen to stand up so that we can all take a good look at the man who is the founder of this organization.

Mr. Steffen: I don't know how to address this audience this evening, for it is over twenty years since I left milk inspection work, but I want to say, Mr. President, that it was very pleasing to me this afternoon when I found the high caliber of the men and I found that the same problems that confronted us twenty years ago were still under discussion, but I believe that we must keep everlastingly at those problems—bacteriological tests, farm inspection, proper ordinances, proper enforcement—it was those things that brought about the organization of this Society. I can recall in 1911, on visits to Cincinnati, Columbus, Cleveland, Springfield, Toledo, Detroit, Indianapolis,—in visiting probably, fifty farms and milk plants, I found that the problems that confronted us in Milwaukee, confronted them there.

Inspection then was in a primitive stage, we had ordinances that meant nothing, to this extent—there were penalties provided for doing certain things but if you prosecuted men under those ordinances you found political pressure was brought to bear to have those prosecutions set aside.

At the first meeting, twenty-three years ago, when this Association was organized at the National Dairy Show held at the Auditorium I believe we had eleven members and there were representatives from Seattle, Omaha, Wichita, Indianapolis, Fort Wayne, Detroit, Chicago and some other cities; today, we probably have representatives here from one hundred cities!

I am pleased, Mr. Chairman, to find the president of our Association now comes from a foreign country, so to speak. We had a representative from Australia, and we welcomed him. I do not know whether he is still a member or not. We had numerous inquiries from Mexico, indicating at that time that the men interested in this line of work were interested in the exchange of ideas and in the improvement and broadening of this inspection work.

I live here in Milwaukee, and I am going to drop in on you men. I wish you a very good meeting!

President Johns: Thank you, Mr. Steffen. I hope you enjoy your visit with us for the rest of our meetings. Now, to get on with our program. There is a change necessary in connection with this first paper to be given by Dr. K. C. Weckel, of the University of Wisconsin. Dr. Weckel tells me that on account of unfortunate circumstances connected with extremely hot weather and one thing and another this summer, their experimental rats have fallen down on the job and they have been unable to complete this piece of work that was to be the basis for this paper. In its place, Dr. Weckel is going to give us a paper on "Radiation and the Microorganisms of Milk."

OUR ASSOCIATION IN RETROSPECT

CHARLES J. STEFFEN
President, 1911-1914

WHEN this association was decided upon, and we met and adopted a constitution in October, 1911, it was for the reason that we felt the need of just such an order. The milk dealers, the supply men, had their organizations; and even the producers were demanding recognition. The sale of bulk milk and the bell were still the principal stock in trade and the requisites of some milk peddlers. Slowly and surely the small dealer was crowded out, due to his continued lengthened haul and the ever condensing or shortened haul for the large dealer.

With the advent of the large dealer, and his supply coming from more remote distances, bought almost entirely at so much per gallon or can, and of uncertain quality, he was compelled to pasteurize his product to enable him to do business. About this time revolutionary changes took place. Pasteurization of milk brought about the sale of bottled milk, and sometimes this was done voluntarily ahead of city requirements. The homogenizer was extensively used by this same class of dealers, particularly in the preparation of cream, and in some western cities to prepare a product for the manufacture of ice cream from butter and milk. Clarification of milk was for a time considered very essential and necessary, but, of course, with proper farm inspection and supervision of milk supplies, the clarifier was no longer needed.

The daylight delivery of milk was another innovation instituted about this time; and finally the tuberculin test of cows as a requisite to sell milk to the city was demanded. Sometimes these new regulations were adopted without regard for public sentiment or demand, but were solely the pet project of some one in authority. Then it became the duty of the inspector to enforce such regulations. Generally speaking, no two cities stressed the same fundamentals, and the printed milk ordinances sometimes failed entirely when it came to a practical enforcement. However, when the inspectors met at conventions and exchanged views, they found that they differed little as to general requirements that were practical and that could be enforced.

In preparation for this organization meeting of 1911, we visited the milk inspection divisions in Chicago, Illinois; St. Paul, Minneapolis, Minnesota; St. Joseph, Kansas City, and St. Louis, Mo.; Omaha, Neb.; and Wichita, Kansas. What a group of fine, earnest fellows we met! After we had informed them of our plans, practically in every city the milk inspectors were enthused with the possibilities and the need of such a central organization.

In some cities the conditions were plain "bad", and the inspectors knew it but did not have the proper support to remedy them. This business was in a transitory stage and these new ideas about clean cows, clean barns, and clean milk were in advance of the times; and the inspectors, generally, were of the opinion that in order materially to advance this work in a reasonable and rational manner, education and cooperation among the dealers, the consumers, and the producers, would be the first requisites. While on our trip of inspection, though there were things to be condemned, we found many up-to-date milk plants, with keen management and a willingness to learn and improve upon their methods.

We informed the inspectors at this time that we proposed to organize an association, and that our first annual meeting would be held a year later. It so happened that the National Dairy Show of 1912 was held in Milwaukee, Wisconsin, and we held our first meeting at the same time. Just prior to this, we visited the cities of Cincinnati, Columbus, Cleveland and Toledo, Ohio; and Detroit, Michigan; with the same purpose in mind—to interest them in our meeting. Here we also were promised cooperation and support.

Our secretary, Mr. Ivan C. Weld, of Washington, D. C. (and let me say here that our early success was largely due to his indefatigable work), had prepared a very interesting program, and to those present it was their first opportunity to hear what some expert, or other milk inspector, believed was essentially important in the improvement of the milk supply. Papers submitted by J. A. Gamble of Springfield, Mass.; Dr. James Jordan of Boston, Mass.; Peyton Rowe of Richmond, Va.; and Dr. George Babb of Topeka, Kans.; were read by the secretary; and talks were delivered in person by Dr. W. H. Price of Detroit; G. M. Henderson of Seattle, Wash.; Claude Bossie of Omaha, Neb.; Dr. Hulburt Young of Washington, D. C.; and B. H. Rawl, Chief of the Dairy Division, Department of Agriculture, Washington, D. C. Papers dealing with technical and research work were delivered by Professor W. A. Stocking of Ithaca, N. Y.; Professor E. G. Hastings of Madison, Wis.; and Professor W. J. Frazier of Champaign, Ill. A fine talk also was delivered by Mr. John Nichols of Cleveland, Ohio, President of the International Milk Dealers Association. I mention this program, showing that immediate response and cooperation were forthcoming from these varied sources, and it was indeed gratifying to us; but we well knew and understood that to apply newer, and perhaps better and more practical ideas was easier said than done. However, for the first time we had a feeling that by cooperating with each other and working for more uniform and more practical milk laws, we would be able to meet the new problems with which we were, and had been confronted. We valued the friendships of our fellow inspectors, who became enthusiastic coworkers in furthering the aims of our organization. How we looked forward to meeting the genial Dr. Price from Detroit; Mr. Henderson of Seattle, always interesting and inspiring; Claude Bossie of Omaha "who had the cleanest farm-owned dairies in the country" (at least so he said); and from Wichita came Mr. Huxtable who had a method all his own, and who said he had no problems but what he could cope with them. How we envied his lot! From Fort Wayne, Ind., came Dr. Gillie; and from Jacksonville, Fla., came Horatio M. Parker. After a lapse of twenty-three years our friend and coworker, Mr. Parker of Jacksonville, Fla., is the only one present, excepting "yours truly", of all those who were present at the first annual convention in 1912.

When the second annual convention was held in Chicago in 1913, at the time of the holding of the National Dairy Show, it is interesting to note that Mr. Ernest Kelly, Department of Agriculture, Washington, D. C., then delivered a paper and is now still active in our order. Professor Erf of Columbus, Ohio; Professor Rasmussen, of Durham, N. H.; Professor H. A. Harding of Champaign, Ill.; Professor H. N. Parker of Urbana, Ill.; William F. Luick, National Association of Ice Cream Manufacturers, Milwaukee, Wis.; were some of the newer aids to appear on our program. How inspiring was the talk by W. A. Evans, former Commissioner of Health of Chicago, at our banquet in the Sirloin and Saddle Club.

Holding your convention here brings back to me many pleasant memories of friendships made; and when we realize after twenty-four years that there is still a vast field for work, and that a proper supervised milk supply is now available to but a small portion of our people, you have an abundant field for expansion of the work of this order, and perhaps you will encounter as many difficulties in the future as we did in the past. Now that I have attended the twenty-fourth annual convention of our association after an absence of twenty-one years, it is indeed gratifying to observe that you are carrying forward the aims and purposes of our association; and interesting to observe that you are still confronted with some of the same early difficulties which we encountered.

When I retired from this work, we had a member from Australia; inquiries from Mexico and Germany; and on this occasion, your presiding officer is from Ottawa, Canada. Yes, our order is truly "international"; the opportunity is worldwide, and the work must bring about a better understanding among its members. My early association as an officer of this order was a pleasure I shall long remember; and that you should return to the "home city" after twenty-four years with increased membership and enthusiasm, is truly an indication that there was a need for such an order as this.

President Johns: Thank you, Mr. Steffen. I hope you enjoy your visit with us for the rest of our meetings. Now, to get on with our program. There is a change necessary in connection with this first paper, to be given by Dr. K. G. Weckel, of the University of Wisconsin. Dr. Weckel tells me that on account of unfortunate circumstances connected with extremely hot weather and one thing and another this summer, their experimental rats have fallen down on the job and they have been unable to complete this piece of work that was to be the basis for this paper. In its place Dr. Weckel is going to give us a paper on "Radiation and the Micro-Organisms of Milk."

RADIATION AND THE MICROORGANISMS OF MILK

K. G. Weckel

Department of Dairy Industry, University of Wisconsin

Introduction

SUNLIGHT has been used since time immemorial by mankind for the purpose of curing and preservation of certain foods. It is today a common practice, in lieu of more desirable practices, to recommend the administration of sunlight to dairy utensils.

Sunlight has, physically speaking, composition. It consists of energy arbitrarily classified according to its characteristics, as visible light, ultra-violet energy, and infra-red energy. Of the three, only the visible, which we observe in the form of colors, induces an optical response. The others have been discovered and are known by their effect on various chemicals or substances. Artificial sources of radiant energy have been developed which emit relatively greater proportions of the ultra-violet energy, and which are used for one of several industrial purposes.

Review

During the past decade a number of studies have been made concerning the relative germicidal effect of radiation of various wave lengths of the ultra-violet emission of various arcs. The action has been shown to be dependent on two factors, light intensity, and wave length.* It appears that the light action increases with decreasing wave length.

* Coblenz, W. W. and Fulton, H. R., Scientific Papers of the Bureau of Standards, No. 495, 1924.

Inspectors!
TEST
WITH
Taylors

THE Taylor Handled Thermometer on the left is becoming increasingly popular with inspectors for taking milk temperatures at the receiving platform. It is quick reading, easy to handle and easy to read, even where the light is poor. Stem is of stainless steel, 14″ or 24″ length, readily cleaned and sterilized as the thermometer is not injured by sterilizing temperatures.

The scale is 7″ long, with a range of 30° to 90°F in 1° divisions. You will find this thermometer valuable and handy in your test work.

•

THE test thermometer at the top right, with a range of 138° to 148°F in 1/5° divisions, covering the pasteurizing range very accurately, may be had as a registering instrument, holding its temperature until shaken down, or non-registering.

The double scale thermometer at the bottom, for general testing, covers the range of about 30° to 100° in 2° divisions, for checking cooling and incoming milk temperatures and also has the 140° to 180° range in 1° divisions for pasteurizing temperatures of sweet and sour milk or cream, buttermilk, ice-cream mix, etc.

Taylor
Instrument Companies

ROCHESTER, NEW YORK

In Canada: Taylor Instrument Companies of Canada, Limited, Toronto

The time required to kill the bacteria by radiation is relatively small, varying from a magnitude of seconds to several minutes, and depends on the character of the energy and the substrata or media. In general, little difference is reported to exist in the susceptibility of various species of organisms, or even spores, although higher forms are more resistant.

A number of sources of radiant energy are available, the emission of which is relatively rich in ultra violet. These sources of radiant energy are employed for the sterilization of community and industrial water supplies. Application is also being made for the purpose of limiting the bacteria numbers of sugars. During the past few years increasing application has been made of the process whereby ultra-violet energy is used to enhance the antirachitic quality of foods, notably milk. The methods at present in operation for the activation of milk involve exposures ranging from 0.1 to 5 seconds' duration. While organisms are susceptible to the action of ultra-violet energy, the opacity of milk would tend to preclude any significant effect of the energy upon the bacteria numbers. A few preliminary observations suggested the possibility that the numbers of organisms in milk might be reduced by the process as commercially employed.

A series of studies was undertaken to determine:

1 Whether there was any reduction in the bacteria population of whole milk given proper commercial irradiation to enhance the antirachitic value of the milk.

2 Whether there was any specific effect of the radiant energy upon the various organisms of which milk is a normal habitat.

Procedure

Two units of equipment were used for the irradiation of milk, one a commercial unit, operating at a milk flow capacity of 4000 pounds per hour, the milk activated by the emission of a therapeutic C carbon arc operating at

50 volts and 60 amperes, the other, a small experimental surface cooler employing a similar carbon arc lamp.

The units were daily prepared for the experimental runs by use of a strong chlorine rinse pumped for a period of four to five minutes, followed by water pumped through at a temperature of 90° C for twenty to thirty minutes. Milks of various quality were used in the experiments; selected raw milk of poor quality, milk of high quality, and pasteurized milk. Sufficient quantity of the milk was used to permit six to ten minutes' operation of the experimental units. The influence of the radiation on numbers, and species of organisms was determined by equivalent size batch milk cultures of *Streptococcus lactis, Escherichi coli*, and *Bacillus coagulans.* The cultures were prepared in milk previously heated to 180 degrees for thirty minutes and subsequently cooled.

The bacteria numbers of the irradiated and non-irradiated milks were determined by the plate count method employing lactose agar.

Results of the Experiments

The influence of aeration imparted the milk during passage through the irradiation units was discounted by comparative tests upon the bacteria numbers, fermentation rate and hydrogen ion concentration of non-aerated milk and milk passed through the units three times without the application of radiant energy. No difference was observed in the bacteria numbers or associated tests of the aerated and non-aerated milks, indicating that any effects observed during the experiment proper were the probable result of the effects of radiant energy.

A summary of thirty-eight separate irradiation experiments when classified according to the bacteria count of the milk indicates, as shown in Table 1, that the influence of radiation on the bacteria numbers of milks of good quality is of no significant value, whereas when the bacteria numbers in milk increase, there is a measurable increase in the percentage reduction of the number of organisms.

Table 1

INFLUENCE OF RADIATION ON MILKS OF VARYING QUALITY

Bacteria Count of the Milk	0 50,000	50,000 100,000	100,000 500,000	500,000 1,000,000	1,000,000 or more
No. of Experiments	9	3	8	5	13
Effect of Radiation on Count (Per Cent)	—.96	—16.3	—37.1	—28.0	—28.3

In milks having relatively low bacteria numbers, the range in percentage reduction was from + 21.5 to — 22.0. In milks having high bacteria numbers, *i.e.,* 1,000,000 organisms per cc. or more, the percentage reduction varied from —0.69 to —59.9.

An analysis of the data obtained in the experiments reveals that there is no apparent difference in the action of the radiation on the various organisms which may be found in milk, inasmuch as the effect upon the numbers of organisms of the milk of varying quality, and the cultured milks was similar.

While the influence of radiation on the bacteria numbers of milk of good or moderate quality is held to be of no import, it was observed that a distinct effect on the rate of fermentation of the milk as determined by measurement of the titratable acidity and hydrogen ion concentration occurs. When samples of radiated and non-radiated milks are allowed to ferment by incubation at 30° C, a lag in the rate of acidity development and hydrogen ion concentration in the radiated sample is observed. The lag effect is not observed until after about two hours have elapsed. The lag effect is not of permanent character, inasmuch as the final acidity of the two milks approaches equality. The difference in titratable acidity of the two milks during the course of the fermentation was as much as 0.15 per cent, and the pH values a conformable amount. The delay in fermentation rate was not only observed in milks held at incubator temperatures, but also on milks stored as long as nine days at refrigerator temperatures. Similar effects were observed in measuring the rate of acid development and rennet coagulation of milk and whey during the manufacture of cheddar cheese.

It is of interest to note that the inhibiting effect of radiation on the fermentation of milk is not observed when the radiation is conducted after the development of acidity is well under way. Milks radiated after attaining an acidity of 0.25 to 0.30 per cent or more fail to exhibit the lag effect. Since the lag effect in fermentation rate is observed in milk of high quality and thus low initial bacteria count, on which radiation had no significant effect, there exists a probability that the effect of the radiation on the organisms is transient and thus is not measured by the colony count method.

Conclusions

The radiation of whole milk under commercial conditions appears to have little influence on the bacteria count of high quality milks.

The radiation of whole milk appears to have a significant effect on the bacteria count of poor quality high count milk, inasmuch as the numbers are reduced.

The radiation as applied to milk appears to have no selective action on the various organisms naturally occurring in milk, or on organisms such as *Streptococcus lactis, Escherichi coli*, or *B. coagulans*, introduced into the milk.

The rate of fermentation of radiated milk is delayed and thus indirectly the keeping quality is improved.

Discussion

President Johns: I am sure we are all thankful to Dr. Weckel for coming here this evening and giving us this paper. He certainly filled in the gap most acceptably when his original experiment was not ready for our meeting. The paper is now open for discussion.

Dr. J. H. Shrader: Maybe it was because I got in here too late, but I was quite interested to hear what the speaker said about the effect of radiation on delayed spores. What was the order of magnitude on that?

Dr. Weckel: We found in experiments that the fermentation at 30 degrees centigrade probably occurred in nine to ten hours. The lag in fermentation effect was not observed until after the first two hours had elapsed; thereafter, the difference in degree of fermentation amounted to approximately 0.15 per cent and would be observed during the course of four or five hours until after the interval of nine or ten hours had elapsed. The final acidity of the two types of milk is approximately the same, indicating that this lag effect is of a transient character.

In the case of milks held at low incubator temperatures, I should say refrigerator temperatures, it was found that the lag effect could be observed during the course of a period of several days, approximating essentially the same maximum differentiation in acidity, that is, 0.15 per cent. We carried this holding of milks at low temperatures as long as nine or ten days and observed similar differences in acidity during the course of fermentation.

As the acidity approaches the maximum of .5 to .6 per cent in terms of milks of that quality, we find that the acidity of the two milks approaches equality. In terms of the inoculum used in the experiments, there appears to be no difference in the effects of radiation on the rate of fermentation of milks containing spore-forming or non-spore forming organisms.

Mr. Wm. B. Palmer: In the radiation of milk and the flavor developing in the milk, particularly due to what is called the over-exposure, has it been determined that there is any significance to that off-flavor in the consumption of that product?

Dr. Weckel: Experiments have recently been completed at the University of Wisconsin which show that when radiated milks having a unit age of 200 Steenbock Units per quart were fed to experimental animals *ad libitum* over a period of ten months, that studies conducted upon the experimental animal showed no pathologic effects whatever. This particular study is reported in the annual report of the College of Agriculture for the year 1934.

REPORT OF COMMITTEE ON LABORATORY METHODS

YOUR chairman, being guided by requests from various members and others interested in the development of suitable and adaptable laboratory methods of analysis for determining the bacterial content of frozen desserts, sent out a questionnaire to ascertain to what extent the present "Standard Methods" of the A.P.H.A. were being used. These methods were first officially recommended in the recent sixth edition.

Only 146 replies were received from approximately one thousand questionnaires sent out through the courtesy of the office of the American Public Health Association. The replies came from laboratories as follows:

55 municipal	6 college or university
8 county	37 industrial commercial
28 state or provincial	12 private commercial

Of these replies, seventy-four reported that no frozen desserts were examined to determine their bacterial content. The remaining seventy-two replies were received from the following types of laboratories:

29 municipal	21 industrial commercial
10 state or provincial	7 private commercial
5 college or university	

The failure to receive more replies from among the thousand laboratories engaged in milk control may be interpreted as an index of the current relative significance attached to the sanitary control of milk and frozen desserts. While the percentage of replies seems small, the significance of the reports from pioneering control laboratories can not be overestimated. They obviously will form the nucleus for all future recognized methods for the analysis of ice cream and related frozen desserts. A tabulation of the replies with respect to their origin follows:

M=Municipal, S=State and Provincial, C=College and University, I=Industrial Commercial, and P=Private Commercial

	M	S	C	I	P
Questionnaires returned	55	36	6	37	12
Questionnaires with satisfactory replies	29	10	5	21	7

6 *What is your official bacteriological standard for ice cream?*

	M	S	C	I	P
Replies	22	6	5	16	3
25,000 or less per cc.	1	——	1 (10,000/cc)	1	——
25,000 to 50,000 per cc.	3	——	——	6	1
50.001 to 100,000 per cc.	10	1	3	4	——
More than 100,000 per cc.	2	——	1	——	1
100,000 or less per gm.	3	2	——	3	1
100,001 to 150,000 per gm.	3	3	——	2	——
No *B. coli* per 1 cc.	1	——	1	2	——

New Hampshire, State Laboratory of Hygiene reports as follows on the percentage distribution of bacterial counts on 147 samples;—

Not more than 50.000 per cc.	54.0 per cent
Not more than 100,000 per cc.	77.7 per cent
500,000 per cc. or more	10.1 per cent
1.000.000 per cc. or more	3.6 per cent
Highest	3,320,000 per cc.

7 *What standard would you recommend if you have no official standard?*

	M	S	C	I	P
Replies	13	2	1	5	2
10,000 per cc. or less	——	——	——	——	1
10,001 to 25,000 per cc.	1	1	1	——	——
25,000 to 50,000 per cc.	6	——	——	4	1
50,000 to 100,00 per cc.	4	1	——	——	——
Over 100,000 per cc. or gm.	1	——	——	1	——
B. coli per cc. 1	1	——	——	——	——
B. coli per cc. 10	——	1	——	——	——

One municipality recommending 100,000 per cc. for ice creams also recommended 50,000 for sherbets and 25,000 for ices. Massachusetts Agricultural College at Amherst reports that 25,000 per cc. could easily be maintained.

8 *Do you make bacteriological tests of frozen desserts other than ice cream? If so, what are they? Is the same standard applied?*

	M	S	C	I	P
Replies	27	8	5	20	5
Tests made on other frozen desserts, Affirmative	19	5	4	14	4
Same standards are applied, Affirmative	13	2	2	7	1

One municipality with 50,000 per cc. standard for ice cream, uses 25,000 for sherbets. One industrial laboratory reduces the standard from 100,000 for ice cream to 50,000 when milk products are not incorporated.

9 *Approximately how many ice cream samples were tested (a) bacteriologically in 1934, (b) chemically in 1934 and (c) bacteriologically in 1935 prior to May 1?*

Samples examined bacteriologically in 1934

	M	S	C	I	P
Replies	28	8	5	17	6
50 or less	7	4	3	2	1
51 to 500	11	3	2(2yrs.)	8	4
501 to 5,000	10	1	0	6	1
Over 5,000	0	0	0	1	0
Total samples examined	12,406	5,323	790	24,653	1,486

Chicago, Rochester, Washington and Los Angeles examined respectively 1497, 1440, 1471 and 1406 samples. General Ice Cream, Pioneer Ice Cream, Hydrox, Hoods and Abbots examined respectively, 5000, 4200, 3000, 1800 and 7616 samples. California State at Sacramento examined 4693 samples. The Dairy Laboratories of Philadelphia examined 900 samples.

Samples examined chemically (chiefly for fat) in 1934

	M	S	C	I	P
50 or less	7	3	1	1	1
51 to 500	13	4	2	8	4
501 to 5,000	8	1	0	5	1
Over 5,000	0	0	0	1	0

Approximately the same numbers of samples were examined for fat in the respective laboratories as listed above for the bacteriological examination in 1934.

Samples examined bacteriologically in 1935 prior to May 1

	M	S	C	I	P
50 or less	12	5	3	7	3
51 to 500	11	1	1	7	2
501 to 5,000	3	1	0	5	1
Over 5,000	0	0	0	0	0

Approximately the same proportionate numbers of samples were examined bacteriologically during the first four months of 1935 in the respective laboratories as listed above.

10 *Are you following in detail the A.P.H.A. Standard Methods (sixth edition) for the bacteriological analysis of ice cream?*

	M	S	C	I	P
Replies	29	8	4	21	7
Affirmative	24	7	3	18	6

11 *If not, how do you differ? (Please answer specifically as your suggestions are sure to be helpful and constructive.)*

New York City, Bureau of Laboratories, uses sixty-cc. bottles with screw caps and glass beads for breaking up frozen dessert in original sample. Massachusetts Agricultural College, in addition to the A.P.H.A. procedure, uses 32° C. for incubation. They also use a special medium for the isolation of molds and yeasts. St. Louis, Mo., reports as follows:

With a sterile tongue depressor a portion of frozen ice cream is removed from the center of the package to a sterile petri plate and allowed to soften at room temperature. Tongue depressors in separate envelopes, are wrapped and sterilized by steam (to prevent charring of paper). The gravimetric method is used as in weighing cream for the Babcock test. A ten cc. pipette is used to mix the material in the petri dish and to add it to the 99 cc. water blank. Only the 1:100 dilution is plated as no accurate account is taken by our milk control section of low counts.

Louisville, Kentucky, reports as follows:

A parchment paper cup is placed into glass tube with flat bottom, 1x2 in. This tube is corked and sterilized. One gram of frozen cream is weighed into the paper cup. The cup removed from tube with sterile forceps, and placed in a wide-mouth dilution bottle with 99 cc. of water.

Hoods of Boston reports as follows:

We use 1 cc. of melted ice cream rather than 1 gram as we believe it better to pipette out 1 cc. than to attempt to weigh 1 gram aseptically.

Abbotts of Philadelphia uses beef infusion broth for *B. coli* determination.

Mitchell Dairies of Bridgeport, Conn., let retailer put sample into a new sterile cardboard container.

Purdue University, Lafayette, Indiana, reports the making of comparative counts on one per cent sucrose nutrient agar and on yeast dextrose agar, each after five days' incubation.

Several others report the use of special media.

Lehmkuhl of Rochester, N. Y., reports as follows:

Ice cream allowed to melt in cold water at room temp. 10 gms. then weighed directly into 90 cc. sterile blank in pyrex dilution bottle, (last shown in illustration—page 8, A.P.H.A. methods, except that curved glass rod is used). This 1:10 dilution then used for further dilutions. The 1:100 plate made directly from the 1:10 dilution, using .1 cc. Reported in grams.

12 *Have you bacteriological standards for the ice cream ingredients? If so, what are they?*

	M	S	C	I	P
Replies, affirmative	6	1	0	11	1

Most municipalities use same standards for milk and cream as those for the same products when used for fluid purposes. These range from 10,000 in certified milk to 500,000 for the poorest grades of cream, the majority ranging from 50,000 to 200,000 per cc. Most industrial laboratories use more severe standards although one recommends a 500,000 limit for both milk and cream. Standards for gelatin range from 100 to 1,000 per gram, sugar 10 to 1,000 per gram, powdered skim milk 10,000 per gram, egg yolk 100 per gram, condensed milk 10,000 per gram, flavoring 200 per gram, with additional requirements of no *B. coli* or thermophiles in gelatin and sugar.

13 *Do you penalize vendor or packer when one count exceeds standard?*

14 *If not, how is standard maintained?*

Most municipalities and state regulatory agencies use educational methods, repeated examinations, hearings, etc. Two cities use publicity. Some average 3 or 4 counts before taking any action.

Industries usually reject shipments and seek other sources of supply.

15 *Do official representatives take your samples?*

16 *What proportion of your ice cream samples are unofficial?*

Nearly all samples analyzed by municipal, state, provincial and industrial laboratories are obtained by official representatives. Colleges, universities and private laboratories analyze samples as supplied but prefer to have samples taken in a representative manner and received in a suitable condition for analysis.

17 *Attach copy of instructions to official inspectors for sampling ice cream when returning questionnaire.*

Very few have written instructions for sampling and for sanitary inspections. The replies are as follows:
Plainfield, New Jersey:

Instructions to Inspectors for Sampling Ice Cream.

Equipment: Sterile mason jar containing sterile metal table spoons.

Sterile 10 oz. metal-capped mayonnaise jars—with labels.

Insulated copper refrigerated carrying case.

Instructions: From each can of ice cream to be tested two samples are taken as follows:

(A) 1. Samples taken with vendor's scoop as it would be served to customer.
   2. Placed in sterile jar and labeled.

(B) 1. Remove surface layer of ice cream with one scrape of sterile spoon.
   2. Remove sample from freshly exposed surface with another sterile spoon.
   3. Place in sterile jar and label.

Approximately two scoops full of ice cream are taken for each sample. Samples must be placed in refrigerated case and returned to laboratory for analysis as soon as possible.

Chicago provides perhaps the most complete set of directions:

Regulations For Retail Food Establishments Manufacturing, Making Or Mixing Ice-Cream, Water Ices, Frozen Puddings, Or Any Other Food Product Made In Part From Milk Or Cream, And Frozen, For Sale Within The City

---

Any person, firm or corporation engaging in the manufacture of ice-creams, water ices, frozen puddings, or any other food product made in part from milk or cream, and frozen, for sale within the city, shall make application to the President of the Board of Health for a permit to install and operate a freezer unit or units. Each application for such permit shall be accompanied by a set of plans showing in detail the location of the freezer unit, disinfection facilities and other necessary information as provided for in Section 3035 of the Municipal Code.

No manufacturing of ice-cream, water ices, frozen puddings, or any other food product made in part from milk or cream, and frozen, for sale within the city, shall be done until the premises have been inspected by the Board of Health for sanitation, equipment, etc., and a permit has been issued.

No freezer unit shall be installed for the purpose of manufacturing ice-cream, water ices, frozen puddings, or any other food product made in part from milk or cream, and frozen, for sale within the city until such unit has been inspected and approved as to its construction insofar as it affects sanitation.

No permit shall be issued unless adequate facilities are provided for the disinfection of all utensils and equipment with hot water or live steam.

The term "hot water" in this section shall mean water at a temperature of not less than 170°F.

STERILIZATION:

Where hot water disinfection is used, an adequate container of sufficient size shall be provided for such hot water, to permit the complete immersion of all utensils and other equipment. Such container shall have proper trap connection to sewer.

PROTECTION:

Necessary protection from unclean and insanitary conditions in the process of production, preparation, manufacturing, packing, sorting and distribution shall be provided, as per section 3079 of the Municipal Code.

No freezer unit shall be installed in such a way that it is subject to contamination by dust, dirt, flies or handling by customers. To this end, the following necessary protection shall be provided for the various types of installation:

1. *Freezer unit may be installed in a separate room* connected with a retail food establishment, provided that the food establishment is properly protected from flies, and, further provided, that the public has no access to that room.

2. *Whenever a freezer is installed on a counter of a retail food establishment,* to which the public has access, the protection necessary shall be an enclosure of glass, wood or sheet metal, or material of a similar character, on three sides, of sufficient height to give adequate protection. That side of the freezer facing the public must in all cases be provided with such protection.

3. *Counter freezers installed on the back bar of any retail store.* If such back bar is located more than six feet from the side of the counter to which the public has access, no further protection shall be required in a fly-proof building.

4. *Where ice-cream freezers are installed in windows* of such premises where the public is excluded from such windows by counters, cabinets, or other devices, no further protection shall be deemed necessary. Where counters, cabinets, or other devices are not provided to exclude the public, the necessary protection shall be an enclosure of sufficient height to prevent contamination.

5. No freezer unit shall be installed in any open-front building or any other enclosure not protected against dust and flies in an approved manner.

Installation of counter freezers shall not be made beneath transoms, or at open front doors where street dust and flies may contaminate the product, unless a complete enclosure on four sides and top is provided.

Adequate toilet facilities and soap and clean towels shall be provided.

No counter ice-cream freezer shall be established or maintained in any cellar, basement, or any other place not provided with sufficient natural light.

Adequate ventilation shall be provided by means of windows, skylights, airshafts, or air ducts, and if necessary by mechanical apparatus.

(FRONT)

BOARD OF HEALTH—CITY OF CHICAGO

Retail Ice Cream Manufacture — TIME Date

Business Occupies — Address — Occupant — How long occupied? Inspector

Floor Part Basement Front Rear Window Space %Fl. Space
Freezer Type Capacity Gals. State License Permit No.

Utensils — Cleanliness — Defects

Sterilization Facilities — Steam — Hot Water — Size of sink x x — Temp. of water

Final Mix Boiled — Temp. — Required — Hour to Cool to 35°F.

Counter Freezer — Make — Cleanliness

Glass protection — Three Sides — Top — Height — Efficient

Milk Supply or Mix From — Past. Permit No.

Date of Past.

Time Delivered — Time Boiled — Storage Temp. — Freezing Temp.

How is Mix Cooled After Boiling — Thermometer Used

Employees Clean — Healthy

Freezer Cleaned — Disinfected — Before Using

Alkali — Bushes — Chlorine — Screens

State What Contaminating Influence Exists

Toilets — Adequate — Convenient — Lavatory — Soap and towels — Hot Water

Orders and employees names on reverse side

(REVERSE)

Orders — Date sent — Days limit

NAME OF PERSON MFG. ICE CREAM OR CLEANING UTENSILS — ADDRESS

BOARD OF HEALTH—CITY OF CHICAGO, BUREAU OF DAIRY PRODUCTS

Distributor — Address

Name of owner .... Dist. No. ....

Collected at .... Location ....

Past. Plant Platform Store Wagon Office

Milk from — Address

Inspector ...... Day ...... Date ...... Hour ...... M. Attendant ......

Sample No.	Sample of	Past. or Raw	Container	Approximate Amt. in Container	Serial Number Day Marks	Temp.	Result of Analysis				
							Bacteria per C.C.	Butter Fat %	Sediment	Solids not Fat	

President of Board

(Reverse)

CHICAGO BOARD OF HEALTH MILK STANDARDS

Chemical:

Milk shall contain not less than eight and one-half per cent of milk-solids-not-fat, and not less than three and one-quarter per cent of milk fat.

Cream shall contain not less than eighteen per cent of milk fat.

Buttermilk and cultured buttermilk shall contain not less than eight and one-half per cent of milk solids-not-fat.

Bacteriological:

Pasteurized milk and skimmed milk shall not contain more than 30,000 bacteria per cubic centimeter.

Pasteurized cream shall not contain more than 60,000 bacteria per cubic centimeter.

Raw milk to be pasteurized shall not contain more than 200,000 bacteria per cubic centimeter.

THIS SLIP IS A RECEIPT FOR YOUR SAMPLE, and you cannot get your test without it, unless it has been destroyed or lost, when satisfactory evidence of the fact must be given. No results of tests will be given by telephone: either present this slip for your test or mail it, with a stamped, self-addressed envelope, and the result of test will be sent you.

For further information address

Chicago Board of Health, Bureau of Dairy Products,
Room 707, City Hall, Chicago, Ill.

Worcester, Mass., reports as follows:

If an inspector of milk, board of health or other officer or department enforcing these regulations obtains a sample of frozen dessert and finds the bacterial content thereof in excess of that provided in these regulations, he shall send the result of such analysis to the person from whom the sample was taken or to the person responsible for the condition of the article. If, within a period of not less than 7 days nor more than two months thereafter such inspector of milk, board of health or other officer or department enforcing these regulations obtains subsequent samples, such samples shall be obtained from three containers at substantially the same time or one sample each day on three different days within a period of two weeks. It shall be deemed to be a violation of these regulations if the majority of these subsequent samples exceeds in bacterial count that provided therein.

Said chapter ninety-four is hereby further amended by striking out section sixty and inserting in place thereof the following:—Section 60. Each inspector of milk shall institute complaints for the violation of any provision of sections forty-nine to fifty-eight, inclusive, sixty-two or sixty-five G to sixty-five S, inclusive, except subsections (c) to (e), inclusive, of section sixty-five P, on the information of any person who lays before him satisfactory evidence to sustain such complaint, if he has reasonable cause to believe that said provision has been violated.

He may enter each place where butter, cheese or imitations thereof, or frozen desserts or ice cream mix as defined in section sixty-five G, are stored or kept for sale, and shall take samples of suspected butter, cheese or imitations thereof, or frozen desserts or ice cream mix, and cause them to be analyzed or otherwise satisfactorily tested and shall record and preserve as evidence the result of such analysis or test. Before commencing the analysis of any sample in any proceeding for violation of any provision of section forty-nine to fifty-one, inclusive, and sixty-five G to sixty-five S, inclusive, the analyst shall reserve and seal a portion of the sample, and, upon complaint made against the person from whom such sample was taken, such reserved portion of the sample alleged to be adulterated shall, upon application, be delivered to such person or to his attorney. The expense of such analysis or test, not exceeding twenty dollars in any one case, may be included in the expense of such prosecution.

Louisville, Kentucky, provides as follows:

The inspectors, in taking official samples of ice cream are to be provided with:

(1). Sterile pint or half-pint mason jars, with glass cover, or if metal cover the inside glass lining must be broken out.

(2) With sterile long-handle spoons, which are sterilized in the laboratory and wrapped in paper.

In taking the sample of ice cream, the inspector is instructed to take the sample from an unopened can, if possible, and to dig down into the ice cream with the spoon.

For bacteriological samples, at least 4 oz. are taken.

For chemical samples—1 pint of the frozen cream is obtained.

Ins. No. 16675 STATE BOARD OF HEALTH OF KENTUCKY Date..........

BUREAU OF FOODS, DRUGS AND HOTELS Hour.......

Sample of Quantity Price

Dealer Salesman

Town Street

Manufacturer

Wholesaler or Jobber

Guaranteed by Date of Invoice

From Original or Broken Package Control No.

Amount in Stock Condition of Storage

Original Label

REMARKS

Sample delivered to Date Inspector

(Reverse)

STATE HEALTH LABORATORIES
ANALYTICAL REPORT

Ins. No. ______ Date Rec'd ______

Lab. No. ______ Date Rept'd ______

Recommendation

Chemist

HEARING AND COURT DATA

Notice sent to Mfg. Jobber, Dealer

Date of Hearing

Decision

Reported to ______ Attorney

Head

18 *Does your official analysis report show time the ice cream was made? Sampled? Analyzed?*

	M	S	C	I	P
Date made	1	0	0	9	1
Date sampled	24	7	2	10	4
Date analyzed	25	8	3	11	4

One private commercial laboratory records the hour of sampling and analyzing.

19 *Are unopened, half-pint, pint or quart samples sent to the laboratory for bacteriological testing?*

	M	S	C	I	P
Unopened samples only	1	0	0	2	0
Both opened and unopened including bulk	26	5	3	16	6

One laboratory reports sampling the frozen dessert as sold to the consumer in a manner similar to the sampling of fluid milk and cream.

20 *Is all apparatus used for sampling bulk ice cream sterilized in the laboratory?*

	M	S	C	I	P
Affirmative	24	4	0	15	6
Negative	4	4	1	3	1

Sample containers invariably are sterilized in laboratory. Thief tubes and glass tubes are always sterilized in laboratory. When spoon, knives, cheese triers and dippers are used they may or may not be sterilized in laboratory. Burning off alcohol or dipping in boiling water is used for sterilization when not in laboratory. Lehmkuhl of Rochester, N. Y., uses glass sampling tubes because he does not feel sure that aluminum tubes are properly cleaned.

22 *Do you sample from previously opened containers?*

	M	S	C	I	P
Affirmative	17	3	0	1	2
Negative	7	3	4	1	3
Rarely	3	2	1	5	1

23 *When sampling small unopened packages, do you remove the surface layer and take your portion from beneath?*

	M	S	C	I	P
Affirmative	15	5	5	11	7
Negative	10	2	0	4	0

One municipality uses whole package only.

One state laboratory removes portions from top, middle and bottom of package.

24 *Do you take added precautions when sampling previously opened containers? If so, what are they?*

	M	S	C	I	P
Affirmative	10	3	2	4	6
Negative	8	2	0	4	0

25 *Do you use spoons, butter triers, or electric drills when sampling bulk ice cream?*

	M	S	C	I	P
Spoons	17	5	2	12	3
Triers	3	2	—	2	3
Knives	1	—	—	—	—
Spatulas	3	2	1	4	—
Scoops	3	—	—	1	—
Depressors (tongue)	1	—	—	—	—
Large pipettes	1	—	—	1	—

St. Louis reports as follows:

Our milk control service in charge of this work have not to date taken samples from unopened cans of ice cream, plant sampling is done by taking samples according to Standard Methods as the ice cream comes from the freezer. Samples are removed from broken cans of ice cream by using the instrument used for this purpose by the vendor offering the product for sale, and without sterilization, on the theory that the sample so taken will reflect the sanitary quality of the product as it is sold to the consumer, that is more nearly so than when taken with special precaution.

26 *Have you special containers for transporting the sterilized spoons and other sampling apparatus? Explain.*

Use is made of screw-top mason jars, fiber cases, paper bags, parchment paper, pipette boxes, glassine bags, canisters, envelopes, cotton-plugged glass tubes, and special sterilizing kits for containers of sampling devices.

27 *What is the time and temperature used for sterilizing (a) glassware? (b) agar?*

Majority are using standard methods recommendations but a few reported as low as 160° C. for 30 minutes to 210° C. for 2½ hours. One municipality reported sterilizing for 24 hours at 170° C. Greater uniformity was observed in steam sterilization methods, ranging from 15 lbs. for 15 minutes to 20 lbs. for 30 minutes.

28 *Do you sample the ice cream ingredients?*

	M	S	C	I	P
Affirmative	16	2	2	20	7
Negative	12	5	3	1	0

29 *When sampling ice cream mix, cream, milk, skimmed milk, evaporated milk, condensed milk, do you agitate the contents of each can with a sterile stirrer?*

	M	S	C	I	P
Stirrer affirmative	19	3	2	11	0
Pipette affirmative	2	1	0	2	6

Some shake or pour, when practical, to get sample.

30 *How is stirrer sterilized between repeated samplings?*

	M	S	C	I	P
Separate stirrer sterilized in laboratory for each container	10	0	2	4	1
Repeated use but subjected to practical sterilization between samples	9	3	1	12	4

Use is made of burning alcohol, chlorine and hot water or steam for practical sterilization at frozen dessert plants.

31 *When sampling non-perishable items, such as: gelatin, sugar, milk powder, etc., what procedure is followed?*

Use is made of spoons, sterilized either at the laboratory or by burning alcohol from them at the plant.

Some shake container and pour out sample. Others dip a sterile vial beneath surface. In industrial plants, the mix is often caught as it goes into hopper or as it leaves freezer. The ultra-cautious char the exterior of barrels with a torch and remove sample with butter triers and open sacks with the greatest of care, scrape off the surface and use sterile spatula for obtaining sample.

Kansas State University reports as follows:

Agitate if possible before sampling—but when sampling from sacks, barrels, etc., dig down into middle of package (at least 4 inches below surface) and remove with a sterile spoon about 50 grams. This is placed in a wide mouth container (sterile) and thoroughly shaken before ultimate gravimetric sample is removed. Container should be sufficiently large so that a 50 gram sample does not occupy more than half the volume. Shaking is more satisfactory than pouring out on sterile paper and mixing with sterile spatula—less contamination.

32 *Are the results from such samples used officially?*

	M	S	C	I	P
Affirmative	6	1	0	8	1
Negative	5	3	4	5	1

33 *Do you take samples from vats? Do you follow A.P.H.A. methods when doing so?*

	M	S	C	I	P
Vat samples, affirmative	16	2	1	16	4
Vat samples, negative	7	5	2	3	1
A.P.H.A. Method, Affirmative	19	1	1	14	3
A.P.H.A. Method, Negative	0	1	0	3	—

34 *What amount of ice cream does the inspector remove for the official laboratory sample?*

	M	S	C	I	P
Less than ½ pt.	19	3	1	11	2
½ pt.	4	1	1	3	3
1 pt.	2	5	0	0	0

35 *Do you use wide-mouthed ground glass-stoppered bottles of at least 125 ml. capacity for laboratory samples?*

	M	S	C	I	P
Affirmative	12	4	1	4	3
Negative	15	4	2	12	4

36 *Do you use screw-topped, metal-capped, glass vials of 1 oz. capacity for laboratory samples?*

	M	S	C	I	P
Affirmative	0	0	2	5	2
Negative	12	4	1	13	3

37 *If other containers are used, describe briefly.*

Use is made of containers as follows:

(a) By cities, (1) 8 oz. corked bottle for mix, (2) 60 cc. wide-mouthed, glass-stoppered bottle, (3) aluminum-covered round bottles, (4) 125 cc. bottles with screw bakelite caps, (5) pint mason jars and (6) 250 cc. wide-mouthed, screw-capped jars.

(b) By states and provinces, (1) milk bottles, (2) 4 oz. screw-topped metal-capped bottles and (3) as sold by vendor.

(c) By colleges and universities, (1) ½ pint milk bottles with sterile fiber caps.

(d) By industrial commercial laboratories, (1) aluminum, rubber or glass stoppers on 125 cc. bottles, (2) aluminum foil on 200 cc. bottles, (3) wide-mouthed, cap stopper on 1 oz. bottles, (4) wide-mouthed, cap stopper on 2 oz. bottles, (5) rubber-stoppered test tubes, (6) 4 oz. grape juice bottles, and (7) 4 oz. screw cap, glass jars.

(e) By private commercial laboratories, (1) wide-mouthed, glass-stoppered 250 cc. bottles and (2) cartons as used by manufacturer or vendor.

38 *Are all samples tested on day of sampling?*

	M	S	C	I	P
Affirmative	27	5	2	13	5
Negative	1	2	1	7	*1

* As received.

39 *What is maximum interval between sampling and plating?*

	M	S	C	I	P
Less than 1 hr.	4	1	0	3	1
1 to 2 hrs.	4	2	0	2	2
2 to 3 hrs.	5	1	0	0	0
3 to 4 hrs.	8	0	2	3	0
4 to 5 hrs.	2	0	0	2	0
5 to 6 hrs.	3	1	0	0	2
Over 6 hrs.	2	3	2	11	0

Miscellaneous reports as follows: Los Angeles, 7 hours; Detroit, 16 hours; Lansing, Department of Agriculture Chemical Laboratory, 12 hours; Indianapolis, Indiana Division of Public Health, 24 hours; Sacramento, California Department of Agriculture, 5 to 6 days; Purdue University, 24 hours; Kansas State University (State Inspection Samples), 24 hours; industrial commercial laboratories from 24 to 72 hours up to 30 days at 10° F.

40 *What distances are samples transported between sampling and examination? Average? Maximum?*

	M		S		C		I		P	
	Av.	*Max.*	*Av.*	*Max.*	*Av.*	*Max.*	*Av.*	*Max.*	*Av.*	*Max.*
Less than 2 miles	15	5	3	1	1	1	11	8	1	0
2 to 5 miles	8	10	1	0	0	0	1	0	3	0
5 to 10 miles	3	4	0	2	0	0	2	3	0	1
More than 10 miles	1	8	3	4	3	3	5	7	1	2

41 *What time interval elapses between sampling and delivery at laboratory? Average? Maximum?*

	M		S		C		I		P	
	Av.	*Max.*	*Av.*	*Max.*	*Av.*	*Max.*	*Av.*	*Max.*	*Av.*	*Max.*
Less than 1 hr.	15	7	3	1	2	1	11	7	4	3
1 to 2 hrs.	7	4	1	0	0	0	0	3	1	0
2 to 3 hrs.	3	6	0	2	0	0	0	0	0	1
3 to 5 hrs.	2	6	1	0	0	1	5	2	0	0
More than 5 hrs.	0	2	2	3	2	2	4	5	0	1

42 *Are well-insulated refrigerating cases used for transporting samples to laboratory? Explain style briefly.*

(a) Municipal
- (1) Hard paper bag in copper-lined tank with dry ice.
- (2) Asbestos-insulated cases with dry ice.
- (3) Metal-lined case in wooden box with cracked ice.
- (4) Cork-insulated metal box with cracked ice.
- (5) Street vendor's box.

(b) State Dept. or Provincial
- (1) Dry ice, cracked ice and salt in metal-lined box.

(c) College
- (1) 5 gallon ice cream cans with dry ice.

(d) Industrial commercial
- (1) Brine pads in small cases.
- (2) Dry ice about ice cream cartons.
- (3) Electric refrigerator in pasteurizing room.

43 *How many samples will case hold?*

	M	S	C	I	P
Less than 10	6	1	0	4	2
10 to 20	11	1	0	1	2
20 to 30	3	0	0	1	0
More than 30	1	2	0	2	1

44 *What refrigerant is used?*

	M	S	C	I	P
None	2	0	0	5	0
Electric refrigerator	2	0	0	2	0
Ice	13	1	1	4	4
Dry ice	9	4	1	7	1
Brine pads	0	1	0	1	0

45 *Do you use the "Jo-Lo" shipping containers?*

	M	S	C	I	P
Affirmative	0	4	0	*1	0
Negative	26	1	2	15	5

* Sometimes.

46 *Do you analyze samples of ice cream which have melted before arrival at laboratory?*

	M	S	C	I	P
Affirmative	2	0	0	1	3
Negative	23	5	4	15	2

Sometimes they are plated if brine is still below 32° F. or if evidence shows they are still lumpy.

47 *At what temperature and how long do you melt the laboratory sample before removing the portion to be plated?*

	M	S	C	I	P
45° C. for 15 min.	15	4	2	12	5
Room	9	2	2	7	0
Beads	1	0	0	0	0
Weigh frozen samples	0	1	0	0	0
180° F. for 1 min.	0	0	0	0	1

48 *After sample is melted do you vigorously shake or stir the melted mixture immediately before removing the portion to be plated?*

	M	S	C	I	P
Stir	6	0	1	1	0
Shake	21	6	3	18	6
Rotate	4	0	0	1	0

49 *Do you weigh or measure the portion removed from the laboratory sample for plating?*

	M	S	C	I	P
Weigh	8	4	2	3	2
Measure	21	5	1	18	5

One college laboratory reports weighing for research samples and measuring for routine analysis.

50 *Do you use the agar plate method?*

All laboratories reporting use agar plate method, in addition one state laboratory uses the Frost Little Plate technic.

51 *Do bacteriological pipettes conform to A.P.H.A. specifications* (see pages 5-7, Sixth Edition of Standard Methods)?

Nearly all laboratories are using approved 1 cc. pipettes with the following exceptions:

(1) New York City—special short, open-tipped pipettes to speed up delivery.

(2) Bucknell College—Exax 1 cc. pipettes.

52 *Which style of dilution bottle* (page 8, Standard Methods) *do you use? Describe style, if not illustrated.*

STYLE	M	S	C	I	P
6 oz. Fr. square, rubber stopper and 3 in. glass rod or Escher stopper type	14	—	—	9	*1
4 oz. wide mouth, ground glass stoppered bottle	2	1	1	2	†3
Small mouth, rubber stopper (probably prescription)	1	—	—	—	—
Cotton plug, 2 oz. Fr. square marked at 49.5 cc.	1	—	—	—	—
Grape juice, metal cap	1	—	—	2	—
125 cc. with "U-presit" cap	1	1	—	—	—
8 oz. screw cap (Bakelite)	1	—	—	—	—
6 oz. screw cap (Bakelite)	1	2	3	2	2
4 oz. screw cap (Bakelite)	—	—	—	1	—
6 oz. glass stoppered	2	—	—	—	—
1 oz. and 4 oz. glass stoppered	1	—	—	—	—
Non-absorbent cotton stoppered	1	—	—	—	—
Fr. square with metal foil cap	1	—	—	—	—
150 cc. rubber stopper in round bottle	1	—	—	—	—
Round bottom flasks	—	—	—	1	—
8 oz. prescription bottle with rubber stopper	—	—	—	2	—
6 oz. Boston round, screw caps	—	—	—	1	—
6 oz. oval with wine bottle caps	—	1	—	—	—
8 oz. Fr. square, "U-presit" caps	—	1	—	—	—
Metal screw caps	—	1	—	—	—
4 oz. parafined cork stopper	—	—	1	—	—

* Rod below stopper bent inverted L-shape
† Mushroom-shaped bottle.

53 *Do you use 11 cc. or 1 cc. for making the first dilution?*

	M	S	C	I	P
11 cc.	6	3	2	2	4
1 cc.	2	4	3	18	2
½ cc. to 49½ cc.	1	0	0	—	—
10 gm.	0	0	0	1	1
11 gm.	2	1	1	0	1
1 gm.	6	3	0	2	0

54 *What dilutions are employed?*

	M	S	C	I	P
1-10	2	1	1	4	2
1-100	22	6	5	20	6
1-1,000	27	6	5	16	7
1-10,000	10	2	5	4	5
1-100,000	1	0	1	0	1

55 *Do you use a sterile butter boat for weighing the portion for analysis?*

56 *If not, how is it done?*

	M	S	C	I	P
Boat	4	3	0	1	1
Bottle	4	1	3	2	1
Paper cone	0	1	0	—	—

57 *Do you use other than standard nutrient agar for plating? If so, what?*

	M	S	C	I	P
Affirmative	28	7	3	17	6
Negative	1	0	2	3	0

Some use sucrose standard agar or Ayres and Mudge's milk powder agar.

58 *What aids do you use when counting colonies on the agar plate?*

	M	S	C	I	P
Lens only	9	1	1	9	2
Buck counter	8	1	1	0	0
Steward counter	1	2	0	0	0
Lumi lens	7	0	0	4	4
? Aids	4	2	1	2	1
Binoculars	0	0	2	0	0
Phelan counter	0	1	0	3	0
No aid	0	0	0	2	0

59 *Do you report results as "standard plate counts"?*

	M	S	C	I	P
"Standard plate count"	22	5	5	19	6
Bact. per gm.	2	3	0	0	0
Colonies per cc.	1	0	0	0	0
Bact. per cc.	1	0	0	0	0
"Count"	0	0	0	2	0
"Official plate count"	0	1	0	0	0

60 *Do you use the direct microscopic method?*

	M	S	C	I	P
Affirmative	10	0	2	8	3
Negative	19	6	3	11	4

61 *Do you use 0.01 ml. of ice cream in preparing the slide for the microscopic count?*

	M	S	C	I	P
Affirmative	5	—	1	8	3
Negative	4	—	—	2	—
Stewart Slack	1	—	—	—	—
Newman Cal. method	1	—	—	—	—

62 *Do you use the Fay method in preparing the slide for the microscopic count?*

	M	S	C	I	P
Affirmative	2	—	2	.	2
Negative	13	—	—	8	—

63 *Do you test for the presence of the Escherichia-Aerobacter group? If so, what medium do you use?*

	M	S	C	I	P
Affirmative	8	3	4	18	6
Negative	17	4	1	2	—
Brilliant green bile	3	1	2	9	3
Endo	3	1	1	3	1
Lactose broth	5	—	1	2	1
Eosin methylene blue	4	—	—	4	2
Ricinoleate broth	—	—	1	1	—
Gentian violet	—	—	1	—	1

64 *Report all criticisms or suggestions to improve the ice cream section of Standard Methods.*

Manhattan, Kansas State University, reports criticism on ground glass-stoppered sample bottles as follows:

Remove the recommendation for the use of ground glass-stoppered sample bottles—unless extra precautions are taken, water runs in when the stopper is removed. Certainly the *preference* should not be given these containers which is at least implied by naming them first.

Worcester, Mass., reports as follows:

We suggest a faster Standard Method of determining the bacteria by the gravimetric method. We have tried the gravimetric method as outlined in the Standard Methods and have found that it involves too much time when a large number of plate counts are to be made. We have for the past 9 months used the following procedure and find the results very favorable and check with the procedure as described by Standard Methods:—

Balance two 99 cc. water blanks on cream scales. Weigh in 11 grams of the melted sample. When weighing, place the stopper in an inverted position on the platform beside the bottle. This makes a 1:10 dilution and other dilutions are made by the use of 1 cc. pipettes without further weighing. We find very little difference between counts where the volumetric method is compared with the gravimetric method.

Purdue University, Lafayette, Ind., recommends the elimination of present standard agar and use of duplicate plates. (It is assumed that they would replace standard agar with a more suitable medium.)

Massachusetts Agricultural College, Amherst, Mass., recommends 32° C. for incubation and study the necessity of determining the mold and yeast count. Also the study of other agars for plating.

City Dairy Company of Toronto recommend inclusion of rapid quantitative milk fat tests (modification of Babcock Method).

Purity Ice Cream Company of Montreal wants a section for determining the fat content of chocolate milk and ice cream beverages.

Abbotts Dairies, Inc., of Philadelphia, recommend as follows:

Elimination of all gravimetric ice cream dilution methods, with more attention to proper melting and volumetric measurement. Coordination and standardization of *B. coli* testing, with more significance to fecal and less significance to non-fecal members. Uniform standards very necessary in this test for comparative valuations.

65 *What other bacteriological methods have you adapted to the control of frozen desserts and what success has been achieved?*

New Hampshire State Laboratory of Hygiene reports the following record on tests for *B. coli* (colon group) in 147 samples—

Standard Endo plates for colon group organisms. Good success on test of 147 samples results as follows:

None in 0.01 cc.	30.2%
Not more than 10 in .01 cc.	72.0%
Not more than 25 in .01 cc.	82.7%
Not more than 50 in .01 cc.	91.4%

City Dairy Company of Toronto recommend the addition of a substance to the dilution water to determine what dilutions to use dependent upon the bacterial content present. The original method for differentiation is as follows:

Dichrome ¼% neutral red, ¼% methylene blue in distilled 100 cc. distilled water 1 drop to 10 cc. media or 1 cc. to dilution water. This method shows different colors according to bacterial content. If very alkaline, color would show green to blue, red, yellow, etc. Will detect bacteriological changes.

The Dairy Laboratories of Philadelphia want fairly severe standards for the presumptive colon test.

Abbotts' Dairies, Inc., of Philadelphia, use Simmons citrate agar in final confirmation of *B. coli* tests to determine fecal and non-fecal members and also members of salmonella group.

Hoods of Boston want eosin nile blue agar plates for *B. coli* counts in gelatin, eggs, etc.

A. H. Robertson, *Chairman*

R. L. Griffith	H. O. Way
J. H. Shrader	F. P. Wilcox
Horatio N. Parker	H. E. Bowman
F. Lee Mickle	C. K. Johns

Discussion

President Johns: Thank you, Dr. Robertson. Are there any questions arising out of the report of Dr. Robertson's Committee?

Mr. Friend Lee Mickle: I think that Dr. Robertson is certainly to be congratulated on doing a hard piece of work that has brought results. It has shown what should not be done in examining ice cream samples in the future and that is worth a great deal. By that I mean it has shown that there are certainly variations in methods that should be corrected and undoubtedly will be corrected through the work of his Committee and I have only two or three comments to make.

I have a group of workers examining increasingly large numbers of samples of ice cream and one of the things that has come to my notice is the great variety of products to be examined under the heading of frozen desserts; they range all the way from frozen colored water on a stick to the most elaborate frozen specialties, as we call them, looking like birthday cakes and our state dairy inspectors seem to like to pick up a very great variety. In the case of these frozen popsicles and things of that sort, the question has arisen of how big a sample we need; do we need four or five samples to have a sufficient amount to examine, or is it necessary to examine that type of product as much as the other type? I requested the inspectors to bring in three or four of them and then our workers reported. What should they do? One popsicle was orange, one raspberry, one grape—should they mix them or should they analyze them separately?

Another minor puzzling difficulty is the way to sample the bulk ice creams. I refer to the pint containers of mixed flavors, such as vanilla, strawberry and chocolate. Our workers have called my attention to the fact that it is many times more difficult to sample separate portions of these because of the manner of packing; the flavors run together and one particular package might have such a narrow strip of chocolate in it that it is difficult to get any of it out or at least enough out to test it separately, and the analysts have raised the question, should they try to take a portion from each flavor and then composite it and examine the composite, or should they make three samples out of the one-half pint by examining each flavor separately? I do not know the answer to some of these questions and I do not know that all of them need to be answered, but I just raise them as some of the practical difficulties that we run into.

President Johns: Are there any more questions? If not, perhaps Dr. Robertson would like to say a word or two.

Dr. Robertson: My work happens to be that of watching for food adulterations and misbrandings. While we have done nothing at all on bacteriological examination of ice cream in our laboratory, we do run into a lot of curious inspectors who are picking up rare specimens of frozen desserts. These samples are often annoying to us because sometimes we do not know how to classify them.

As to the size of the sample, since you make only one analysis in the form of a plate count, I would say the vender's amount—whatever quantity he sells—would be adequate on the specialties, providing no specific food solids standards are established by law. In the case of orange, grape and strawberry popsicles, I would analyze each one separately, since each sample represents a different mixture of carbonated water, sugar and flavoring.

When speaking of bulk ice-cream, I referred to that in large five-gallon cans. In the case of packaged ice cream, I referred to that which is already packed for retailing in pints, quarts or half-pints or even smaller: two, three, four-ounce containers. With Neopolitan types of ice cream, where you have three or four layers in a pint or quart brick, I recommend the packing of the sample in dry ice to prevent melting and subsequent mixing, if it is necessary to delay analysis. In the first place, I should discourage the sampling of Neopolitan types of ice cream.

Dr. H. A. Harding: Maybe I am asking things out of turn, but every once in awhile the question occurs to me, after we have wrestled with a lot of these technical matters: "Well, what of it? What is it all about, anyway?" The men in the laboratories get very much interested in the technical details of any proposition; they want to do it just as right as it can be done. This effort at standardizing methods is a natural expression of that very laudable desire, but we have been making bacterial plate counts of milk now for thirty odd years and I do not think very many of us have reached the point where we know what we mean after we get them. Under those circumstances is it not just a little premature to launch off on another whole set of bacterial plate counts of all of these other substances enumerated, when the problem may be twenty-five or thirty years more before we find out what those results mean?

It is a nice thing if the laboratory man does not have much to do and is afraid that he will run out of his job, to have a lot of things, technical things, to be working at. But, in the last analysis, those who take themselves and their work seriously really do want to be working at something which is worthwhile. I am just raising these questions; I am not trying to answer them—just sort of thinking out loud regarding a lot of these things. Maybe I am an annoyance for so doing; thinking may not be in order in some of these discussions.

Mr. Floyd C. Rath: I think Dr. Harding has hit on a good line; the only thing is, I wish he would think a little farther on some of those lines and maybe somebody can instruct us what is and what is not important along bacteriological lines of milk inspection.

President Johns: Well, I presume that Dr. Harding has his own view on this matter, but it seems to me that one thing was brought out in Dr. Robertson's report that was extremely interesting and important and that is, the difference between samples taken with aseptic precautions and those taken with the vender's dipper. It looks as though there might be quite a little public health significance in the enormous differences in counts that Dr. Robertson has shown there.

We will go on to the next paper, in which Dr. Breed is going to talk to us about "Progress in Standardizing Laboratory Procedures." Dr. Breed, of course, as the chairman of the Committee on Standard Methods in the American Public Health Association, is very closely in touch with the work not only in his own country but in other parts of the world and I am sure that he will be able to give us a very good picture of the way this work is shaping up from an internationl as well as from a continental point of view.

Dr. Robert S. Breed: I am interested in the point that Dr. Harding has raised. I thought we were all in agreement that effective milk control work is based on inspection work which is guided by laboratory work. Control work from the standpoint of preventing disease is generally regarded as desirable for ice cream as well as for milk.

PROGRESS IN STANDARDIZING LABORATORY PROCEDURES

ROBERT S. BREED

New York State Agricultural Experiment Station
Geneva, New York

SINCE the reorganization of the Standard Methods Committee of the Laboratory Section of the American Public Health Association that took place in 1932 the Committee on Standard Methods for the Examination of Dairy and Food Products * has been developed in such a way as to draw a number of new men into the work. These men are of two groups, administrative officials who are responsible for municipal, provincial or state milk laboratory work, and specialists actively interested in the particular work that has been assigned to them. The amount of work that has been done profitably in this field is very large so that this development has permitted undertaking several lines of effort that were not possible under the older method of organization.

Various new lines of investigation have been stimulated to clarify points that have been under discussion for many years. These deal particularly with the development of an agar of more satisfactory composition than the present standard agar † and with the use of an incubation temperature † that will stimulate the development of a greater number of colonies on agar plates, and, at the same time, make it less important to maintain an absolutely uniform temperature in incubation chambers. Both of these developments have to do with the generally used agar plate technic. A study of the methylene blue

* See Reports by this Committee in the Yearbook of the American Public Health Association for 1934-35, and for 1935-36.
† See articles that are to be published in the *American Journal Public Health* during 1936.

reduction test has shown that there are several places where this test needs better standardization. While the methylene blue tablets used in America permit a much better standardization than would be brought about where each laboratory attempted to standardize its own methylene blue solutions, the standardization of these tablets has not been perfect. The experience gained by the manufacturers of these tablets will permit a much better standardization of the tablets in the future. Moreover, studies by our Associate Referee, Dr. H. R. Thornton,* in this field indicates that methylene blue thiocyanate is a better dye to use in this work than the commonly used methylene blue chloride.

Progress has been made during the past few years both in regard to the development of a better technic for recognizing those beta hemolytic streptococci than cause milk-borne epidemics and in regard to our knowledge of the distribution and relationships of these organisms. Likewise, the characters that differentiate these streptococci from the ordinary bovine mastitis streptococci are better known than they were when the sixth edition of the Milk Report was issued.

The inclusion of a test for the organisms of the colon group in dairy products has stimulated still further studies of the usefulness of such a procedure. These studies are demonstrating the soundness of our requirement that indiscriminate testing of samples of dairy products for organisms of the colon group be discontinued. Useful information can, however, be secured where samples of definite types are examined, if these samples are taken in such a way as to eliminate the possibility that there has been growth of the organisms of this group in the sample. Some interesting papers discussing these problems are being presented before various scientific associations this fall.

* *Amer. Jour. Pub. Health*, 25, 1114-1117, 1935.

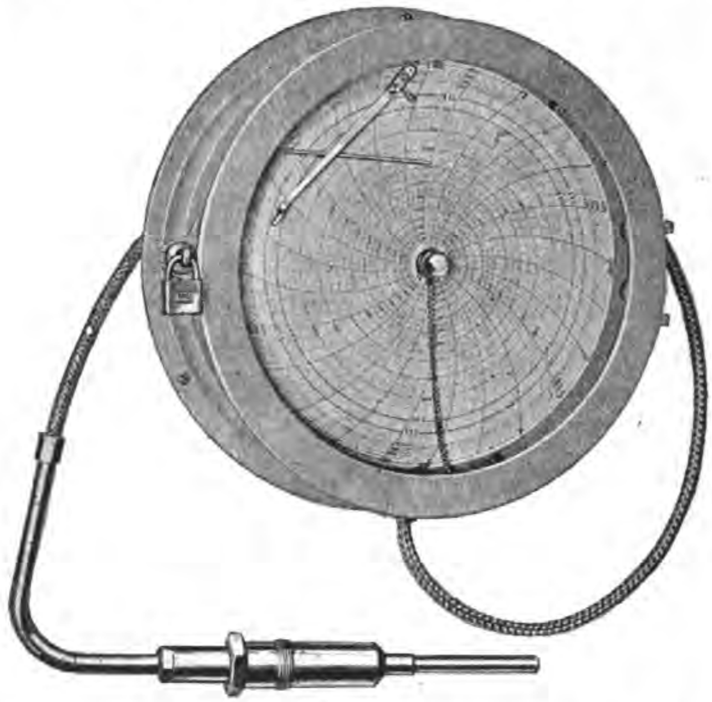
Interest is also being shown in the utilization of bacterial counts of samples of ice cream and other frozen products as a means of determining (1) whether the materials used have been properly pasteurized, and (2) protected from recontamination after pasteurization. The Committee maintained by the International Dairy and Milk Inspectors Association has been most cooperative and helpful in developing interest in this subject as has also the Committee on Ice Cream Methods maintained by the American Dairy Science Association.

For many years we have realized that sanitary conditions on farms producing cream for butter making and in some butter factories do not compare with the conditions that are being maintained on dairy farms where milk is produced. The development of laboratory methods for the examination of the finished product (butter) that will reveal something of the sanitary conditions under which the butter has been produced has stimulated interest in the introduction of a standard technic for this purpose. This should at least result in bringing about better clarification of the cream from which butter is made and we hope will produce more lasting benefits than this. The utilization of this technic has directed attention to a very unsatisfactory situation. While bacteriologists are not yet in entire agreement in regard to the significance that should be placed on yeast and mold counts from butter, research work in this field suggests certain possibilities for the use of laboratory technic of this type in official control work.

As the next Standard Methods Report issued by the American Public Health Association in this field is to include methods for the examination of ice cream and butter as well as for milk, it is probable that it will be given the title of "Standard Methods for the Examination of Dairy Products" rather than the present title of "Standard Methods of Milk Analysis."

TAG Standard Dairy Milk Recorder

The New TAG Universal Scale Indicating Thermometer with Full 1-16 inch Degree Divisions Over the Entire Range of Cooling and Pasteurizing.



THE TAG Standard Dairy Milk Recorder is fitted with stainless steel capillary tubing covered with a stainless steel braided armor. Here is a tubing that, while flexible, will stand a tremendous amount of rough handling without damage to the instrument, bulb or tube system. The braided armor will not fray, discolor or corrode.

Another feature of the TAG Standard Dairy Milk Recorder is the handle formed by the stainless steel extension piece of the bulb, by which the bulb can be easily removed from the pasteurizer for the daily cleaning operation. All danger, from rough handling, to the bulb and tube system is removed by this handle and tube construction. By utilizing a unique method of joining the extension piece of the bulb to the connecting tube, all brazing and soldering have been entirely eliminated.

These TAG Recorders have been subjected to severe actual running tests in many large dairies over a period of years. They have been proven to be rugged, sensitive and accurate.

C. J. TAGLIABUE MFG. CO.
Park & Nostrand Ave's., Brooklyn, N.Y.

"When Writing Mention This Report"

Your speaker found much interest in the general subject of the utilization and standardization of laboratory procedures for the control of the sanitary quality of dairy products in European and other countries when he attended the Tenth International Dairy Congress in Rome in May, 1934. English authorities are perhaps the most active in these fields, although public health workers in a number of European continental countries are also very active. Naturally these workers have examined carefully the work that started in America about thirty to forty years ago. At the moment, English agricultural authorities favor the use of the total count as a means of controlling sanitary quality in milk, but prefer to make the count on an agar showing the same composition as is used in America with the exception that one-half per cent to one per cent of fresh skim milk is added. Other English authorities believe in the use of a modified methylene blue test for the control of producers' milk and of tests for organisms of the colon group as a means of controlling the efficiency of pasteurization. The Ministry of Agriculture * in England has issued directions covering laboratory technic for use in clean milk competitions while the Ministry of Health has a committee working on the preparation of a report in this field.† Meanwhile, in Germany the committee authorized to prepare a report on uniform methods for the examination of milk have recommended the use of a bacterial count determined on lactose agar plates incubated at 30° C.

There is a general feeling in these European countries that it is desirable to bring about an international standardization of technic in this field so that a symposium is being organized in connection with the Second International Microbiological Congress that is to be held in London at the end of July, 1936. A number of persons, including representatives from the United States

* Bulletin No. 46, 1934.
† Medical Research Council, Spec. Rept. 206, 1935.

and Canada, have been asked to participate in this discussion.

During the coming year still further use will be made of an address list of 1000 or more laboratories in the United States and Canada using Standard Methods for the examination of dairy products, to distribute questionnaires and information which it is hoped will stimulate laboratory workers to give greater attention to a real standardization of the technic now in use. We are all aware of the fact that even laboratories that state that they are following standard procedures do not always follow the directions given in detail, even sometimes failing to observe quite important requirements.

The Committee on Standard Methods for the Examination of Dairy and other Food Products of the American Public Health Association has the following personnel at present: *Chairman,* Robert S. Breed; *Referees,* Mac H. McCrady, (Montreal), A. H. Robertson (Albany), F. C. Blanck (Washington, D. C.), C. A. Perry (Baltimore), A. J. Slack (London, Ontario), R. V. Stone (Los Angeles); *Associate Referees,* G. J. Hucker (Geneva, N. Y.), F. W. Fabian (East Lansing), C. C. Carson (Hartford), H. R. Thornton (Edmonton), W. A. Hagan (Ithaca), I. F. Huddleson (East Lansing), E. H. Parfitt (LaFayette, Indiana), C. S. Mudge (Davis, Cal.), F. H. K. Reynolds (Washington, D. C.).

Discussion

Dr. Harding: I think we have all enjoyed the report of progress which we have just heard here and I believe progress is being made—sometimes by a circuitous route.

Ten years ago, when Dr. Ward and I began to poke fun at the bacterial counts, a good many people were rather scandalized. If we had said and demonstrated as severe themes against standard methods' counts as was presented this morning by Dr. Breed's colleagues I think we would probably have been read out of the Bacteriological Society and possibly out of the Inspectors' Society, as well, so I think we are making progress. The present movement, as I understand it, and I think it is probably progress, is to shift our temperature of incubation down some five degrees centigrade, to around 32. It so happens that the temperature we have been trying to follow, of 37, is about on the lower range of the growth point of a good many of the organisms which are common to pasteurized milk. In shifting down we will undoubtedly increase the amount of growth we get in the raw milk of the flora which is accustomed to the out-of-doors. In that particular, I think it is quite an improvement. In doing so we shall shift our incubating temperature out of the range of a good many of the organisms which make up commonly the bulk of the flora in pasteurized milk.

Our standard counts, as we now have them, frequently represent as little as one-tenth of one per cent of the germ life actually present in the milk and that is low enough, the Lord knows. If we shift down, what proportion will we get out of the flora? I am not quite clear; you can say it can not be much worse than it is now and maybe that is true.

I think it is not generally recognized that the large proportion of the germ life in the pasteurized milk consists of those organisms which are either heat-resistant or heat-loving. As we shift our temperature downward we are shifting more and more out of the growth range of the organisms that make up the flora of the pasteurized milk. Now, maybe that is progress, but I maintain that it is progress in a somewhat circuitous route. However, so long as we are going somewhere I think there is a good deal of hope in the situation. We have a knack, after we run around in a circle, of coming back not quite to the place where we were originally, but probably a little up above, and so we are getting somewhere. We are on the way and are having a rattling good time going and I think we all ought to take it good-naturedly.

President Johns: Any further discussion on Dr. Breed's paper? Well, Dr. Breed, I am sure we are very grateful to you.

Dr. Breed: One purpose in sending questionnaires to milk control laboratories is to call their attention to specific requirements in these methods. In the section giving tentative methods in the last Standard Methods Report is a requirement that wherever there is evidence of the presence of any bacteria that do not develop on standard agar plates, it is required that additional samples from the same source be examined, preferably by microscopic examination in comparison with standard agar plates.

The presence of large, rod-shaped, presumably spore forming bacteria should lead to the incubation of agar plates at 55°C or even better at 45°C. No one incubation temperature can be selected at which all types of bacteria found in milk will grow.

President Johns: The last paper on our program for this evening has to do with the value of the colon test as a means of detecting insanitary conditions on the farm and is by Dr. M. W. Yale and Mr. R. E. Eglinton, of the State Agricultural Experiment Station, Geneva, New York. Dr. Yale, unfortunately, is unable to be with us and Dr. Breed will read his paper.

THE VALUE OF THE COLON TEST AS A MEANS OF DETECTING UNSANITARY CONDITIONS ON THE FARM *

M. W. YALE and RICHARD EGLINTON **

New York Agricultural Experiment Station, Geneva, N. Y.

THERE are many factors which must be taken into consideration when the colon test is applied to raw milk. Some officials have not considered all of the points involved and have used this test to indicate pollution with stable dirt, because members of the colon group are present in cow manure and materials such as soil, bedding and feeds. Ayers and Clemmer [1] and Sherman and Wing [2] have shown conclusively that the growth of the colon group in milk or on the surface of utensils makes such an interpretation of results incorrect.

Standard Methods of Milk Analysis † recognized the colon test in the first edition in 1910, but then dropped it until the last edition (sixth) when it was included as a provisional method. This was done in order to open the issue for discussion so that the value of this test for use in milk control work might be definitely decided before it is necessary to publish another edition of this report.

The limitations of the colon test as applied to samples of raw milk are stated as follows: "Unless a raw milk is tested within three or four hours after production or has been produced and cooled under such satisfactory conditions that the total count is low, that is, less than 10,000 per ml. growth normally plays such a part that it

* Approved by the Director of the New York Agr. Exp. Station for publication as Journal Paper No. 108, October 29, 1935.

** Bacteriologist and Dairy Inspector for the city of Geneva.

† American Public Health Assoc., 50 W. 50th St., New York City, cost $1.50.

becomes impossible to determine the significance of the results secured." Furthermore, this report states "Even in a raw milk tested within three to four hours after production, additional tests of samples drawn aseptically from the udder and of samples obtained from rinsing utensils, strainer cloths, udders, etc., in sterile water are necessary in order to determine the immediate source of any contamination with organisms of this group."

Much of the previous experimental work has been done, either with milk held for twelve or more hours at temperatures at which growth of colon organisms has occurred or results have been obtained experimentally which are not applicable to everyday farm conditions. In the present study, samples of morning milk which were usually not over four hours old were examined as delivered by approximately eighty-five dairies to two local pasteurizing plants. Samples were taken monthly from each dairy. Approximately 3,000 samples have been examined during the past three years.

Methods

Brilliant green lactose bile (two per cent) was used as the medium for the colon test during the first two years. This method, as we used it, yielded counts that were too inaccurate for research work and a lactose desoxycholate agar plating medium developed by Leifson [3] was employed during the third year. In using this method, 1 ml. and 0.1 ml. quantities of milk were plated and the large deep red colonies counted after twenty-four hours' incubation. While not entirely satisfactory, this medium yielded counts which were more accurate than those secured from the tubes of brilliant green bile wherein only a single tube each of a 0.1 and 0.01 ml. dilution was used for each sample of milk.

Results

Counts of colon organisms from individual dairies varied greatly from month to month. In order to determine the reason or reasons for this variation, four dairies were selected from which composite samples of morning milk were taken on consecutive days for a period of one month. In order to obtain fairly reliable counts of colon organisms, fifteen dilution tubes were inoculated per sample. In many instances, counts of colon organisms fluctuated markedly from one day to the next, even when the total bacterial count on yeast extract-dextrose agar remained approximately the same and when uniformity of atmospheric temperatures indicated that there should have been no appreciable difference in growth of organisms on utensils. The dairies were visited at the end of the month but the sources of the high counts of colon organisms were not located from farm samples probably because low counts were obtained from the dairies at the time. The failure to account for the variation in colon counts from day to day stimulated further study for it was evident that the identification of the source of these organisms was not to be easily accomplished. At this time the change was made from the liquid medium to the plating medium in order to secure a more accurate determination of the colon organisms present.

During the past year (August, 1934-August, 1935) plate counts showing the number of colon organisms present in samples of morning milk are available for 882 dairies. (Table 1.) The counts were less than 1 per ml. in 46 per cent of the cases; less than 10 per ml. in 83 per cent; less than 100 per ml. in 95 per cent and ranged from 100 to 5,500 per ml. in 5 per cent of the cases. An arbitrary standard of 100 per ml. or over was fixed for cases to be investigated. Thirty-three of the eighty-five producers or 39 per cent had counts exceeding this standard at some time during the year.

Table 1

PLATE COUNTS OF COLON ORGANISMS IN 882 SAMPLES OF FRESH RAW MILK TAKEN MONTHLY FROM 85 PRODUCERS, AUGUST, 1934-AUGUST, 1935

Plate Count per ml.	*Per cent of samples*
<1	46
<10	83
<100	95
100—5,500	5

More high counts of colon organisms were obtained in June, July, August and September than in other months. This suggests that high atmospheric temperatures which resulted in growth of colon organisms on utensils were a greater source of colon organisms than was stable dirt. This opinion was strengthened by the observation that cows and stables were kept cleaner during the summer months than during the winter months. Also, dairies believed to produce the milk freest from sediment were quite as likely to deliver milk containing large numbers of colon organisms as were dairies where conditions of cleanliness were not so good.

Thirteen dairies were visited where samples were taken from individual cows and rinses made from utensils to determine the sources of the colon organisms. In nine cases, the source of the colon organisms could not be located. Five dairies were visited previous to the morning milking. Results from these early morning visits furnished more valuable information than those from late afternoon visits. The ways in which colon organisms gained entrance to the raw milk were as follows:

UDDER INFECTIONS

An examination of 115 composite samples secured from individual cows in eight herds indicated that an infected udder was the source of the high counts of colon organisms in the case of two herds. The infection was traced in each case to a single quarter of one cow. In the first case studied, the milk was normal in appearance at the time the sample from the infected quarter was taken, although the dairyman observed that the quarter was swollen as he was stripping the cow. The dilution used in plating this sample was too low for an accurate estimate of numbers. When a second sample was taken thirty-six hours later, the count of colon organisms in the milk was 633,000 per ml. At this time the milk was clearly abnormal, resembling melted butter in appearance. Samples secured every two days showed a gradual decrease in the count of colon organisms until less than 1 per ml. was present on the tenth day when the milk was again normal in appearance. This case resembled those described by Hardenbergh and Schlottbauer,[4] Smith and Henderson [5] and other workers.

In the case of the second cow studied, a colon infection followed a severe teat injury which subsequently left a large opening into the milk cistern. The count of colon organisms in the foremilk from this quarter decreased from 59,000 per ml. when the infection was first noted to 17 per ml. four months later. Counts of colon organisms from the strippings were much lower, the highest count being 6,500 per ml. This observation, together with the fact that the nature of the injury made it difficult to secure aseptic samples indicates that the real source of the colon organisms was from the exterior and that this was not a true deep seated infection. However, growth of colon organisms probably occurred in the milk cistern. Milk from the injured quarter was normal in appearance at all times.

Stable Dirt

Stable dirt, some of which finds its way into milk under average conditions includes cow manure, soil, feed, bedding and other materials. The colon content of fresh cow manure may range between 100,000 and 10,000,000 per gram while in the case of dry cow manure it may be as high as 90,000,000 per gram. Ayers and Clemmer[1] point out that there is no relation between the colon count and the amount of manurial contamination because different samples of feces vary widely in their colon content. This is an important point for relatively clean milk containing a small amount of stable dirt of a high colon content may show as many or even more colon organisms than a milk containing a larger amount of dirt of a low colon content. Thus, it is evident that the colon test frequently fails to correlate with the amount of dirt present in the milk. Ayers and Clemmer[1] determined the number of colon organisms added to milk when cows were held and milked under exceedingly dirty conditions and found that in about 95 per cent of the cases, they were absent from 0.01 ml. quantities of milk. It is, therefore, evident that colon counts of 100 per ml. or over are not usually due to manurial contamination. Foreign materials, such as dried mud, dust and feeds add still smaller numbers of colon organisms to milk.

Growth on Utensils

Ayers and Clemmer[1] have shown that unsterilized utensils are the cause of the majority of high colon counts. In the case of three of the thirteen dairies visited in the present work, utensils were a significant source of colon contamination. At the dairy where the cow with the injured teat was discharging colon organisms into the milk, the pails were contaminated, the count of colon organisms per pail being 150 on March 15 and 600 per pail on July 27. The total bacterial count per pail exceeded 500,000,000 on the latter date indicating that the utensils were poorly washly and sterilized. The utensils probably received their original contamination with colon organisms mainly from the cow with the injury and possibly to a lesser extent from cistern water used to wash

"THERE IS NO SUBSTITUTE FOR FRESH MILK"

Certified Milk

is produced only by clean and healthy employees. All employees are required to keep themselves clean all the time. The following are some of the important points:

Hands **scrubbed before each milking, using scrubbing brush, liquid surgical soap, and paper towels.**

Inspected **when employed, and once a week thereafter by a physician.**

No man who has ever had *typhoid can be employed* upon a Certified farm.

No man allowed to work when *ill*, with either *fever* or *sore throat.*

AMERICAN ASSOCIATION OF MEDICAL MILK COMMISSIONS, Inc.

National Headquarters
1265 Broadway, New York, N. Y.

"When Writing Mention This Report"

utensils. The latter had a count of colon organisms of 170 per ml.

In the case of two dairies using milking machines, colon organisms were recovered in large numbers from the rubber parts at one dairy and from the milker pails at the other. The colon group comprised only 1 to 2 per cent of the total count. At one dairy, the well water had a count of colon organisms of 28 per ml. which may have contaminated the poorly sterilized milker pails for a culture of an *Aerobacter* type, similar in appearance on eosine methylene blue agar, was isolated in each case. Several dairies were visited where high total counts were obtained from utensil rinses although no colon organisms were detected. It is evident that the proportion of colon organisms to other types of bacteria is quite variable in the case of different dairies.

Growth in Fresh Raw Milk

In the case of the dairy where the cow had an injured teat, growth of colon organisms took place during the two hour interval between production at the farm and delivery to the plant. The increase was from 4 per ml. to 52 per ml. in the case of one can and from 1300 per ml. to 6200 per ml. in the case of a second can.

Summary

The fluctuation in the number of colon organisms from day to day in the milk from individual dairies is probably due chiefly to variability in growth of colon organisms on dairy utensils rather than to varying amounts of stable dirt added to the milk. While variability in growth on utensils may be due to changes in atmospheric temperatures, it appears that a difference in initial contamination of utensils affects the numbers present. If utensils are washed in contaminated water, the numbers present will be greater than where pure water is used. If the last milk strained is the dirtiest of the lot or comes from a cow with an infected udder, the pail and strainer retain a heavier initial colon contamination after they are washed than where such milk is strained earlier during the milking period. If growth of colon organisms takes place on

utensils, variability in colon counts from day to day may then be largely due to this difference in initial contamination, while general sanitary conditions may remain the same.

All of the conditions responsible for the presence of colon organisms in milk are undesirable so that positive results indicate conditions that should be corrected. However, the value of the colon test as applied to fresh raw milk is very slight, due to the fact that a great deal of time and energy are required to ascertain which of several conditions are at fault. The effort required to determine the significance of positive results might better be expended in other ways. Under conditions such as occur in Certified milk supplies, the colon test may have sufficient value to justify its use.

The main sources of colon organisms in fresh raw milk are summarized in Diagram 1.

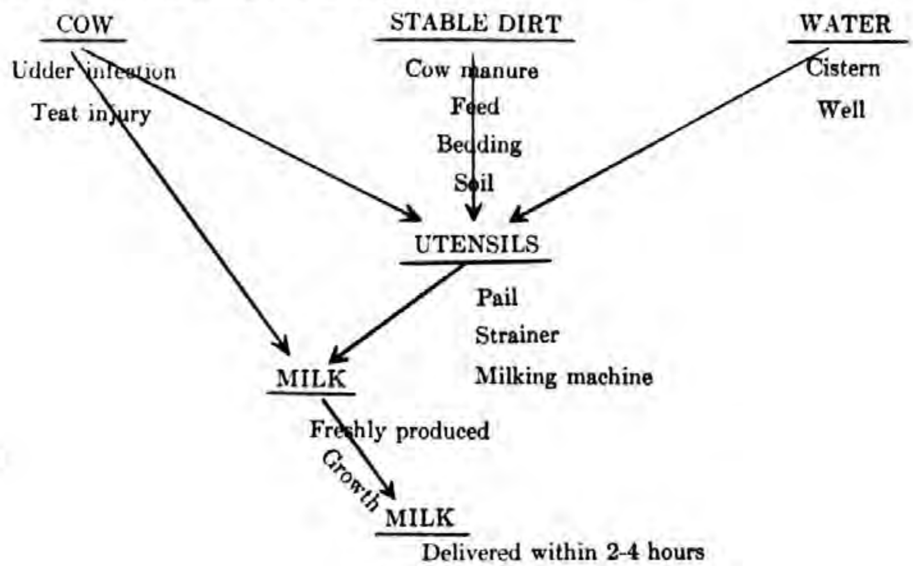


Diagram 1

Sources of Colon Organisms in Fresh Raw Milk

The above diagram shows that colon organisms may get into milk directly from udder infection, teat injuries or from addition of stable dirt. They may also be added to milk from utensils upon which growth of colon organisms has occurred. The utensils may have received their original contamination from the cow, from stable dirt or from farm water supplies used in washing utensils. Lastly, growth of colon organisms may sometimes take place in fresh raw milk even when it is delivered within two to four hours following production.

Conclusions

The colon test has only a slight value when used as a routine test of ordinary fresh raw milk supplies because:

1 Much time and energy are required to make the observations necessary to determine the true significance of high numbers of colon organisms.

2 The test yields misleading results as a test for dirt or fecal contamination since milk with a small amount of dirt containing numerous colon organisms may have as high or a higher number of colon organisms present than milk with a larger amount of dirt containing a less number of colon organisms.

3 Colon infections of the udder are too rare to make a routine colon test of mixed milk valuable as a means of finding them except possibly in the case of Certified or equivalent grades of raw milk. If samples are taken during the early stages of the infection, very high colon counts may be obtained.

4 High numbers of colon organisms are usually not due to manurial contamination but to growth on utensils and in milk.

References

1 Ayers, S. Henry and Clemmer, Paul, W., U.S.D.A. Bul. 739, 1918.

2 Sherman, James M., and Wing, Helen Upton, *Jour. Dairy Sci., 16,* 165, 1933.

3 Leifson, Einar, *Jour. of Path. and Bact., 40,* 581, 1935. Also personal correspondence, 1934.

4 Hardenbergh, John G., and Schlottbauer, Carl F., *J. Inf. Dis., 40,* 667, 1927.

5 Smith, F. R. and Henderson, J. L., *Jour. Dairy Sci., 17,* 799, 1934.

Discussion

Dr. Breed: Dr. Yale has made a sketch that brings out the complexity of the situation presented in his paper. (The use of the diagram is better than this discussion.)

President Johns: I spoke to Dr. Stark at noon today, but unfortunately he had to leave early this evening and could not be with us. I wonder if it would be imposing too greatly on Dr. Breed if we were to ask him to outline very briefly Dr. Stark's findings in connection with the significance of coli and pasteurized milk?

Dr. Breed: I would rather have that done by another man here. Dr. Brooks' group has been doing a lot of work along that line and I wonder if Mr. Tiedeman would not sum up what they have been doing. I think it was Mr. Leete who summed it up at Elmira.

Mr. W. D. Tiedeman: Dr. Stark gave the report at Elmira. I will not attempt to report exactly what Dr. Stark said but I can give you some of our own experiences in the use of the colon test. For some time our two field laboratory parties have been taking and examining process samples from pasteurizing plants. These consist of the mixed raw milk, milk taken directly from the pasteurizer at the end of the heating period, milk taken directly out of the pasteurizer at the end of the holding period, the first milk over the equipment and a bottle of milk later in the run. In the examination of these samples they almost invariably find coli in the raw milk which is, I guess, a common experience. They very rarely find any in the milk after it has been heated and not held.

In only a few instances—I do not have the figures here but I believe it was in about 12 out of about 1200 samples—we found positives in the milk at the end of the holding period.

Dr. Breed: That is in 1 cc, is it not?

Mr. Tiedeman: Yes, in 1 cc. We feel that the finding of colon organisms in milk taken from the pasteurizer at the end of the holding period raises the question as to whether pasteurization has been properly done. We have found a large number of positives in the first sample of milk over the equipment, when the sample from the pasteurizer gave negative results, indicating that in some way or another colon organisms had been introduced into the milk after it left the pasteurizer. We believe, as Dr. Stark pointed out, that it may get in in a number of different ways. Perhaps it indicates poor sterilization of equipment or perhaps water has dripped from the ceiling on to a milk contact surface or into the milk. There may be a number of different ways that they get it, but they do get in in a large number of cases and we feel that the colon test is particularly valuable to indicate some looseness in the method of handling the milk after it has been properly pasteurized.

Our work indicates, however, that the colon test is not satisfactory for use as an index of proper pasteurization, that is, the organism we ordinarily find in raw milk is killed at much lower than pasteurizing temperature.

President Johns: I have been very much interested in this paper of Dr. Yale and Mr. Eglinton as read by Dr. Breed. It so happens that during the past year I have had occasion twice a day to make platings and coli tests on freshly drawn milk, by which I mean milk which was sampled at the barn as soon as the can was filled and the sample taken directly to the laboratory for analysis. Under these conditions I think you will agree no growth would be possible. We found, during a six-week period in April and May, that our milk was almost without exception negative in coli in one cc quantities. When this experiment was again resumed in August we found in the majority of cases we were getting positive fermentation in the tenths and even in the one-hundredths of a cc. with the same technique; total count was practically the same, between the early spring and the warm weather. The utensils were sterilized in a pressure steam sterilizer; the samples, in the hot weather at least, were from a hand-milked herd, the cattle were on pasture and the conditions in the barn, generally, were much more favorable, much more satisfactory, and yet we were getting these enormously larger number of coli in our milk.

Now, if anybody can throw any light on the reason for that, I shall be extremely grateful.

Leslie C. Frank: I have been very much interested in the reading of this paper and also in Mr. Tiedeman's report, because I have been asked many times whether the colon test will soon be included as one indication of sanitation at the farm and at the pasteurizing plant. I have been afraid of it, quite frankly, because the laboratories in most of the communities that are doing milk control work are already over-burdened, and so I have been particularly interested in this diagram and in the conclusions Dr. Yale and Mr. Eglinton have reached.

Furthermore, with respect to pasteurized milk, I am interested to hear Mr. Tiedeman say that it was not concluded that the absence of the coli was necessarily an indication of correct pasteurization; they may be absent and still the temperature of pasteurization not be up to the legal requirement.

I would like to add to that that I am suspicious that the presence of the organism may not necessarily indicate poor pasteurization. It probably does, in a majority of cases, but not always. Several years ago, when we were hunting for a criterion organism to use for a test for pasteurization and sterilization, we attempted to isolate organisms of the colon group from pasteurized milk and while most of them, as Mr. Tiedeman reports, had been killed, we found a few which were not, and the strain we are now using for our research work is not entirely killed after a temperature of 140 degrees Fahrenheit has been applied for fifty minutes. Hence I think we should be quite cautious.

L. H. Burgwald: We have been carrying on a little research problem there at the University on the milk organisms that might throw a little light. We get samples from pasteurizing plants from over the State about every two months and we have in the past year collected over 500 samples of pasteurized milk from over 100 different plants in the State. They have been collected by the health departments in the various cities, iced and sent in to the university laboratory where, in addition to a standard agar plate count, we have been running a presumptive test for B coli and we have found that in these samples of pasteurized milk which are probably from twenty-four to thirty-six hours old, approximately 50 per cent of the samples have shown the presence of B coli in 1 cc samples of milk.

At the present time we are continuing the investigation to get samples from some of the plants directly from the pasteurizing vats immediately after the holding period, following up with a sample of the same milk at the bottom of the cooler and a bottle from the bottler of that same

"When Writing Mention This Report"

milk. We intend to examine these samples of milk for B coli at that time and then put them in the refrigerator and hold them until the next day and again sample them to see whether or not there will be a difference in the B coli content between the various times of making the test.

In our previous work we reported about 16 per cent of the samples showed heat resistance organisms, but due to the method of determining the thermal death point of heat resistant organisms there has been some criticism and we are again running these tests, using the Sternberg bulb for determining the thermal death point of these organisms, and until we have gotten them we can not say definitely whether 16 per cent of them are heat resistant; but, pastuerizing them at 145° in milk in a test tube immersed in water, with water at least 1 inch above the level of milk, we have found that about 16 per cent of those particular samples have withstood 145°F. for 30 minutes. The large inoculation used at this time is also another reason for repeating these tests.

Dr. Robertson: For several years it has been my opinion that the colon test should be reserved for the sanitary control of water supplies. The reason is because in milk one had to distinguish between initial contamination with and the subsequent growth of the colon organisms. Yale and Eglinton's work is outstanding because it shows that the colon organism is a common utensil organism. In many instances, particularly under humid conditions during the summer, it is probably present on utensils in relatively large numbers.

In the state of New York, the Department of Agriculture and Markets has supervision over the accuracy of the methods used when determining the bacterial content of certain grades of milk where premiums are paid to producers, based on the bacterial count. When premiums are lost, the dairymen claim that they have always handled the milk in exactly the same manner but still the count varies from one week to the next. Obviously, something different has occurred. In connection with this, I would call your attention to the fact that when the morning's milk is delivered uncooled it is quite possible that a direct relation exists between the failure to cool, combined with a heavy utensil colon contamination and the daily fluctuations in counts. These fluctuations in counts are most difficult to explain satisfactorily to the milk producers.

With reference to what Mr. Burgwald has said, it occurs to me that if 50 per cent of the samples showed colon, the results might be interpreted as an index of the efficiency of the pasteurizers.

Before the meeting, Dr. Holford mentioned some observations in which he noticed a difference in the growth of bacteria on utensils, depending upon whether the daily temperature was high or relatively low. I wish Dr. Holford would say something more about this for the benefit of this Association.

Dr. F. D. Holford: Our experience leads us to believe that atmospheric conditions play a very important part in the bacterial content cf dairymen's milk. During a recent test of 48 Grade "A" dairies where bacterial premiums are paid on the raw milk as it is delivered to the plant, chlorine sterilization was used on the utensils and cans just prior to usage. A close check was maintained on the methods of cleansing and sterilizing after each use and a test was run for a period of ten consecutive days. Samples for bacterial analysis (Standard Plate Method) were taken each morning as the milk was delivered to the factory. For the first three days the counts showed a marked improvement but on the following four days the counts were high. The last three days the counts again showed a marked improvement. During the four days when the counts were high the weather was very warm and the humidity high and we concluded that there was sufficient moisture in the atmosphere to create a condition on the utensils causing an increased growth of bacteria.

Later we collected some pails and strainers at several dairies where they had received the regular treatment of cleansing, and placed them in an incubator with the thought in mind of creating the same condition that we would have on a hot, humid night in summer. These utensils were incubated from twelve to fourteen hours. Samples were taken by a swab method and in practically each case excessive counts were present. The utensils were then scoured, washed and sterilized and again incubated, resulting in a low count in each case.

This experiment tends to indicate that on a hot night with high humidity there is sufficient moisture upon the utensils to develop a bacterial growth, especially in such cases where all organic matter has not been removed. It is our intention to continue this experiment under normal conditions this coming summer.

Mr. Tiedeman: In further comment on the point raised by Mr. Frank, I would like to say that of the 1200 cases in which we had process samples, only one per cent showed this heat resistant colon—that is, about one out of 100.

Now, of course, the point Mr. Frank raised is correct, but the colon organisms we find in raw milk are not particularly heat resistant. Our samples were taken under ordinary conditions, in some 900 plants in about 200 different municipalities, so I believe they represent pretty good average field conditions. It may be that in plants which do not have very good sterilization a few heat resistant ones develop.

In commenting on the point raised by Mr. Burgwald, I would say that in this same series of samples in which one per cent of the milk samples taken out of the pasteurizer, at the end of of the holding period were positive, we got 35 per cent positive for *B. Coli* out of the first milk bottled, indicating that in many instances organisms were picked up after the milk left the pasteurizer.

Dr. Corbin: In regard to the study of the *B. Coli* group of organisms in milk, I wish to advise that the Sheffield Farms Company has been doing considerable work on this for a number of years.

We found that in the production of Certified Milk it is important to be sure that the cows are properly washed and cleaned with clean water and clean towels. It is true that some cows secrete milk with the *B. Coli* group organism. Following our study of the milk supply from our Certified Farms, in an attempt to control *B. Coli*, it was necessary in order to eliminate this group of organism, to provide special supervision in the operation of producing Certified Milk. Special effort has been made on our farms to be sure that plenty of water is provided near the operator who washes and cleans the cows in preparation for milking. Wet hand milkers will cause the milk to become contaminated with the *B. Coli* group. It has been found that in all cases a separate wash cloth is essential in order to avoid contamination of the milk with this organism. It is impossible to avoid trouble when dirty wash cloths and dirty water is used.

In the production of Certified Milk it has been found that there is a high per cent of contamination by this organism coming from the dust and dirt that is permitted to accumulate on the cow beds under the bedding. It is therefore necessary to have the cow beds under the bedding cleaned daily and to use nothing but clean bedding.

In herds where it is necessary to control and eliminate *B. Coli* group organisms from the milk supply, it has also been found that it is necessary to make careful examination of the water supply used at that farm. A water supply may be found satisfactory at its source but highly contaminated in the storage tanks or in some of the water lines leading to the point where it is drawn for use in the operation. We have found it necessary not only to have all water supplies regularly examined at the source but it is more important to have the same supply examined at the several outlets where this water is drawn to be used.

In the study of the *B. Coli* group in our finished pasteurized milk and milk products wish to say that we have had considerable experience in this. We have found for instance that condensed water collecting on water pipes and other pipes directly over covered storage tanks of pasteurized products drops on the covers and contaminates the pasteurized product with *B. Coli* Group organism. It has also been found that condensed water under the hood of bottle conveyors and condensed water around the bottom of filler bowls has also been a factor that should be studied when attempt is made to eliminate *B. Coli* group organisms in pasteurized dairy products.

Naturally any carelessness in the cleaning of the equipment is necessarily important in the control of this condition. It is also important in the case of pasteurized milk products the same as it is in Certified Milk, to observe and continually check the water supply both at the source and at the outlet where the supply is taken for use at the several points in the plant.

Dr. H. N. Parker: I would like to ask Mr. Tiedeman whether he found any relationship between the sanitary condition of the farms and the *B. Coli* count or, to put it in other words, would you expect in a plant that was receiving milk from a farm that was contributing *B. Coli* liberally to find more trouble with *B. Coli* than you would in a plant that was particular in selecting its source of supply and getting milk that was handled in a cleanly manner?

Mr. Tiedeman: I am sure, Dr. Parker, I can not answer that question. Our samples of raw milk were taken from the receiving tank after individual producers' milk had been mixed together and no attempt was made to follow back to the farm. We expected to find *B. Coli* in the raw milk and almost always did. Our work was done to study the effect of pasteurization; perhaps Dr. Breed can answer your question.

Dr. George W. Grim: This discussion on *B. Coli* contamination of milk is one that is very interesting to me. I do not think we have to concern ourselves about the extra burden placed upon our laboratories were we to require them to run *B. Coli* tests routinely on all samples of milk. We have done this in our laboratories for the past fifteen or sixteen years and we feel we have been well repaid for our efforts. We all know that the healthy udders of the cow do not secrete *B. Coli* group organisms; and that when gas producing organisms are present in milk they get there by reason of contamination after the milk has been drawn from the udder. Whether or not we feel that we should spare special effort on the part of our laboratories as may be necessary to demonstrate *B. Coli* contamination of milk, contamination is entirely aside from the question. I think if we want to be sincere in our efforts to secure a pure milk supply it is our duty to find out whether *B. Coli* is present in the milk or not, and if it is present, how best to protect against contamination of this kind for the future.

I think what Mr. Corbin said along these lines is very much to the point; contamination frequently occurs in the plant following effective pasteurization due to the fact that the equipment was not properly cleaned or sterilized or was not properly constructed. Consider for an instance, the joint between fittings and milk piping with the cracks, the rough solder and the off center shoulders, there always lurks organisms responsible for contamination.

I think one of the chief sources of *B. Coli* contamination in milk plants is the floats supplied by all equipment manufacturers for use in bottle fillers or supply tanks between the pasteurizers and bottle fillers; of course, all floats are hollow and sooner or later all of them leak. When sufficient heat is applied to the float to effect sterilization a vacuum is created within and foreign material is sucked into the hollow closed float chamber and during operation the material which has been sucked in, oozes out. How one could be expected not to get *B. Coli* contamination under these conditions is beyond understanding. Neither can it be understood why manufacturers always make floats of the closed type. We know if we invert a bucket, immersing the rim in a liquid it will float and at the same time entrap sufficient air to provide the necessary buoyancy—it is not necessary to close the top of the bucket in order that it may function in the same manner as a float of the closed type. If a float of the open type was used in a bottle filler or in constant flow tank I am satisfied its performance would be equal to the floats of the closed type and that the cleaning difficulties, always present with closed floats would be entirely eliminated.

I know of one plant that has recently converted all of their closed type floats into floats of the open type. Since this has been done there has been an improvement with respect to both *B. Coli* and total counts.

There is a similar difficulty with the feed tubes which function as a guide for the float used in one of the popular bottle fillers.

I think it is up to us to see to it that a better job is accomplished in our plants with respect to cleaning and to the elimination of crevices and cracks, if we are to accomplish much in the way of eliminating *B. Coli* contamination.

With respect to farm conditions, we are all familiar with many of the conditions under which *B. Coli* may contaminate milk—they are many, they are multiple and they are very difficult to control.

Mr. E. K. Kline: If I might avail myself of the floor for a minute, as guest and laboratory man, could I answer the last statement by saying that you should not worry about putting the burden on the laboratory. As Dr. Breed pointed out in his discussion on Dr. Yale's paper on raw milk, where you find low count milk with high colon count, something is wrong. In milks of pasteurized grade you expect when you find a high colon count to put the burden on the inspector, to go back and find out where the mistake is, so do not worry about burdening the laboratory. Before sitting down, I would like to tell Dr. Harding that, as a laboratory man, I quite agree with him that milk inspection officials have been running around in circles and, in fact, sometimes we think they are dizzy.

Mr. Leon Bauman: My experience in this has been rather limited, but I would like to answer Dr. Parker's question from my experience. I do my own inspection, also my own laboratory work and (I have been quite surprised) I can, almost, tell the farm which will give high *B. Coli* count from a general inspection of the place; that is, the general cleanliness and carefulness with which they handle their utensils.

We have three pasteurizing plants in Lawrence, Kansas. I have run quite a number of coli counts on bottled milk, as distributed to customers, but have found only one of those high colon count in 1 cc.

Dr. Holford: I believe we can do considerable to reduce the colon count, especially where the growth takes place on the utensils, by keeping the utensils well scoured. The film that develops on utensils after they have been washed and sterilized a good many times must contain food for bacterial growth and that is one point that I wanted to emphasize: the scouring of utensils; we can better clean and sterilize a smooth surface than we can a roughened surface and utensils where they have been washed and sterilized a good many times will develop this roughened surface and in many cases you see an accumulation of so-called "milk stone."

Mr. Richard Powell: I have been listening to the discussion of *B. Coli* in milk both from the laboratory and the practical or dairy inspector's viewpoint. Dr. Grim just spoke on plant causes and Dr. Corbin on dairy causes. Dr. Corbin mentioned the wiping of five or six cow's udders with one cloth. I have inspected and surveyed dairies and dairy territory in some twenty-three states and I might say that 95 per cent of the dairies I have inspected and seen never had a cloth in the barn to wipe a cow's udder. With this condition and the condition of manure in the barnyards which the cows have to go through, there is no wonder, in my mind, that there is *B. Coli* in milk. I would suggest that all departments make a real effort to keep barnyards clean and free of manure, and then to educate the farmer to brush and keep cows clean at all times. If a wet cloth is used on cows teats, then some mild disinfectant should be used, such as chlorine. I might say as to plants that there is also much work to be done along the lines of education in sanitary upkeep. I had occasion to make inspection of a plant just lately that had applied for a permit to ship to our city. I made the plant inspection on a Saturday afternoon and found that the pumps and equipment had not been taken apart and properly washed and sterilized. I spoke to the men doing the work and they seemed to feel that because it was Saturday they could slip through this work and did not have to take the same care of equipment as on other days. I might say that this plant did not get a permit.

I would say as a summary that I believe if all departments of health and companies would put forth some real effort in educating the dairymen on keeping cows clean and barnyards free of manure as per our Newark Ordinance (manure fifty feet from barn and so disposed of that the cows can not get at it) and also educate the companies in plant sanitation, we would eliminate the so much-discussed item, "B. Coli."

Dr. W. L. Williams: I have heard quite a few references to the colon organisms and to the *B. Coli* group. I am wondering if the references are to the colon-aerogenes group or to *B. Coli* (the methyl-red positive, citrate negative organism). Also what medium was used in the presumptive tests.

Dr. Breed: I think in most of the dairy work they are testing for the colon group. Brilliant green bile was used as a presumptive test and the colon-aerogenes group was what they were interested in rather than *B. Coli* itself.

President Johns: There is not the same significance to *B. Coli* in milk as there is in water.

Dr. Holford: I would like to ask Dr. Breed if he has had any experiences with wet hand milkers.

Dr. Breed: By microscopic smear? Some can very surely tell a wet hand milker by looking at the direct microscopic smear. I think that is quite wonderful. I could not do it myself.

Dr. Holford: You can tell by looking at the milk stool, generally.

Dr. Harding: It seems to me that a part of the real interest and confusion in our thinking regarding these problems comes about because there are two very distinctly different problems involved; one large problem or group of problems has to do with technical matters of the laboratory end. We very frequently get these reports saying "No coli." I think it has been used several times this evening. Some years ago it was my good fortune to be associated with some rather careful tests in the coli group, in the very finest certified milk that we know anything about; that is Brookside Dairy at Newburgh, N. Y. We were getting no count from New York on 1/100 cc not infrequently and 98 per cent of those samples we studied showed the presence of *B. Coli.* We later made a study of fifty samples, at Detroit, Michigan, taking the routine bottle of certified milk brought in by the city inspectors. I forget now whether it was 97 or 98 per cent of those samples showed *B. Coli.*

If that is a condition in the very best certified milk, then you can figure that just about 100 per cent of the ordinary milk supply contains *B. Coli.* Whenever you report "no coli" in milk samples the joke is on you, because it is there and you missed it. That is the technical side of this thing and I think it is very thoroughly established.

President Johns: Will you indicate in what dilution you are referring to?

Dr. Harding: We did not dilute; all you have to do is set that bottle of milk in an incubator at 37° until the next day, then examine it and you will find anything from 10,000 per cubic centimeter up. They are always there. This question of the ability to withstand pasteurization was worked over carefully by Ayres about 1915 or 1914, who made a rather exhaustive study; as I remember his figures, 30 per cent of the strains he found would go through alive quite successfully—145 for thirty minutes.

Any time anybody examines a sample of pasteurized milk at a pasteurizing plant and reports "no *B. Coli,*" as I say, the joke is on them—that is just the laboratory end of it.

Now the other side of it is that this body of inspectors has to do with bottles of milk taken off milk wagons and delivered to the consumer. The work which has been reported by Dr. Breed shows rather clearly you are going to get some troublesome data. The discussion does not seem to get very far because the whole matter is a bit confused, but, as was pointed out, if we are to have data which we have some chance of interpreting into terms of those things which we are interested in as inspectors, we must have our samples within a couple of hours from the cow.

Obviously, we get samples on the wagon as delivered to the consumer, which are twelve or more hours from the cow. In the light of the paper already presented, it seems self-evident that neither we nor anybody else is in a position to interpret the results from these samples in a way that will throw light on the problems in which we are interested. If that kind of work—getting data that you can not interpret—is not a waste of time it seems to me it is very close to it! We have enough of that sort of data around laboratories now.

President Johns: If Dr. Harding is ever up in our part of the world I would like to show him some data we have been collecting for seven or eight years, using colon tests on raw milk, on pasteurized milk from vat and from bottle samples. We find that while we occasionally get coli positive in 1 cc of pasteurized milk in the vat, when we get a positive in the bottle from the same vat we know what to do about it.

That extra sample and that colon determination gives us a check on the washing and sterilizing of piping, etc. in a way that we can not get with a total count and for this reason I believe the colon test is of considerable value in milk plant control.

I will ask Dr. Breed to sum up the discussion at this point.

Dr. Breed: The discussion has brought out just what I hoped it would. It shows that the inclusion of the colon technic in Standard Methods as a tentative procedure was worthwhile.

A number of laboratories are using the colon test in the examination of dairy products in one form or another. They would not continue this work unless they secured results that they felt were of value. If these laboratories are placing the wrong interpretation on their results, further studies of that sort that Dr. Yale, Mr. Eglinton and others have been making should reveal this fact.

Dr. Harding has pointed out the difficulties that we face in regard to technic. The laboratories that use the colon test are using about as many varieties of methods for detecting these organisms as Heinz makes of pickles. There is no standardization of the technic and reports from one laboratory can not really be compared with those from other laboratories. We should determine which one of these technics is most adaptable for use on dairy products and then recommend that all laboratories use the same technic.

In regard to the point that Mr. Frank has raised, I do not think we have satisfactory data as yet to determine whether strains of colon organisms exist that are really able to survive pasteurization at 143°F for thirty minutes. Determinations of thermal death points are not readily made. Mr. Frank has carried through his thermal death point determinations under carefully controlled practical conditions. However, I believe the real answer to this question must be sought in observations such as those made by Mr. Tiedeman and his associates under practical field conditions.

There has always been much more interest in the use of this colon technic in Canada and in England than there has been in the United States. Many of you know McCrady and Langevine's paper that was published in the *Journal of Dairy Science* (Vol. 15, 321, 1932). This brought out the usefulness of the colon technic as a means of detecting inefficient pasteurization and of detecting recontamination after proper pasteurization.

Their study was made in connection with the Montreal typhoid epidemic. These men still use the colon test on samples of freshly pasteurized milk gathered from pasteurizing plants in the province of Quebec; and they report, just as Mr. Tiedeman has done for New York State, that 1 cc quantities of freshly pasteurized milk almost never give a positive colon test. When positive tests occur they usually find something at fault in the pasteurizing process.

When in Rome last year I talked with Dr. Savage of England about this matter. He is one of the best known of English dairy bacteriologists. I found that he was convinced that, in England, it would not be unreasonable to expect even thirty cc quantities of freshly pasteurized milk to be free from organisms of the colon group. English regulations call for pasteurization at a higher temperature than ours, *i.e.*, between 145° and 150°F for thirty minutes. However, coming back to the point discussed in Yale and Eglinton's paper, it is very doubtful whether it is worthwhile to make colon tests on samples of raw milk. I think you get further by doing good field inspection work than you do by burdening the laboratory with a lot of colon tests on raw milk.

Some of you may wish to look up the Report of the Committee on Standard Methods which will appear in the 1935-36 Yearbook of the American Public Health Association; and an article that gives the formula of the agar media that have been suggested as substitutes for the present standard agar. The latter appeared in the *American Journal of Public Health, 25*, 663-665, 1935.

REPORT OF COMMITTEE ON COMMUNICABLE DISEASES AFFECTING MAN

I

THE 1934 statistics on epidemics of disease carried by milk and dairy products are very similar to the 1933 figures. There were forty-nine epidemics reported in the United States and Canada with 1845 cases and forty-five deaths.

Table 1[1,2]

MILKBORNE EPIDEMICS, 1934

Diseases	No. of Epidemics	No. of Cases	No. of Deaths
United States:			
Typhoid fever	26	345	27
Septic sore throat	8	557	13
Scarlet fever	3	131	2
Diphtheria	1	9	0
Paratyphoid	1	400	0
Gastroenteritis	3	125	0
Food poisoning	3	220	0
Total—United States	45	1,787	42
Canada:			
Typhoid fever	3	37	3
Undulant fever	1	21	0
Total—Canada	4	58	3
Grand Total — United States and Canada	49	1,845	45

In forty-five outbreaks in the United States, the following dairy products were involved.

	No. of Epidemics
Sweet milk—raw	38
Sweet milk (?) *	1
Skim milk—raw	1
Cream—raw	1
Ice cream—raw	1
Ice cream—pasteurized	1
Sweet milk and cottage cheese—"raw"	1
Buttermilk and cottage cheese—"raw"	1

* There is evidence that some of the milk may have been raw.

The four epidemics in Canada were all traced to raw milk supplies. With respect to sweet milk alone, it is thus seen that in forty-three outbreaks, raw milk was responsible in forty-two instances and that raw milk was probably mixed with pasteurized in the supply involved in the other instance.

As usual, the milk supplies of large cities, where frequently the types of milk permitted are limited to pasteurized and certified, had no disease traced to them. Communities under 5000 population where pasteurization is not compulsory comprised nearly 75 per cent of the communities where milkborne epidemics occurred. Only one city of over 50,000 population was so involved.

Typhoid fever, septic sore throat and scarlet fever accounted for 82 per cent of the epidemics, 58 per cent of the cases and all of the deaths. Typhoid fever caused the largest number of epidemics but the greatest number of cases occurred among the septic sore throat victims. Carriers caused the largest number of epidemics, and cases on the dairy the second largest. The human health factor is thus again emphasized.

In the Canadian provinces in which a total of four epidemics with fifty-eight cases and three deaths were reported, the milk supplies involved were all raw. Three of these epidemics and all of the deaths were traced to typhoid fever; one epidemic of undulant fever occurred, twenty-one cases being reported.

II

The reports of this committee are largely dependent for new information upon the studies and researches of others: data published by health departments and health officials and results of investigations in infectious diseases reported in medical and other scientific literature. Each year a large number of such contributions appear and attention is directed to a few which have special significance or interest in connection with our particular problems.

Laboratory Examinations of Milk Handlers

A thorough appraisal of the problems in this field has been reported by Borman, West and Mickle [3-4] of the Connecticut State Department of Health. The comprehensive program undertaken in that State in 1927 "was initiated to bring the joint efforts of medical and laboratory science to bear upon the source of the majority of outbreaks of milkborne diseases, *i.e.*, upon milk handlers who are carriers or cases, by insisting that each handler of certain grades of milk be given periodic physical examinations by a licensed physician, and that this physician consider certain laboratory tests performed in an approved laboratory an integral part of his examination before certifying his opinion of fitness to handle milk." [4]

The observations reported, which include a discussion of replies received to a "milk handler questionnaire" submitted to 205 authorities, present a cross-section of considered opinion with respect to the cost, significance, reliability, and applicability of and results to be expected from routine laboratory examinations of milk handler specimens in relation to the prevention of milkborne disease.

Borman, West and Mickle also point out certain fundamental principles which they believe should be incorporated in a program designed to include minimum requirements. These principles bear so well upon questions that commonly confront milk control officials that they are repeated in the following excerpts from the original article [4]:

A program designed to attain an acceptable efficiency in preventing contamination of milk supplies by milk handlers who are carriers of organisms capable of causing disease in the consuming group, must first of all include handlers of all milk supplies over which administrative supervision can be exercised with a thoroughness compatible with success. Control of the very small dairy supplying one or a very few families is extremely difficult, if not impossible. In regard to pasteurized supplies, assuming that every portion of the milk is actually pasteurized according to a satisfactory definition, with adequate inspectional and plant control facilities, it is necessary to subject to the program only those handlers who may contaminate the pasteurized product, directly or indirectly, in the processes of cooling, bottling, capping, or distributing the milk. . . .

This program must then take into consideration the epidemiological significance of milk in the prevalence of the diseases from which the consuming public should be protected, and the means by which the incidence of milkborne disease can be most effectively reduced with the funds available.

The relative importance of the various types of milkborne diseases traceable directly or indirectly to carriers or cases among milk handlers can be judged from the number of consumers affected by each type since 1910. Infections with beta hemolytic streptococci occupy the front rank. Furthermore, the death rate per outbreak has been higher for these infections than for the others under consideration. . . . Typhoid fever and related infections comprise the next most important group in which the human carrier has been implicated. Milkborne diphtheria is comparatively rare and the use of toxin-antitoxin or toxoid will immunize the great majority of the susceptibles in any community and confine the occurrence of diphtheria from all sources to a few sporadic cases. Milkborne tuberculosis is almost exclusively confined to the bovine type which is outside our discussion.

A well rounded program should include laboratory examinations to detect carriers of the typhoid-paratyphoid-dysentery group of organisms. . . . An adequately large series of feces specimens should be examined to permit detection of the intermittent carriers. . . .Care should be exercised to insure the authenticity of these specimens. We have found little value in the Widal test as an aid in this connection and do not recommend its use. . . .

The detecting of diphtheria carriers is probably of major importance only in areas where the disease is prevalent. . . .

The examination of sputum for *Mycobacterium tuberculosis* is relatively unimportant from the standpoint of milkborne disease and may well be left to the discretion of the examining physician.

We see no sound reason for incorporating examinations for vegetative or encysted forms of *Endameba histolytica* in the program, in the light of our present knowledge, unless there is definite reason to believe milk an important factor in disseminating amebic infection to any given locality.

Local sanitary codes, rules or regulations should be amended to apply to handlers who are kept from handling milk under this program, and compatible release requirements incorporated.

Finally, a satisfactory physical examination made periodically by a licensed physician should be compulsory for all milk handlers subject to the requirements of the program. All specimens for laboratory examinations should be collected by him or under his supervision and all laboratory reports made only to him and to the proper administrative authorities. Both employers and employees should be made responsible for reporting to him, following his instructions, any suspicious clinical symptoms among the milk handlers.

Because of the importance of milkborne streptococcus infections a later study by Foote, Welch, West and Borman [5] was made to test the efficiency and practicability of methods applicable in a central laboratory for the detection of carriers of beta hemolytic streptococci. Pertinent conclusions from this study are quoted:

Transportation of throat and nose swabbings through the mails resulted in a reduction of approximately 50% in positive findings as determined by making control cultures . . . in duplicate before and after transportation. The time elapsing between collection and plating after transportation was approximately 18 hours.

Twenty (23.5%) of 85 milk handlers in the representative group selected harbored beta hemolytic streptococci, in throat or nose secretions or both, at least once during the three months of the study as determined by weekly cultures.

Five of the twenty individuals showing positive cultures were persistent carriers. . . .

. . . , the association between positive laboratory findings and such clinical symptoms as acute rhinitis, pharyngitis and tonsillitis, while statistically significant, was not sufficiently close to be of practical value for control purposes.

Individuals without tonsils or remnants of tonsillar tissue may be persistent carriers . . . in the absence of significant clinical findings.

Our results indicate that strains of beta hemolytic streptococci found in individuals in an average state of health are indistinguishable on the basis of biochemical and serological characteristics from strains of known pathogenicity for man. Assuming the lytic action of any strain on human fibrin to be associated with its invasive power, the majority of these strains are potential human pathogens.

With regard to the problem of milkborne streptococci infections and under climatic and other conditions similar to those under which this study was made, our results indicate that:

(a) Physical examinations alone are not sufficient for the detection of all carriers of beta hemolytic streptococci.

(b) Routine laboratory cultures are inadequate for the detection of all carriers unless made more frequently than is practicable under ordinary administrative conditions.

(c) Beta hemolytic streptococci do not withstand drying and other factors associated with delay in transportation to the laboratory sufficiently well for the detection of carriers in a central laboratory with any adequate degree of completeness.

(d) Two types of carriers of these organisms, transient or occasional and persistent, occur among milk handlers in an average state of health and the organisms of this type carried are potentially pathogenic for man, should sufficient numbers find access to the milk.

(e) The percentage of persons harboring these organisms is too large to permit adequate control of milkborne streptococcus infections by employing any practical measures to eliminate the carriers.

(f) Since the frequency of the carrier state seems to bear no close relationship to the frequency of milkborne streptococcus infections, outbreaks probably occur only when a comparatively large inoculum of infecting organisms reaches the milk from an udder infected by a milker or, probably less often, from some other source.

(g) Consumers must be protected against milkborne streptococcus infections by other means than by periodic physical and laboratory examinations.

A majority of those answering the Connecticut questionnaire were favorable to routine laboratory examinations of milk handlers as performed in Connecticut. Others expressed objections based on costs, questionable efficiency of tests in detecting carriers, false sense of security engendered, and so on. However, periodic examinations may have an indirect value that outweighs their shortcomings, namely, their educational value in making milk handlers and producers "health conscious" with respect to protecting milk supplies from human infections.

"Milk Poisoning" and Staphylococci

Outbreaks of so-called food poisoning have a varied and oftentimes obscure etiology. Bacteria or their toxins

and products caused by bacterial decomposition of foods are frequently the source of such troubles. Reports of outbreaks of "milk poisoning" appear from time to time but seldom is the epidemiology of these cases carried to a definite conclusion. The fact is that the bacteria that cause food poisoning are usually difficult to trace.

The most common types of such bacteria belong to the *Salmonella,* the *Shigella,* the *Staphylococcus,* the *Aerobacter* and the *Clostridium* genera. Of the staphylococcus group, certain strains of *S. aureus* and, less frequently, *S. albus* secrete a toxin which shortly after the food's ingestion causes gastroenteritis or other illness. The broth filtrates from such strains have the power to reproduce poisoning symptoms. The toxic principles are not destroyed by momentary boiling, chlorination or freezing.

As an example of milk poisoning which was conclusively investigated, the report of Crabtree and Litterer [6] on an outbreak due to a toxin-producing staphylococcus is worthy of note.

The offending organism was finally traced to the udders of two cows in a dairy supplying the institution in which the trouble occurred. Beginning in July, 1933, a total of 242 cases of food or milk poisoning was seen over a period of three months in a Tennessee missionary school in which the milk supply came from the school herd of 13 cows. At first the cases were characterized by acute and sudden onset of nausea and vomiting, and in some cases prostration. In later outbreaks, purging and diarrhea were prominent symptoms.

Following the last outbreak on October 20, 1933, all articles of food served at the meal immediately preceding onset and also pooled specimens of first vomitus of the patients were examined bacteriologically and chemically. All the foods except the milk contained only a very few bacteria of various types. The milk and the vomitus were found to contain hemolytic staphylococci in enormous numbers and practically in pure culture; these were of both the aureus and albus types, the ration of aureus being about 40 to 1.

The staphylococci recovered from the milk, the vomitus and the throats of food handlers were tested for toxin production and the toxin filtrates were tried on human volunteers. The yellow staphylococci proved to be toxin producers and the filtrates from them produced illness in all the volunteers. Eight persons were used as controls and were fed milk and sterile media; none became ill.

Since all the evidence indicated that the milk was the most probable vehicle for the "enterotoxin," samples were obtained from each of the 13 cows in the school dairy every other day for a period of five weeks. Two cows consistently showed a large number of hemolytic staphylococci in their milks, both aureus and albus types were found, the aureus predominating in ratios of from 25 to 1 to 60 to 1. Filtrates from the albus produced no symptoms when fed in 50 cc. amounts to human volunteers; filtrates from the aureus cultures produced illness when fed in 3 cc. amounts. The number of organisms per cc. of milk averaged 2,900 in one cow and 4,500 in the other. Some of the samples collected over the five weeks' period from these cows were entirely negative, indicating a "showering" of organisms at intervals. (This "showering" of bacteria from the udders is also encountered with some cases of streptococcus-infected udders). The offending cows were removed from the herd, refrigeration of the milk was improved, and no additional cases of poisoning occurred.

This report, which the authors believe to be "the first recorded outbreak of poisoning due to enterotoxic products of the staphylococcus where it was possible both to identify the enterotoxic substance, and to determine the source of the staphylococcus," contains another item which demonstrates the value of a simple fundamental rule in milk production: the infected milk used in the school itself (where illness occurred) *was not promptly and efficiently cooled* after milking. It was simply placed in large cans and stored in refrigerators where cooling was so slow that it apparently permitted bacterial growth and the formation of toxins. The same milk sent to the houses of the school principal and farm manager (where no illness occurred) was placed in small containers and stored in colder refrigerators where cooling was reasonably prompt and presumably inhibited growth and toxin-production of the infecting staphylococci. The importance of prompt and efficient cooling is obvious.

Hemolytic Streptococcus Infection

Another instance of a well-ordered and comprehensive epidemiological survey of milkborne infection is the report by Newitt, Glassen and Pryer [7] of a severe sore throat outbreak in Michigan in 1934. There were 186 known cases and six deaths in a rural community of about 700 population. While some cases presented manifestations of scarlet fever or erysipelas, the disease more nearly resembled septic sore throat.

The report portrays the action taken in running down the essential factors of such an outbreak: the preliminary survey to determine a common vehicle of infection; the evidence pointing to one dairy which supplied much of the milk in the community and which was not pasteurized; the identification of one cow in this dairy herd with hemolytic streptococcus infection of the udder; the withdrawal of the infected supply and substitution of a pasteurized supply; the survey to determine the "attack rates," etc., among users and nonusers, respectively of the suspected milk; the bacteriological, serological and immunological studies which established the identity of the streptococci isolated from the throats of patients with those isolated from one quarter of the udder of one cow in the suspected dairy. The report lacks definite information respecting the source of the streptococcus which infected the cow's udder, but the authors state that "the cow was probably infected by a hemolytic streptococcus of human origin."

Here in one epidemic are illustrated the protean characteristics of hemolytic streptococci in producing symptoms of scarlet fever, septic sore throat and erysipelas. It has been noted repeatedly that in some outbreaks of scarlet fever, scarlatinal rash symptoms predominate in some patients, while in others sore throat symptoms are paramount. As stated by Newitt, Glassen and Pryer in their paper: "Hemolytic streptococci associated with scarlet fever, erysipelas, and septic sore throat may well be variables rather than fixed strains deserving separate classification." In this connection, J. C. Sleigh, Medical

Officer of Health in Chelmsford, England, recently suggested[8] that the term "scarlet fever" be abolished and the term "hemolytic fevers" be adopted to cover the whole group of hemolytic streptococcal infections which, in his opinion, do not differ "in any matter of practical importance."

UNDULANT FEVER

The United States Public Health Service lists 2010 cases of undulant fever in 1934 reported from forty-one states. The number of these that are milkborne is unknown. Crumbine[2] lists two milkborne epidemics of undulant fever involving nineteen cases and two deaths which do not appear as part of the United States Public Health Service data on milkborne epidemics. The actual importance of *Brucella abortus* in the pathogenesis of undulant fever still remains to be evaluated.

Stone and Bogen[9] have reported their studies of correlated human and bovine brucelliasis. Their material had for its source three tuberculosis sanatoriums in Los Angeles County which were supplied with raw milk from three dairy herds in which nearly 30 per cent of the cattle showed agglutination titres of 1:100 or higher. The authors conclude:

> The results of this investigation indicate that the ingestion of raw milk obtained from cows infected with contagious abortion and showing positive tests for agglutinins to *Br. abortus* in their blood is responsible for the development of similar agglutinins in the blood of some consumers. This has been found to occur in about 8 per cent of those continuously exposed to the ingestion of heavily infected raw milk, but varies with the duration of exposure, the amount of infection in the herd, and the amount of the raw milk so consumed. No particular sex or age susceptibility to this infection has been found. No effect of tuberculosis or other disease upon the development of such agglutinins is apparent, except in so far as they affect the amount of exposure to the infected milk. The development of such agglutinins has not been found to exercise any marked effect on the course of the tuberculosis. More than half of the patients developing agglutinins to *Br. abortus* give no other manifestation of the infection and, therefore, come well within the groups described as sub-clinical, asymptomatic, or purely

serological brucelliasis. About one-eleventh of them manifest clinical symptoms warranting a diagnosis of undulant fever, and an additional group present other symptoms that might be attributable to the same cause. The disease manifestations are, however, comparatively mild, conforming, therefore, to the bovine type of infection, as described by Theobald Smith, rather than to caprine or porcine sources. It constitutes, however, a definite disease entity, and cannot be disregarded.

Thompson[10] has studied the elimination of *Brucella abortus* from the milk of ten cows whose blood serum showed agglutinins for the organism in dilutions of from 1:50 to 1:500. The cows were termed healthy carriers because they never manifested clinical symptoms of the infection (actual abortion). Both guinea-pig inoculation and direct Petri plate methods of isolation were used to detect the presence of *Brucella abortus* in milk samples obtained at intervals of thirty days over the entire lactation periods of the cows studied. From two to twelve tests were made on each cow (twelve tests in seven cows out of ten).

Of four cows that reacted to the agglutination test in dilutions of from 1:200 to 1:500, all showed *Brucella abortus* repeatedly in their milks by either one or both methods of isolation. Of three cows whose maximum blood-serum titres were 1:80, only one showed *Brucella abortus* in her milk and in only two samples out of eight that were tested. Of three cows with maximum blood-serum titres of 1:50, only one gave a positive result in the milk tested and this by guinea-pig inoculation from a single sample only. Thompson states that "it appears from the results that an animal whose blood serum agglutinates in dilutions not higher than 1:50 does not eliminate *Brucella abortus* with the milk." This is in accord with the observations of several other investigators to the effect that cows actually shedding *Brucella abortus* in the milk almost always carry agglutination titres of at least 1:100 and usually higher.

Of interest in the consideration of undulant fever at this time is the Federal Bang's disease testing program that has been carried on for over a year now as one of the emergency measures of the Agricultural Adjustment Administration. Originally designed to reduce dairy cattle populations and thereby to reduce milk surpluses, the A.A.A. allotted funds to the Federal Bureau of Animal Industry for disease control work which was broadened to include Bang's disease. The tests have been conducted more or less actively in all but two states of the Union since July, 1934, along somewhat the same lines as tuberculin testing was originally carried on. The federal government has paid indemnity to the owners of cattle reacting to the agglutination test amounting to not more than $50.00 each for pure-bred animals and from $20.00 to $25.00 for grade cattle.

A recent summary of this emergency Bang's disease work to June 30, 1935, shows that more than 3,300,000 cattle have been tested of which 381,000 were found to be reactors (complete agglutination in dilution of 1:100 or above). These figures include a considerable number of retests. On initial tests all over the country, the average reactor rate has been found to be 14 per cent of the cattle under supervision. Infection has been found in about 43 per cent of the herds tested.

Funds have been allotted so that this work can be continued to July 1, 1936. It is hoped that many of the dairy herds under proper supervision, will be maintained free from abortus infection. Some states already have provided to add to the federal indemnity or to carry on the program after the federal assistance ceases.

Following the removal of large numbers of *Brucella* infected animals, it will be interesting to watch for any significant decrease in the numbers of undulant fever cases reported, particularly in states where the blood test work has been prosecuted with great vigor and many infected cattle have been eliminated from the dairy herds.

Pasteurization

Permissive Pasteurization of Certified Milk

Paragraphs 58 and 59 of "Methods and Standards for the Production of Certified Milk" [11] now read in part as follows:

58 . . . . Certified Milk must be produced strictly in accordance with the Methods and Standards, and when so produced it may be subsequently pasteurized, provided it is labeled on the bottle cap with the words "Certified Milk—Pasteurized" in addition to the other requirements for the capping and sealing of bottles as described in Section 44.

59—Pasteurization of Certified Milk must be done on the Farm where it is produced and under the existing state and local rules and regulations. Equipment used for the pasteurization of Certified Milk shall not be used for the pasteurization of any other grade of milk.

The provision to permit pasteurization of certified milk in localities where there is a demand for such a grade of milk was adopted at the last annual meeting of the American Association of Medical Milk Commissions in June, 1935, and was endorsed by the Certified Milk Producers Association of America. It is a significant and progressive step in the history of the industry. It shows appreciation of the fact that many consumers and many public health officials desire the additional protection of pasteurization even for the safest raw milk that can be produced. Since a considerable percentage of the milk supply of the country is still consumed raw, the compulsory and universal pasteurization of certified milk would be inconsistent; permissively pasteurized certified milk reveals a progressive attitude of those responsible for it and an earnest cooperation with milk control and health officials for the best interests of all, while it leaves a clean raw milk with a high factor of safety for physicians and consumers who desire it.

The value of pasteurization in general in protecting the health of milk consumers is amply reflected by the official statistics on milkborne disease as compiled each year. The burden of such diseases now falls almost entirely on smaller communities where pasteurization either is considered not feasible or where it is actually opposed. Milkborne diseases do not constitute a major item when viewed in relation to the total morbidity and mortality figures on communicable diseases for the entire populations concerned, *e.g.*, in 1931 only one out of 350 deaths from typhoid fever in the United States was caused by milkborne infection. The fact remains that milkborne diseases are largely preventable when efficient milk control and effective pasteurization are utilized as safeguards. The repeated recommendations of this and other associations vitally interested in the promotion of public health have resulted in giving much of the North American continent the best and safest milk supplies in the world. In spite of this, it is indicated by careful surveys that the majority of consumers have no clear concept of milk quality and of those properties, including safety, which collectively comprise quality in milk supplies. If full value is to be obtained from the very great expenditures applied to milk supervision, it would seem important that milk control officials should not only continue but even increase their educational efforts with the public in order that the unique importance of milk in the dietary may be appreciated.

J. G. Hardenbergh, *Chairman*

Paul B. Brooks
Leslie C. Frank
Horatio N. Parker
A. R. B. Richmond
Ira V. Hiscock
F. L. Mickle
W. D. Dotterrer
Russell Palmer
W. W. Scofield
W. A. Shoults

References

1 Frank, Leslie C.: Annual Report of Milkborne Diseases in the United States, 1934. U. S. Public Health Service, Office of Milk Investigations.

2 Crumbine, S. J.: Milkborne Epidemic Diseases in the United States and Canada—1934. *Child Health Bulletin*, July, 1935.

3 West, D. E.; Borman, E. K.; and Mickle, F. L.: The Detection of Carriers among Food Handlers in Connecticut. *American Journal Public Health,* 24:493 (May) 1934.

4 Borman, E. K.; West, D. E.; and Mickle, F. L.: Laboratory Examinations of Milk Handlers. *American Journal Public Health,* 25:557, (May) 1935.

5 Foote, F. M.; Welch, H.; West, D. E.; and Borman, E. K.: The Incidence and Significance of Beta Hemolytic Streptococci in Cultures from a Selected Group of Milk Handlers. *American Journal Public Health,* in press.

6 Crabtree, J. A.; and Litterer, Wm.: Outbreak of Milk Poisoning Due to a Toxin-producing Staphylococcus found in the Udders of Two Cows. *American Journal Public Health,* 24:1116 (November), 1934.

7 Newitt, A. W.; Glassen, J. W., and Pryer, R. W.: An Outbreak of Milkborne Hemolytic Streptococci Infection. *American Journal Public Health,* 25:804 (July) 1935.

8 Sleigh, J. C.: Scarlet Fever. *Journal Royal Sanitary Institute* (June) 1935, p. 662.

9 Stone, R. V.; and Bogen, E.: Studies of Correlated Human and Bovine Brucelliasis. *American Journal Public Health,* 25:580 (May) 1935.

10 Thompson, R.: Elimination of Brucella Abortus with the Milk of "Carrier" Cows. *Journal Infectious Diseases,* 55:7 (July-Aug.) 1934.

11 Methods and Standards for the Production of Certified Milk. Adopted by Am. Assoc. of Med. Milk Commissions, July 11, 1935.

Discussion

President Johns: Well, gentlemen, I think you will agree with me that we are extremely fortunate in having a man of Dr. Hardenbergh's caliber to preside over this Committee and present such a valuable report as he does each year. Dr. Hardenbergh asked to be excused from heading this Committee again, feeling that there were more competent or at least equally competent men who could undertake this work. I feel sure that after listening to this report you will disagree with Dr. Hardenbergh. I doubt very much if we will find another man who would put in the work that Dr. Hardenbergh, with the assistance of his committee, has in this connection.

The report is now open for discussion.

Dr. J. H. Shrader: This subject interests me very greatly and I fully recognize the amount of work that is entailed in not only getting up a report of the type and scope that you have, but the additional work that would be involved in running back the data on which the report is built. I recall that some years ago I had occasion to look into the subject of the role of the milk bottle as being the epidemiological agent in milkborne outbreaks or, rather, outbreaks that were alleged to have been caused by that. The late Dr. Stokes at the Baltimore Department of Health and I looked up each one of those epidemics where the milk bottle was alleged to be the agent and it was quite surprising to note the lack of any real evidence. There seemed to be quite a tendency in the reports to hang an epidemic onto the milk bottle or the milk when all other lines seemed to be pretty well blocked off.

I have had some experience with epidemiologists—I will not make it too broad, but with some who in the absence of anything very conclusive, particularly with regard to typhoid (the occurrence of which is somewhat a reflection on public health administration of a community and therefore the stimulus is very great to trace every one) considered that in case of doubt a positive colon coming through in the water is a very convenient peg on which to hang the probable cause of that typhoid outbreak and therefore traced.

Now I was just wondering how many epidemics really should be hung on milk, even those listed; probably the matter evens up in the end, that there are many that are not listed that were attributed to milk. In the case of ice cream we know, of course, that the famous Washington outbreak of one or two years ago is a case in point.

I am wondering if we could impose upon the good nature and ability of the committee to extend their work a little further to this question of examination of food handlers: the milk plant operators. I think that question is very much open. I have been very much impressed with the work done in Connecticut and was quite hopeful that their rather clear-cut recommendations as published this year in the May issue of the *Journal* was the way out of the fog and I was much disconcerted at this meeting that over in the Laboratory Section they felt that the recommendations had gone too far and they were hauling in on them and the committee had felt that its work was completed and asked to be discharged. I was quite interested in the discussion that came from that recommendation and the discussion by Dr. Ravenel and Mr. Horatio Parker. Dr. Ravenel felt that the work of that Committee on examination of food handlers in dairy plants should not be considered concluded for numerous reasons of general policy and Mr. Parker brought up, particularly, a case in point to show the value of that kind of work. His point, in general, was that the very fact that food handlers must go through an examination has a tendency to stabilize the turnover among food handlers which, without such examination, would be greater.

It seems to me, to get back to the particular subject here, that if there is as much septic sore throat and typhoid—in other words, milkborne outbreaks caused by milk as recorded—I am wondering why we do not see more from the exposure of milk in plants, even well organized pasteurizing plants, when the milk is exposed to the operators in the plants. It would seem from the great volume of milk that is handled and the great number of plants operating and the great number of people that are employed that the law of chances would give us a greater record, a larger number of epidemics traced to pasteurized milk than there are. I am wondering if the Committee, as it goes into the work in the future, could extend their work a little more and make a critical examination of the references on which they are attributing epidemics to milk. That is a large request, I admit. If the Committee could divide up the work among them in some way so that we could get a clearer picture we should like to know it. We certainly do not think milk ought to have charged to it outbreaks that can not be pretty definitely proven to be caused by it.

Dr. Parker: It occurs to me that Mr. Frank is in the room and he might explain to us how far in collecting his data he goes in going to the original source for information concerning the epidemics.

President Johns: Dr. Frost, a number of years ago you made some study on this question that Dr. Shrader has just touched upon—have you anything to contribute?

Dr. W. D. Frost: I have been delighted with this report. Dr. Hardenbergh always gives his subject a thorough investigation, examination, and presents it with force and dignity.

I have been especially interested in this subject although I can not go into detail here. I wrote a paper several years ago to indicate that it seemed to me that reports of this kind are unfair in a way; that is, they may be used in an unfair way. When you see that there are 1700 or 1800 cases of milkborne disease, that seems pretty big, but when you compare this number with the number that are carried by other means than milk it does not seem so bad, and this is borne out by Dr. Hardenbergh's reference to the fact that of 360 deaths from typhoid fever in the country only one was due to milk.

I think we have also to be careful about the conclusions that we draw from such figures. I would not for a moment be understood to discourage compilations of this kind; we should face the facts, but I do not think they have quite the significance they appear to have when they stand in a table by themselves.

In regard to the question whether milk is held responsible for many of these diseases without proper investigation or without any investigation at all, I believe that is sometimes true and some years ago I pointed out a statement, very curious to me, by the Massachusetts Board of Health, in which they say, in about so many words, that certain diseases are considered milkborne unless it was shown that they were distributed by some other means. I think that that is an attitude that is too frequently taken.

I know something of the difficulty of getting the necessary data. It is easy to talk about running down the epidemiology of an outbreak but you have to be a good deal better at it than I am if you can do it at times. Here is an example:

A year or so ago an epidemic of 200 cases of septic sore throat was reported in one of the Wisconsin towns; doctors from the State Board of Health said it was septic sore throat, but as the city thought they had it under control they did not say anything about it to the State Board of Health for nearly two weeks and then we could not get together immediately and when we got out there we could not find *Streptococcus epidemicus* in any of the patients nor could we find them in any of the cows, and every cow was examined. That they were there I am willing to admit, but we were too late in the field to get any data that was worthwhile. We should have a little different set-up if we are going to work out the epidemiology of such outbreaks.

Of course I am delighted with the interest which these people here show in this subject of milkborne disease.

Dr. Shrader: Do you know whether that case was reported as being traced to milk? Did it get into the literature?

Dr. Frost: This epidemic is undoubtedly in the literature.

Dr. W. A. Shoults: The only recorded outbreak of undulant fever in Manitoba occurred within the last year. The first case that came to light was a physician in Winnipeg who believed he contracted the disease while visiting in Minnedosa. When the matter was reported to the health officer at this point it was learned that three other persons in the town were similarly affected. All secured their milk supply from the same dairyman. The milk was sold raw. On investigation we found that two cows in the herd had recently aborted and five of them gave positive reactions to serological tests. The milk was stopped until affected animals were removed, and no further cases developed.

Mr. W. B. Palmer: I think the question has been asked, how the information is obtained relative to these milkborne epidemics. I do not know if this is the answer, but the United States Public Health Service, through Mr. Frank's office, annually sends out a questionnaire to Health Departments throughout the country asking them to list the number of milkborne epidemics of diseases, giving the number of epidemics of each disease, the type of milk involved, the number of cases and the number of deaths in each epidemic, and I believe when those reports are returned to Mr. Frank's office, a compilation is made and then the compiled report is issued.

Dr. Grim: I think before we pass on this report we should inquire about this matter of pasteurization of Certified Milk which has been mentioned. This is something new, I do not think we in this Association have ever before considered the control of Pasteurized-Certified Milk. As I understood the quoted change in the Methods and Standards for the production of Certified Milk, equipment in the certified dairy building might be used for Certified Raw Milk and Certified-Pasteurized Milk but for no other grade. I have been wondering whether Dr. Hardenberg could inform us whether it was the purpose of the American Association of Medical Milk Commissions to permit surplus milk of certified quality produced upon a certified dairy to be pasteurized in the certified pasteurized equipment and sold merely as pasteurized milk, or some higher grade of pasteurized milk, or whether the Committee meant that only milk labeled Certified Milk Pasteurized could be

processed in the pasteurizing equipment provided at the certified dairy building.

If it really means the latter, it would seem to me rather selfish to insist that this excellent grade of milk, some of which is now to be made par excellent by pasteurizing, must be continued in seclusion and that the surplus can not be pasteurized in the same equipment, or sold as some other grade of milk, so long as the milk is all of the same certified quality and in as much as the surplus milk from dairies producing Certified Milk can frequently be marketed as Grade A Pasteurized.

Dr. Breed: There is one point that I should like to raise in this discussion and in doing this I do not want you to think that I am an advocate of raw rather than pasteurized milk. Why do we not call a spade a spade in these reports of milkborne epidemics? As I understand the figures in Dr. Hardenbergh's report, one of these forty-five epidemics was traced to improperly controlled and pasteurized milk—was that the correct figure?

Dr. Hardenbergh: The notation was that: "There was evidence that some of the milk in the supposedly pasteurized supply was raw, and pasteurized was mixed with it."

Dr. Breed: This would be improperly controlled pasteurized milk.

Dr. Brooks: It never got near the pasteurizer.

Dr. Breed: But it was labeled and sold as pasteurized milk. I take it the forty-four cases of epidemics traced to raw milk were cases where the raw milk was not properly supervised to protect it against being an agent for the spread of disease, just as this pasteurized milk was not really pasteurized and so was not really properly controlled.

In other words, this list of epidemics seems to me a record of the efficiency and effectiveness of our control. The ratio 44 to 1 is one expression of this effectiveness and efficiency. I feel that one strong argument for pasteurized milk should be that pasteurization is a method of protecting the public health that can be carried out effectively and readily, whereas we do not have equally simple and effective methods of protecting raw milk.

It seems to me that the record should read "44 cases where our control over the raw milk was not effective, and 1 case where the control over the pasteurized milk was not effective." I see no reason for adding an apologetic statement regarding the epidemic traced to pasteurized milk where none are added for the raw milk epidemics.

Dr. Harding: I arise to agree with my friend, Dr. Breed, regarding much of what he has said. There is one angle of it, though, which I think will bear a little emphasis stronger than he gave in the case of raw milk. No one seems yet to have discovered a method of supervision which will bring the raw milk into a degree of safety comparable with that which is ordinarily attained with a fair degree of supervision of pasteurized milk.

Now that the pasteurization of certified milk is provided for, perhaps a little frank comparison of the history of certified milk might not be out of place in this connection. The amount of certified milk in the few cities where it is supplied has rarely amounted to two per cent so that the proportion of certified milk in its ratio to the ordinary raw milk has always been very wide. We have at least five well authenticated epidemics spread by certified milk which surely has been supervised as well if not considerably better than you can expect of ordinary milk. The proportion of epidemics spread by certified milk in proportion to the amount of certified milk used is shockingly high.

In other words, there just is not any available means of supervision of raw milk which comes anywhere near guaranteeing the safety of the process; in that respect, I think the comparison of the epidemics being due to a lack of supervision is a little unfair to the raw milk side, because there is not any supervision which will make that milk safe—at least, it has not yet been discovered or demonstrated.

I do not know whether the two cases of undulant fever which were reported last year enter into the discussion or not, but there is another thing where supervision is a little weak in protecting the consumer. I believe that we ought to give the devil his due. I think that the milk supervisor is entitled to a word of defense in this connection because it is not within the realm of human possibility for that milk supervisor to so supervise raw milk as to make its safety in any fair way comparable to the safety of a reasonably well pasteurized milk. Do not expect the milk inspector to accomplish the impossible.

Mr. J. R. Jennings: While the amount of certified milk is very small, the recent action relative to the pastuerization of certified milk may have a very far reaching effect on the pasteurization of a great deal of raw milk we, too, have left in many cities. We have been able to arrange for pasteurization of our certified milk since this announcement; we expect to be pasteurizing it within about ten days. I am wondering if there has been a similar response in other parts of the country.

President Johns: Well, gentlemen, we have had a most interesting discussion on this report, but time is pushing along as usual so I think at this point we had better ask Dr. Hardenbergh to conclude the discussion.

Dr. Hardenbergh: Mr. President, I do not know that I should speak for the whole Committee with respect to what the President said a few minutes ago. With all due respect, I am reminded that those remarks are in a class with Mark Twain's comment: that the reports of his death were greatly exaggerated.

After all, as you will see when you listen to the Report, it is simply a compilation of what other people have done, so that what the Committee reports is not original in any sense at all.

One of the unpleasant, if I may call it that, features of this Committee work is the very thing that Dr. Shrader brought out; it seems that milkborne epidemics of disease, when summarized in a report as presented here, are unduly emphasized in relation to the total mortality statistics for the same diseases but spread by other means. Unless data on milkborne disease are presented in relation to the total morbidity and mortality statistics, I think that a very distorted idea of what is going on is obtained.

Previous reports of this Committee have pointed out the necessity for better epidemiological evidence with respect to these milkborne outbreaks and the difficulties of carrying on those investigations are better realized by men like Dr. Frost and you men who are doing that type of work than by myself, but still the report this year does cite two or three instances in which very conclusive investigations were possible.

It is not often that such conclusive investigations can be made.

Dr. Grim raised the question about the Methods and Standards requiring that the equipment on certified farms be used for pasteurization of certified milk only. The intent of that regulation, I believe, is that certified dairy farms shall not use the equipment for pasteurizing a lower grade of milk. They may have a surplus of certified milk which goes into other channels, but it does not mean that it is of a different grade basically. In other words, all of the milk of certified grade, whether eventually labeled "certified," "pasteurized," or with some other designation, would be eligible to pass through the same pasteurizing equipment. That is the intent.

Mr. Jennings raised the question of the extent to which permissive pasteurization of certified milk is being adopted since provision was made for it. Prior to the adoption of this provision, we already had pasteurization of certified milk in Boston, Cincinnati and perhaps one or two other places. Since then a provision has been made for it in New York City and I presume it will be available there within the next week or ten days. It is also being produced in Scranton and two or three other places that are in about the same position that you are in Louisville: about ready to go ahead with it.

The significance of this step would seem to be that it is not a confession of weakness, as I see it, with respect to certified milk supervision; rather, it is a recognition of the attitude taken by many health officers and by many consumers who have been so thoroughly sold on the protective value of pasteurization for market milk supplies. It is simply intended, I believe, as a progressive step and I trust will not mean the elimination of all raw certified milk.

Dr. Harding said something about giving the devil his due—I do not know whether he means certified milk is the devil or not, but in reviewing the statistics of milkborne disease for the past ten or fifteen years, you will find that as with everything else, a lot of progress has been made. I think you will find, Dr. Harding, that the epidemics traced to certified milk took place a good many years ago. So far as I know, in the last ten years there has been little, if any, disease traced to certified milk—in other words, as time goes on we all make progress and improve our methods and that same thing applies to pasteurization.

Dr. Harding: If a word be permitted, I did not want to leave my meaning in doubt at all; I think it was Mark Twain who said, once, if he could get a publisher he was going to write a book in defense of the devil, because any force which regulated three-fourths of the government and all of the politics, had things to be said in its favor. I merely meant that we are inadvertently putting upon the milk inspector the responsibility for these raw milk epidemics when it was not within the possibilities of even the finest milk inspection to prevent them. It is not quite ten years ago since the epidemic at Hampton just out of New Haven occurred in a certified dairy—and I think that was the last which has come on the official records.

SOURCES OF INFECTION IN SEPTIC SORE THROAT EPIDEMICS

George H. Ramsey, M.D.

Assistant Commissioner for Preventable Diseases
New York State Department of Health

SEPTIC sore throat epidemics in New York State up to the end of 1933 have been summarized by Brooks (1933), who has pointed out that such outbreaks are sometimes overlooked and has called attention to frequent delays in reporting them. The Public Health Council amended the New York State Sanitary Code on January 19, 1934, so that all epidemics of sore throat, whatever their nature, must be reported immediately by telephone or telegraph to representatives of the State Department of Health. In general promptness of reporting seems to have been encouraged by the new regulation; the Department has been notified of recent sore throat epidemics fairly early in their course, and it has been possible to make investigations while active cases were still occurring.

Recent Clinical Observations

During such an epidemic in the village of Baldwinsville in April, 1935, many patients were followed from the early stages to the termination of illness. This epidemic comprised 500 cases with seven deaths. All the patients had highly inflamed sore throat with cervical gland enlargement, and in the majority of cases severe toxic symptoms were present. One or more complications developed in 119 of the 470 cases studied. Besides quinsy, and ear involvements, the list of complications included such disabling conditions as twenty-six cases of arthritis, thirty-two of heart disease and six of nephritis. In each of the fatal cases, death was due to a streptococcus infection, the organism having apparently invaded the blood stream. The Baldwinsville observations and similar ones elsewhere make it plain that far from being a trivial condition, milkborne septic sore throat may be an extremely severe disease followed by death or serious after effects and as such continues to be a problem deserving consideration and study.

Determination of Milk Supply Concerned

Determining the particular supply responsible for a clinically typical septic sore throat outbreak is ordinarily a comparatively simple undertaking. Epidemiological evidence which unmistakably and clearly points toward the use of a single contaminated supply can as a rule be obtained. Moreover, this evidence is of such a character that no particular skill is required for collecting the essential basic data. For example, 91 per cent of the cases in Baldwinsville were among persons supplied by the raw milk dealer incriminated, whereas this dealer furnished only 32 per cent of the total daily village supply. Similarly, 93 per cent of the cases in a recent outbreak in Potsdam, New York, were among patrons of a dairy selling raw milk which sold less than 10 per cent of the total daily village supply. Such results as these can be arrived at from two simple, readily acquired sets of facts, namely the amounts of milk sold by each dealer in the community, and the number of sick persons using each supply.

Special undertakings in Baldwinsville included a milk census covering about one-third of the population of the village. Households were visited, and their regular sources of milk supply ascertained, as well as the amount of milk consumed daily by each member of the household. The survey had reference only to familial sources of milk supply, and did not take into account the fact that individual members of households might consume milk other than that regularly delivered to the home. Of the 1127 persons interviewed, 554 were in families regularly supplied, and 573 were in families not regularly supplied with milk from the dairy believed responsible for the epidemic. Of the 554 persons in suspected dairy households, 28.5 per cent became ill, whereas only 4.5 per cent of persons in households not regularly supplied with the suspected milk developed septic sore throat. The attack rate among 197 persons consuming more than one pint of milk daily and living in households supplied by the suspected dairy was as high as 34.5 per cent, the attack rate among 177 heavy milk drinkers in households not regularly purchasing the suspected supply being 7.3 per cent. Observations like the above are not uncommon and, when made in connection with a septic sore throat outbreak, are generally accepted as proof that a single contaminated milk supply has caused the epidemic. On the other hand, tracing such an epidemic back to its original source and finding out exactly how the milk became contaminated is sometimes a complex and laborious undertaking. The difficulties encountered are increased by the fact that authorities are not universally agreed as to the factors ordinarily concerned in the production of a septic sore throat outbreak.

Original Sources of Infection

Published reports make it appear that in septic sore throat epidemics the milk usually becomes infected with hemolytic streptococci from the udder of a cow, and that extensive outbreaks due to the direct contamination of milk by a human being rarely occur. Although bacteriologists now recognize that the differentiation of strains of hemolytic streptococci is a great deal more difficult than was formerly supposed, it is quite generally held that bovine strains are seldom, if ever, pathogenic for human beings. Acceptance of this belief implies that the cow's udder is usually infected from a human source. How frequently this human source is a sick person, and how frequently a healthy carrier has not been accurately determined. There is also doubt as to the practical importance of healthy cows as carriers of human strains of streptococci, some workers being of the opinion that only cows with previously diseased or injured udders are potentially dangerous to any marked degree, and others believing that cows without recognizable gross lesions may carry human streptococci in sufficient numbers and for a sufficient length of time to cause widespread disease.

New York State's experience with septic sore throat in recent years is of interest with reference to the role played by the human, and that played by the bovine streptococcus carrier. Seventeen epidemics of this disease, each one attributed to a raw milk supply, have been reported in New York State during the past ten years, that is, since July 1925. Detailed investigations were made of thirteen of these outbreaks at the time, or shortly after the time of occurrence. Each investigation included special epidemiological and bacteriological studies, and the careful examination of cattle by a veterinarian.

In seven of the thirteen epidemics, it was found that prior to the beginning of the outbreak one or more human cases of illness had occurred on the dairy farm incriminated. In four instances, these illnesses were cases of sore throat, and in three others draining wounds or hand infections in dairy workers. Human cases occurred on the suspected dairy farm in four epidemics while the outbreak was in progress but as far as could be determined, not previously. In only two epidemics was it impossible to find any evidence of illness among persons on the dairy farm implicated.

While the discovery of an individual with sore throat or other illness on a dairy farm, even prior to the beginning of an outbreak, does not prove that this particular individual was the original source of infection, and while the occurrence of sore throat cases on a farm while an outbreak is in progress of itself means little or nothing, the combined results for the series of epidemics are highly suggestive. There were only two outbreaks in which no human sickness was found on the suspected dairy farm, and in all eleven others the presence of illness on the farm at some time or other was definitely established. Taking into consideration natural reticence on the part of dairy workers and other persons under suspicion to disclose information which might be damaging to themselves or their employers, the findings given above lead to the inference that when a septic sore throat epidemic occurs, the original source of infection is much more apt to be a sick human being than a healthy carrier.

Milk specimens were taken from all milking cows on the suspected dairy farm during the investigation of each of the thirteen outbreaks. Hemolytic streptococci more or less similar to those from patients were isolated from a single cow in ten epidemics. Streptococci were sometimes isolated from other cows in the same herds, but no such organisms were found to be human strains. In each of the remaining three epidemics, streptococci were isolated from cows whose characteristics were not in conformity with those from septic sore throat patients.

In five outbreaks, the single cow from which a human strain of streptococci was isolated was an animal with a history of a teat injury followed by mastitis. In three other epidemics the cow found to harbor a human strain of streptococci, had mastitis of long duration and in two, the cow was stated to have acute mastitis. Cows with mastitis, histories of injury, or both were found during the investigation of each of the three epidemics in which the strains of streptococci isolated could not be proved to be similar to those from patients.

The above observations indicate that in a majority of instances the cow judged responsible for the epidemic was an animal with a pre-existing teat injury or mastitis.

Thus, it may be concluded that in New York State sick human beings and diseased or injured cows have been more often concerned in the production of septic sore throat epidemics than healthy human or cow carriers, and it may be inferred that the same conditions may have prevailed generally. There are certain collateral facts which lend support to this belief and make it appear that some special set of circumstances must be necessary for the development of a septic sore throat outbreak. The prevalence of mastitis in cattle is known to be high, and it is also known that as many as five or more per cent of healthy individuals may be carriers of hemolytic streptococci at a given time. Since dairy workers are probably carriers in fully as large proportions as other persons, it is hard to explain why milk-borne septic sore throat epidemics do not take place more frequently, if healthy carriers are to be credited with any important part of their production.

A number of septic sore throat epidemics have been reported in which healthy human carriers were believed to have been original sources of infections, as well as epidemics in which only cows with little or no gross evidence of mastitis appeared to be concerned. However, it is believed that such epidemics must be rather uncommon, and that the majority of septic sore throat outbreaks arise from a combination of human illness on a dairy farm due to hemolytic streptococcus infection, and the infection of a cow with a previously diseased or injured udder. Lack of pasteurization, and duration and conditions of milk storage are essential contributing factors.

The above hypothesis implies that if milk must be sold raw, every person on a dairy farm affected with sore throat, suppurating lesions, or other illness of a type possibly due to streptococcus infection should be strictly prohibited from handling milk, and further implies that effort should be made to segregate cows with severe mastitis or teat injuries until recovery and to forbid the use of milk from such cows. Steps toward carrying out such provisions as these would seem to be of more practical value than searching for streptococcus carriers either among human beings or cows.

Reference

"Missed" Epidemics of Septic Sore Throat. Paul B. Brooks, *American Journal of Public Health,* Vol. 23:1165-1167, Nov. 1933.

Discussion

President Johns: Thank you, Dr. Ramsey. This paper falls in very nicely after the report of Dr. Hardenbergh's Committee and the discussion which we have already had. I am going to call on our genial secretary-treasurer, Dr. Brooks, to open the discussion on this paper.

Paul B. Brooks

Deputy Commissioner of Health
New York State Department of Health, Albany, N. Y.

I am sure you will agree with me that Dr. Ramsey's paper presents in a most interesting way the results of a thorough study and that it will be a valuable addition to the literature on this subject. Instead of discussing the content of the paper I am going to undertake to bring out some points that he did not cover. What I have to say has a bearing also on some of the discussion on Dr. Hardenbergh's report.

I want to point again to the fact that our available records of milk-borne epidemics of septic sore throat for the United States as a whole are apparently very incomplete and therefore misleading. I presume that may apply also, in some measure, to other communicable diseases but the little study I have made of the records has been limited to septic sore throat.

In an article of mine under the head of "Missed Epidemics of Septic Sore Throat" which appeared in the *American Public Health Journal* for November, 1933, I referred to the records for a period of twenty-five years. These included the Armstrong and Parran report published by the United States Public Health Service in 1927, which covered a

period of nineteen years and the six Public Health Service annual reports on milkborne epidemics covering the period 1927-1932, inclusive. In that entire period only seventeen states reported milkborne outbreaks of septic sore throat, seven of them one each. Sixty-three per cent of all that were reported were "credited" to Massachusetts and New York —27 and 18 respectively. In view of what Dr. Shrader and Prof. Frost said in discussing Dr. Hardenbergh's report, I would like to point out here that so far as New York State was concerned these were definitely all septic sore throat and all milkborne. Thirty-one states reported no outbreaks in this period. At the same time the records show that such outbreaks had occurred in all parts of the country, north, south, east and west, apparently indicating that no section of the country is entirely free from this infection.

In this study I examined the records of death from septic sore throat in the various states, as published in the Public Health Service annual communicable disease reports covering the 1927-1932 period. We know that the case fatality in such outbreaks runs roughly from one to four per cent and, taking two per cent as a fair average, I attempted to estimate the number of cases some of the states should have had. I found some confusing discrepancies. Taking New York State as an example I found that we had recorded 871 deaths, while our "reported cases" in the same period were 1996. This would have represented a case fatality rate of around 43 per cent which, of course, was out of the question. For 1930 our reported cases, as they appeared in the communicable disease report, were 448 while the milkborne epidemic report for the same year showed that we had three outbreaks with 831 cases. This discrepancy, of course, was not the fault of the Public Health Service. They must have obtained the figures from us. It seems very evident, therefore, either that the reporting of cases is very incomplete or that the death records include other conditions than septic sore throat. Probably it is a combination of the two.

However, I felt fairly safe in assuming that the death records were at least 50 per cent accurate. On this basis—taking half of the number of deaths recorded in each instance—and considering the case fatality rate as 2 per cent, I estimated the number of cases some of the states would have had on this basis. Pennsylvania, for example, with 243 deaths should have had about 6000 cases, yet they had recorded only one milkborne outbreak. New Jersey had recorded no cases or deaths and no outbreaks, from which I assume that septic sore throat is not officially a communicable disease there. Illinois would have had 8750 cases but reported no outbreaks and Texas, which would have had upward of 12,000 cases, reported one outbreak. The figures for Virginia were interesting. The first year of the period no deaths were recorded. The next year 112; the next three years none and the sixth year, 34. It would be interesting to know what accounted for the differences.

Our experience, as I think Dr. Ramsey mentioned, indicates that the bulk of our cases of septic sore throat has occurred in connection with milkborne outbreaks; also that in these outbreaks it is nearly always found that there is a cow with an infected udder involved, the infection being from a human source. With these facts in mind it is an interesting question why we have so many outbreaks in Massachusetts and New York, while the majority of the states apparently have none and some others relatively very few.

In looking back over our records in New York State for a period of about nineteen years I find that in the earlier years of the period we also had none. Here I run into another inconsistency. I find that as our organization was improved and our efficiency in dealing with communicable diseases and communicable disease investigations increased our milkborne epidemics also increased.

I can not take the time to go into the various possible explanations of the wide differences in the figures for the various states but will simply give my own tentative conclusion, which is that outbreaks do occur elsewhere and are either not discovered or not traced to their source. I feel justified in this conclusion not only on the basis of the figures but because I know that in my own state, where we now have a fairy effective organization for dealing with this sort of thing, in the past few years we have come very near entirely missing two or three good sized epidemics. Our first intimation of one of them came through a letter from a local resident after the epidemic was over. In short, I feel that many more of these outbreaks occur than are recorded.

I do not feel, as some apparently have felt, that this is merely a subject for academic discussion. If these epidemics, when they occur, are allowed to go on and burn themselves out, as we know they will ultimately do, it is likely to be a matter of life and death. It is important also because these misleading records are not infrequently cited, for example, by opponents of pasteurization, as evidence that milkborne infection is relatively insignificant and that we are making a "mountain out of a molehill." I am quite willing to admit that after the figures are all in milk probably will still be one of the smaller factors in the spread of communicable disease. It certainly is *one* factor; but in any event we should want to know the facts.

Dr. Parker: Some of you gentlemen are aware that I come from Florida; some of our tourists down there have been kind enough to call attention to the fact that no Floridians use throat gargles; that there is no coughing and spitting, and that very few people have colds. Whether that has any relation to Dr. Brooks' problem or not, I think it is rather striking that the black spots on these maps which portray the regions where septic sore throat prevails are confined pretty largely to regions where the climate is distinctly severer and where colds and throat infections, etc. are more prevalent than they are in the South. I have been struck with that. Perhaps it is one of those things that catch the eye and is misleading, but I think some consideration should be given to it.

Reverting to Dr. Hardenbergh's paper, if I may, for a minute, I think attention should be called to the fact, which I am sure we all know, that these milkborne epidemics do not concern the whole population, for it is only a part of the population that is using milk, so that when there are only forty-nine cases of epidemic or four epidemics, as in Canada, that means that there were four epidemics among milk-drinking populations, the milk-consuming population, and the figures should not be compared with the entire population of Canada. That is, while these figures are low—as has been properly pointed out—they may really be larger, relatively, than we think unless we fully realize that only the milk-consuming population is concerned and, as Dr. Shrader I think would admit, the milk-consuming population is smaller than we would like to have it.

President Johns: Before somebody else takes the floor, Dr. Brooks has pointed out that Dr. Ramsey's predecessor, Dr. Edward S. Godfrey, Jr., former Director of the Division of Communicable Diseases, of New York, is present and I would like to call upon Dr. Godfrey at this time to comment on this topic.

Dr. E. S. Godfrey, Jr.: There are a few points both in Dr. Ramsey's paper and Dr. Brooks' discussion that I would like to emphasize. First of all, with reference to Dr. Ramsey's paper I think it is important for us to realize that the investigation of outbreaks is not primarily the duty of the laboratory, it is the duty of the investigator himself; that the laboratory findings are to be correlated and integrated with the field findings and the judgment based upon and the conclusion drawn from that integration.

Too often we find that the investigators simply satisfy themselves with taking throat cultures from the people they find on the farm, the cows they find in the milk line. It is much more important to go over the payroll record of that dairy and find out who has been there as well as who is there now. It is important to find out what cows have been in a milk line within the period of incubation and find out whether any of them have been eliminated because of some udder condition. Failure to do this systematically, very nearly resulted in our not finding the real source of infection in one of our extensive outbreaks.

Dr. Brooks commented on the probable prevalence of this disease based on death certificates. The discrepancy between his estimate and the reported prevalence is due, I think, simply to the nomenclature and classification adopted by Divisions of Vital Statistics. In New York State we no longer require the reporting of individual cases of septic sore throat but do require health officers to report outbreaks of sore throat. There were two reasons for this.

It is a very difficult matter to determine what is septic sore throat. In New York State, we pay twenty-five cents for each report of a communicable disease, and some physicians were found reporting every case of tonsilitis and sore throat in their practice. That proved expensive to some of the smaller communities which had to pay the bill, but back of that such reports were confusing and were not useful in discovering epidemics.

Reporting of *epidemics* of sore throat without reference to exact diagnosis, on the other hand, is important. Without exception, I think, we have found them due to milk transmission. One extensive outbreak of some 400 or 500 cases of septic sore throat was nearly overlooked, due to the fact that a laboratory technician informed physicians that the disease was not septic sore throat because the streptococci did not cause hemolysis. As a result it was not reported to the State Department of Health. It was discovered only through our District Health Officer's happening to observe certain death certificates which indicated to him that there was a septic sore throat epidemic present.

Undiscovered outbreaks exist, I am sure. It is only by having on the spot people who recognize the importance of *outbreaks* of sore throat and report them to competent authorities for investigation, that we will ever determine the extent and importance of septic sore throat.

One of the speakers mentioned a paper by Mr. Mickle and others at the A.P.H.A. meeting with reference to changes in laboratory procedure in the examination of milk handlers. After the outbreak of septic sore throat on the Hamden certified supply, which followed another outbreak on a supply in a nearby town, new requirements with reference to the examination of milk handlers handling certain grades of milk specified that certain laboratory specimens must be submitted as a part of each examination. After considerable experience with this procedure the results were carefully studied and reported in a number of papers, including the one by Mr. Mickle and his associates. As a result of these studies the procedure has been changed. Each handler is still required to submit two specimens of feces at the time of the first examination. Aside from this, the submission of laboratory specimens is entirely at the discretion of the examining physician. He knows what laboratory tests should be made to clear up any suspicious clinical findings, determine the condition of the handler, and whether or not it is safe for him to handle milk. This decision has been reached after very careful study of the subject from all angles.

I thank you for the opportunity to come here and listen to these most interesting and instructive papers, and I am very glad to have had the opportunity of saying a few words to you on this occasion.

President Johns: We are fortunate in having with us Dr. Millard Knowlton who is Director of the Bureau of Preventable Diseases for the State Department of Health of Connecticut. I am going to call on Dr. Knowlton to take part in this discussion.

Dr. Knowlton: Mr. Chairman, I have been very much interested in the discussions that have taken place this morning. I think I might comment on a point or two that has been made. Someone raised a question as to the epidemic that might be missed; Dr. Brooks mentioned two or three that they came near missing in New York, and I fully agree with him that oftentimes these outbreaks are not recognized as due to milk.

To illustrate how nearly we missed one a few years ago, let me tell you about it. A letter from a health officer requested that several cases of sore throat in his town be investigated, as one of the doctors had suggested it might be due to milk. This doctor had recently read an article on a milkborne outbreak of septic sore throat. When he had some eight or ten cases of sore throat in his practice, which was rather unusual, he began making inquiries as to the milk supply. Upon finding that all got milk from the same dairy he reported his suspicions to the health officer.

As an emergency investigation to establish the source of infection, I visited all physicians in their offices or called them by telephone, and got a list of patients with sore throat and their milk supply. In that way I obtained sufficient evidence within a few hours to justify starting pasteurization of the milk responsible for the outbreak. In a later check-up, we discovered a few more cases than I had found in the emergency study, and about two-thirds of all the cases of sore throat occurred on one milk supply of about one-twentieth the supply for the city—that would be a ratio of about forty to one.

Dr. Harding mentioned the Hamden outbreak as having occurred on a certified milk supply. I believe the date was 1926. The milk in that case was delivered in several cities and towns around New Haven. We found the ratio of cases on that milk supply as compared with the number of cases using the same amount of other milk to be about 500 to 1. That was rather conclusive.

Just recently, an outbreak of acute gastrointestinal disturbance of the food poisoning type occurred in one of our towns and upon investigating the cases, we found that there were eighty-four cases in fifty-five families, all using milk from one supply of 300 quarts per day, out of a total supply for the town, estimated at about 4500 quarts per day. If the milk was not responsible for that little outbreak, there ought to have been about fourteen times as many cases on other milk supplies, but there were none. This was very conclusive evidence that milk from one small supply was responsible for the outbreak.

That might be contrasted with the hunch a friend of mine had who contracted food poisoning, found *Salmonella enteritidis* in his stool, and concluded that it was contracted by eating a sandwich at a certain soda fountain. With the various possibilities as to the source of that type of organism, I would be very uncertain as to the adequacy of his evidence from an epidemiological point of view. I should think it was more or less of a "hunch" with the "common factor" element left out.

On the other hand, we are doing a rather interesting bit of work with undulant fever in which we predicate administrative action upon the occurrence of a single case with only one possible source of infection. Incidentally, I may say that last year we had an outbreak of fourteen cases of undulant fever with three deaths on one milk supply.* Usually we have only one or occasionally two cases on a supply. This outbreak was due to the suis type of organism which accounts for the large number of cases and three deaths—the only deaths we have had from undulant fever in Connecticut. A total of fifty-five cases were reported last year, most of them probably due to the bovine type of organism.

Each case is carefully investigated. If the patient consumes raw milk from only one supply, and we can not find any other possible source of infection, we adjudge milk from that supply as deleterious to health and refer it to the Dairy Commissioner, under Section 2484 of the General Statutes which requires him to stop the sale of milk deleterious to health. We specify that the milk will cease to be deleterious to health if the dairyman will test his cows and remove the reactors, or if he will pasteurize the milk. This, then, is an instance in which we attribute infection of a single case to the only possible source we can find because we known that undulant fever in man comes from animals, either by contact with animals, or by the consumption of animal products. This procedure was adopted after a very careful study of the problem, and carrying it out has resulted in quite a number of pasteurizing plants being installed.

President Johns: Since the hour of luncheon is drawing near I think I will call upon Dr. Ramsey now to conclude the discussion.

Dr. Ramsey: There are only one or two points I should like to mention. Dr. Frost quoted various case fatalities from septic sore throats and I believe made the statement that case fatality might vary from one to four per cent. I am quite sure that probably a large number of reports of case fatality during septic sore throat epidemics are erroneous, and that the mortality as stated is often too low. Septic sore throat seldom kills during the acute stages of the disease, the patient does have an initial severe toxemia, apparently due to the toxin produced but then gets better for the time being. If death occurs, it is usually late in the course of the disease—that is, after several weeks, from some complicating general streptococcus infection, such as endocarditis, an empyema, or septicemia. Undoubtedly death certificates of such cases on which the words "septic sore throat," does not appear, are often filed.

In the Baldwinsville epidemic, we had seven deaths among some 470 cases and those deaths were all late, none of them early in the course of the disease.

---

* Report of outbreak by Benjamin G. Horning, M.D., published in *J.A.M.A.*, Vol. 105, No. 24, December 14, 1935.

As regards the geographical distribution of milkborne epidemics of septic sore throat, Dr. Davis showed an interesting map in the A.P.H.A. the other day, a map of the United States, on which epidemics had been spotted. The most heavily spotted areas were Massachusetts, Connecticut and New York State. The only other two states where there had been any appreciable number of reported epidemics were Wisconsin and Illinois, that is, the states in which Dr. Davis and Dr. Frost are living and are working. The whole question of streptococcus infection in the South is a very interesting one. I could not agree with the statement by Dr. Parker that colds are any less frequent in the South than in the North.

Dr. Parker: That was a statement of tourists, not my statement.

Dr. Ramsey: However, there is some evidence that would tend to indicate that streptococcus infections are rarer in the South than they are in the North. There is certainly less reported disease in both cattle and human beings from hemolytic streptococcus infections reported in the South than in the North. That is an interesting question which deserves further study.

Dr. Knowlton has spoken again of the report of Dr. Mickle and his associates in Connecticut that has done a great deal to clarify the whole carrier situation. In closing, I would like to emphasize what I intended to be the major point of my paper, that in order to produce septic sore throat epidemics under ordinary circumstances, you have two things, a sick human being, or a sick or injured cow, and that as practical workers our efforts should be directed toward the control of those two factors, to prevent sick human beings having anything to do with handling milk, and to remove sick cows.

Dr. Breed: Do you know whether any one has attempted to compare scarlet fever statistics of the South and the North?

Dr. Ramsey: Yes, the reported instances of scarlet fever until recent years was much lower in the South than in the North. I am engaged now in a study of the mortality of scarlet fever in the North and South; there has been a marked decline in the North and not so great a decline in the South. The two curves of mortality rates are coming together, but by and large over a course of years, it is true that scarlet fever seems to have been less prevalent in the South than in the North.

An important study was made some years ago by Dr. Doull in which Dick tests were done in Brazil, a tropical country. With this and other material from the results of testing in the South, Doull showed quite definitely that the proportion of children with negative Dick tests is just as high in the South as in the North, even though scarlet fever is believed to be less prevalent there.

Member: Is there any seasonal relationship in septic sore throat epidemics?

Dr. Ramsey: Apparently not—it was formerly believed they often occurred in the spring, but this apparently is not true.

THE NUMBERS AND KINDS OF BACTERIA IN ASEPTICALLY DRAWN MILK *

H. R. Thornton

and

N. J. Strynadka

Department of Dairying, University of Alberta, Edmonton, Canada

Dr. H. R. Thornton: I would like to make a correction on your program. My part in this work has been confined to coming down here and presenting the paper and taking the credit for it, but there is associated with me in this work a graduate student, Mr. N. J. Strynadka. It may be that time will prove that Mr. Strynadka is the first man with patience and diligence enough to give serious meaning to a count of bacteria in milk.

The microscopic counts that I am presenting this morning are all based on the examination of 1,000 fields per smear. This is the minimum number of fields per smear on which we have based any counts, for altogether somewhere between 200 and 300 samples of various kinds of milk, only a part of which I am presenting this morning. The counts, however, apart from this paper, have been based on a number of fields per smear, varying from 1,000 up through 2,000, 6,000 and in just a few cases, 48,000 fields per smear, so I wish that you would accept this work this morning in the light of that explanation.

Introduction

DURING the course of some studies on the relationship between the leukocyte content of milk and the methylene blue reduction test data were obtained which add to our knowledge of the bacteria in udder milk.

The average per cc. bacterial count of aseptically drawn milk reported by nine workers cited in Dorner's review [1] was in no case as high as 2500. By the use of a special counting technique, the Burri slant, Dorner obtained an average of 7475, while his standard plate

* The data contained in this paper are taken from a thesis presented by Mr. Strynadka to the Committee on Graduate Studies, University of Alberta, in partial fulfilment of the requirements for the degree of Master of Science.

counts averaged 2775. The author believes this discrepancy is due to the ability of rod-shaped bacteria to grow on Burri slants and their inability to grow on standard plates.

There are two serious objections to the microscopic colony count for this class of milk, viz., the clumping tendency of the bacteria in the milk and the failure of some species to grow on the medium.

There are two serious objections to the direct microscopic count where this class of milk is concerned, viz., the impossibility of differentiating living and dead bacteria and the improbability of the very small amount of milk actually examined being representative. The latter weakness may be minimized by an extensive search of each smear.

Methods

Samples of milk were obtained from ninety-five cows in twelve herds by carefully drawing into sterile flasks or test tubes an approximately equal amount of milk from each half-empty milking quarter, the udders being previously wiped with a chlorine solution. Two of the samples were drawn within forty-eight hours after parturition and are labeled colostrum. Five samples were macroscopically abnormal suggestive of a condition of mastitis in the udders and are called mastitis milks. The remaining eighty-eight milks were normal in appearance, were included in the milk sent to the city of Edmonton for fluid consumption and for convenience are assumed to have been normal. They are divided into two classes, viz., those containing up to 500,000 leukocytes and those containing more than 500,000 leukocytes per cc.

The plating technique was that prescribed in Standard Methods of Milk Analysis (A.P.H.A. 1929) except that 1 per cent of glucose was added to the plating medium. Standard Methods of Milk Analysis was also followed for the Breed counting. The center of the field was delineated by means of a circle in the eye-piece and counting was done only within this circle, a hand tally being used in the interests of accuracy. With the exception of milks 89 and 90 and Table 3, column 3, *all counts are computed from the examination of 1,000 fields per smear*, care being taken to reduce duplication of fields to a minimum. All counts are reported on a per cc. basis. The possibility that dead cells may have taken the stain is disregarded in this study.

The following terms are used to describe the kinds of bacteria observed—

Group, any bacterial formation of one or more cells.

Chain, three or more cocci grouped in chain formation.

Clumps, three or more cocci grouped in non-chain formation.

Diplococci, these were recorded only when larger formations were not observed.

Single cocci, these were recorded only when larger formations were not observed.

Results

Numbers of bacteria

Of the eighty-eight normal milks thirty-one contained not over 500,000 leukocytes per cc. The plate counts of seventeen of these thirty-one milks average 918, the highest count being 4600. The Breed counts of the thirty-one samples average 34,980 the highest count being 231,600 and the lowest 3000. Ten milks (32.2 per cent) gave Breed counts under 10,000. The Breed counts of two of these milks, numbers 16 and 18, are over 100,000 and, when they are excluded, the average count for the remaining twenty-nine milks is 25,228. The details are set forth in Table 1.

Of the eighty-eight normal milks fifty-seven contained over 500,000 leukocytes per cc. The plate counts of 32 of these fifty-seven milks average 36,625, the highest count being 511,000 and the lowest 150. The Breed counts of the fifty-seven samples average 204,514, the highest being 2,562,000 and the lowest 3600. Six milks (10.5 per cent) gave Breed counts under 10,000. The Breed counts of four of these milks, numbers 46, 56, 70 and 76, are over 1,000,000 and, when these are excluded, the average count for the remaining fifty-three milks is 81,485. The details are set forth in Table 2.

The average Breed count for the eighty-eight milks is 144,678 and the average for the eighty-four remaining milks when numbers 46, 56, 70 and 76 are excluded is 61,462.

Kinds of bacteria

No bacterial forms were observed which were identified as being rod-shaped. It is probable that in a study of this nature very short rods would be classed as cocci. Long rods, however, would be easily identified as such and it is significant that none was found. The identification of stained bodies as bacteria was doubtless more accurate when groups made up of more than one cell per group were found.

Single cocci were found in every milk without exception but are reported in the tables only when no other formations were observed. No other bacterial forms were found in 35.5 per cent of the milks of low leukocyte content and in 15.8 per cent of the milks of high leukocyte content (Table 6) making an average of 22.7 per cent for the eighty-eight milks.

No record was made of the occurrence of diplococci except when larger groups were not present. Diplococci constituted the largest groups found in 38.7 per cent of the low leukocyte milks and 24.6 per cent of the milks of high leukocyte content, making an average of 29.5 per cent for the eighty-eight milks.

NUMBERS AND KINDS OF BACTERIA IN THIRTY-ONE ASEPTICALLY-DRAWN MILKS CONTAINING NOT OVER 500,000 LEUKOCYTES PER CC

				Types of Groups Found					
Milk Number	Leukocytes	Breed Count	Plate Count	Single Cocci Only	Diplococci	Chains	Cells in Longest Chain	Clumps	Cells in Largest Clump
1	500,000	54,000	1,550			+	4	+	9
2	500,000	38,400	550		+	−		−	
3	470,000	18,000			+	−		−	
4	450,000	12,600		+		−		−	
5	430,000	6,000			+	−		−	
6	420,000	27,600	750		+	−		−	
7	420,000	54,000	950			−		+	6
8	360,000	37,200	650		+	−		−	
9	340,000	75,000	300		+	−		−	
10	340,000	11,400				−		+	6
11	320,000	18,000		+		−		−	
12	310,000	6,600		+		−		−	
13	310,000	18,000		+		−		−	
14	290,000	12,000		+		−		−	
15	260,000	9,000			+	−		−	
16	210,000	121,200	150			−		+	87
17	200,000	3,000		+		−		−	
18	200,000	231,600	350			+	28	+	140
19	180,000	7,800		+		−		−	
20	180,000	6,000		+		−		−	
21	170,000	58,800	600			+	16	+	6
22	160,000	35,400	1,100			+	6	+	8
23	140,000	16,200	250		+	−		−	
24	120,000	57,000	750		+	−		−	
25	120,000	6,000	100	+		−		−	
26	120,000	43,200	4,600			+	8	−	
27	120,000	6,600		+		−		−	
28	90,000	7,200			+	−		−	
29	90,000	47,400	150		+	−		−	
30	60,000	4,200	2,700	+		−		−	
31	40,000	36,000	100		+	−		−	
Ave.		34,980	918						
Total				11	12	5		7	

Table 2

NUMBERS AND KINDS OF BACTERIA IN FIFTY-SEVEN ASEPTICALLY-DRAWN MILKS CONTAINING OVER 500,000 LEUKOCYTES PER CC

				Types of Groups Found					
Milk Number	Leukocytes	Breed Count	Plate Count	Single Cocci Only	Diplo-cocci	Chains	Cells in Longest Chain	Clumps	Cells in Largest Clump
32	15,960,000	51,300	1,000		+	—		—	
33	9,310,000	64,800				—		+	50
34	7,520,000	490,800	500			+	28	+	280
35	7,200,000	158,400	14,150			—		+	16
36	5,340,000	88,200				—		+	14
37	4,430,000	40,800			+	—		—	
38	4,160,000	63,600				—		+	4
39	4,150,000	81,600	2,300			+	10	—	
40	4,040,000	175,000				+	110	—	
41	3,700,000	72,600	75,250			+	20	+	6
42	3,500,000	48,000	1,350			—		+	12
43	3,450,000	363,000	8,350			+	32	+	232
44	3,000,000	155,000	1,150		+	—		—	
45	2,400,000	21,000	3,920	+		—		—	
46	2,360,000	2,562,000	511,000			+	250	—	
47	2,310,000	31,200	1,250		+	—		—	
48	2,140,000	82,200				+	146	+	34
49	2,100,000	154,200	7,600			+	4	—	
50	1,960,000	38,400				+	35	—	
51	1,940,000	720,000				+	800	—	
52	1,930,000	140,400				+	8	—	
53	1,740,000	64,200	1,700			—		+	6
54	1,570,000	12,000	2,800			+	6	—	
55	1,500,000	8,400			+	—		—	
56	1,458,000	1,383,600	273,000			+	200	—	
57	1,440,000	17,000			+	—		—	
58	1,430,000	26,400	600		+	—		—	
59	1,320,000	34,800				+	4	—	

60	1,300,000	15,600		+		−		−	
61	1,270,000	99,600	4,400			+	34	−	
62	1,270,000	28,200	17,200			+	8	−	
63	1,190,000	41,400				+	50	−	
64	1,170,000	12,000		+		−		−	
65	1,170,000	90,000	2,600			+	8	−	
66	1,060,000	31,200		+		−		−	
67	1,030,000	158,400	24,950			+	150	−	
68	1,000,000	31,800	26,350			+	24	−	
69	990,000	9,000			+	−		−	
70	960,000	1,593,600	63,600			+	92	−	
71	940,000	64,200	7,850			+	8	+	20
72	930,000	50,400	2,000			−		+	6
73	900,000	4,800		+		−		−	
74	900,000	7,200		+		−		−	
75	840,000	91,200	150		+	−		−	
76	840,000	1,799,400	28,750			+	800	−	
77	800,000	163,800	3,400			−		+	12
78	800,000	10,800		+		−		−	
79	790,000	10,800			+	−		−	
80	780,000	19,200				+	10	−	
81	770,000	30,600	600		+	−		−	
82	750,000	15,000		+		−		−	
83	710,000	38,400	3,400			−		+	3
84	660,000	10,800	1,000		+	−		−	
85	660,000	7,800			+	−		−	
86	600,000	3,600			+	−		−	
87	540,000	13,800		+		−		−	
88	520,000	55,800	7,750			−		+	16
Ave.		204,514	36,625						
Total				9	14	24		15	

Streptococci were observed in 16.1 per cent of the low leukocyte milks and 42.1 per cent of the high leukocyte milks.

Since clumps were observed in 22.6 per cent and 26.3 per cent of the two classes of milk respectively, it seems probable that the existence of non-chain clumps in milk and the udder condition which results in a high leukocyte content are not usually inter-related.

The six milks, 16, 18, 46, 56, 70 and 76 are exceptional in that each had an unusually high Breed count for its respective class. It is interesting to note that each contained large groups of bacterial cells. Uneven distribution of bacteria may account for the discrepancies noted in these six milks. The data in Table 3, however, are not very suggestive that the difference between the counts based upon the examination of 1000 and 2000 fields of ten milks is related to the size or kind of group. On the other hand the data, when arranged as in Table 4, suggest that the clumping of the bacteria is related to the discrepancies between the Breed and plate counts.

Data on two colostrums and five macroscopically abnormal milks are presented (Tables 5 and 6) but it is considered that there are too few samples to justify conclusions.

Table 3

THE RELATIONSHIP BETWEEN THE BREED COUNTS AND THE DISTRIBUTION OF BACTERIA IN 10 MILKS

Milk Number	Breed Count		Cells in Largest Group	Chains	Clumps
	1,000 Fields	2,000 Fields			
32	51,300	48,000	2	−	−
34	490,800	335,400	280	+	+
36	88,200	91,200	14	−	+
38	63,600	119,700	4	−	+
39	81,600	200,700	10	+	−
42	48,000	56,100	12	−	+
49	154,200	143,100	4	+	−
91	115,200	477,000	6	−	+
93	138,600	142,400	24	+	+
95	33,600	39,200	2	−	−

Table 4

THE RELATION OF BREED AND PLATE COUNT DISCREPANCIES OF 6 EXCEPTIONAL MILKS TO THE DISPERSION OF THE BACTERIA

Milk Number	Leukocytes	Breed Count	Plate Count	Type of Group Found	Cells in Largest Group
16	210,000	121,200	150	Clumps	87
18	200,000	231,600	350	Chains	28
46	2,360,000	2,562,000	511,000	Chains	250
56	1,458,000	1,383,600	273,000	Chains	200
70	960,000	1,593,600	63,600	Chains	92
76	840,000	1,799,400	28,750	Chains	800

SUMMARY

An extensive microscopic examination (1000 fields per smear) of eighty-eight carefully drawn macroscopically normal milks revealed that—

1 The number of bacteria in such milk is higher than has hitherto been shown, averaging approximately 25,000 per cc. in twenty-nine milks containing not over 500,000 leukocytes per cc. and approximately 81,000 in fifty-three milks containing over 500,000 leukocytes per cc.

2 No rod-shaped bacteria were observed in ninety-five udder milks.

3 Only single cocci were found in 35.5 per cent of the milks of low leukocyte content and in 15.8 per cent of the milks of high leukocyte content.

4 Groups no larger than diplococci were found in 38.7 per cent and 24.6 per cent of the low and high leukocyte content milks respectively.

5 Streptococci were observed in 16.6 per cent and 42.1 per cent respectively of the two classes of milk while non-chain clumps were recognized in 22.6 per cent and 26.3 per cent resepectively.

REFERENCE

1 Dorner, W. The bacterial flora of aseptically-drawn milk. N. Y State Agric. Exp. Station, *Tech. Bulletin No. 165,* 1930.

ACKNOWLEDGMENT

Financial assistance from the milk industry of Alberta is gratefully acknowledged.

DISCUSSION

President Johns: I am sure that all of us and particularly those who are interested in the laboratory end of dairy work will want to thank

Table 5

THE NUMBERS AND KINDS OF BACTERIA IN 7 MACROSCOPICALLY ABNORMAL ASEPTICALLY-DRAWN MILKS

Milk Number	Leukocytes	Microscopic Count	Plate Count	Types of Groups Found: Diplococci	Chains	Cells in Longest Chain	Clumps	Cells in Largest Clump
89	120,000,000	240,000,000	7,875,000		+	Very long Chains	—	
90	58,000,000	1,863,000	200,000		+	53	—	
91	47,400,000	115,200	100		—		+	6
92	17,880,000	107,400			+	97	—	
93	8,320,000	138,600	4,500		+	24	+	10
*94	860,000	75,000	50		—		+	32
*95	680,000	33,600	100	+	—		—	

* Colostrum.

Table 6

SUMMARY

	Up to 500,000 Leukocytes		Above 500,000 Leukocytes		Mastitis		Colostrum	
	Number	%	Number	%	Number	%	Number	%
Total Number of Samples	31		57		5		2	
Lowest Breed Count	3,000	....	3,600	....	107,400	....	33,600	....
Highest Breed Count	231,600	....	2,562,000	....	240,000,000	....	75,000	....
Average Breed Count	34,980	....	204,514	....	48,444,840	....	54,300	....
Single Cocci Only	11	35.5	9	15.8	0	0	0	0
Single and Diplococci Only	12	38.7	14	24.6	0	0	1	50
Chains no Clumps	1	3.2	19	33.3	3	60	0	0
Clumps no Chains	3	9.7	10	17.5	1	20	1	50
Chains and Clumps	4	12.9	5	8.8	1	20	0	0
Total Containing Chains	5	16.1	24	42.1	4	80	0	0
Total Containing Clumps	7	22.6	15	26.3	2	40	1	50

Dr. Thornton and Mr. Strynadka for presenting this paper. An enormous amount of work must have gone into the collection of the data which has been presented here and I think there is no doubt about it that it is probably the most extensive and most careful study that has been made of the bacterial population of normal milk that has yet been made. I see Dr. Breed is with us again this morning and I certainly hope we will be able to have a few words from him in commenting upon this piece of work which is following the well known technic he devised a number of years ago.

Dr. Breed: You can imagine my interest in listening to this paper by Mr. Strynadka and Dr. Thornton. Dr. Thornton has already indicated its significance. Some have been disturbed because the newer types of agars that have been suggested for standard control work show many more bacteria in some milk supplies than previously reported where ordinary standard agar has been used. However, such figures are never as large as the numbers shown where individual bacteria are counted under the microscope.

This report recalls an incident that happened during our early experience with this microscopic technic. Some of you will remember the comparative analysis of milk samples done under the supervision of Professor H. W. Conn in New York City (*U. S. Public Health Repts.*, 30, No. 33, August 13, 1915) where duplicate samples of milk were sent to four or five laboratories in the city, in an effort to see how accurately counts would be duplicated. Very wide discrepancies in counts were revealed in this study. As a consequence, methods of making milk counts were standardized better than had previously been the case. At the time, Dr. Brew and myself were invited to make microscopic counts from the same samples.

In the last series of analysis, made after the printed report was published and never reported in print, Professor Conn took a bottle of high grade raw milk and prepared samples which were sent to the laboratories in sets of 20 each without their being conscious of the fact that they were duplicate samples.

Dr. Brew and I had separate sets of microscopic smears prepared in duplicate, *i.e.* forty smears each. These were duplicates although we were not conscious of that fact when we started to count them. As I remember it, when we had counted about five smears each, 100 fields per smear, factor 240,000, we compared notes only to find that each of us already suspected that we were counting smears from duplicate samples. When we finished we arranged the counts from the 80 smears on which we had together counted 8,000 fields of the microscope and sent the average count to Professor Conn, telling him that we felt that all the samples were from the same milk. The average plate counts on that bottle of milk for all of the laboratories proved to be something like five thousand two hundred per cc, while our count on clumps of bacteria made with the microscope was something like four thousand, and the individual bacteria count was about six thousand. Professor Conn and others were greatly surprised to find that we could count a high grade milk as accurately as this with the microscope.

This and other work like that reported by Mr. Strynadka and Dr. Thornton show that if enough fields are examined with the microscope and you have patience enough to count them, you can get accurate counts with the microscope even from low count milk.

Dr. Williams: Could I ask the diameter or area of those fields? There seem to be so many fields per smear, I am really wondering if the smears were larger than one square centimeter or if the diameter was small.

Mr. Friend Lee Mickle: Unfortunately, in listening to this paper I realize that I am getting to be an old man; it took me immediately back to 1909 or 1910—that is a long way back—when I was a student under Dr. Breed and the Breed count was just an idea in this very capable head here beside me. While a student under Dr. Breed I watched that idea grow and develop and I have been watching it since and it seems to me that this paper this morning shows what a long step we have gone.

It seems to me that this piece of what seems to be careful, laborious work is an answer to something that I heard raised here last evening: the question of why are we "nuts" of laboratory men trying to extend bacteriological methods to ice cream and other products when we are in such confusion as we are in the milk field?

I am not surprised that the poor quality of some laboratory work (and such has been done by all of us at times) makes the administrative groups and the others who have to use our results very confused and causes them to wonder what it is all about, but it is work of this kind that is going before long to point out definite procedures and methods that will be of value that can not be questioned, in my opinion.

President Johns: Any further discussion? If not, I will call on Dr. Thornton.

Dr. Thornton: Thank you for what you have said regarding this work. I will transmit it to Mr. Strynadka to whom the credit is due. It seems to be a far cry from the oppression of Czarist Russia to the subject under discussion this morning, but Mr. Strynadka is an Ukrainian, coming of stock of the oppressed Ukrainians under Czarist Russia which oppression has given to those people, as we have found in Western Canada, a habit of tenacity that I have not observed in other people. I do not expect to get another student, unless indeed it is another Ukrainian student, who will have the patience to sit at a microscope and do what he has done. I assure you no credit is coming to me for this.

I think that my attitude of rather unconcern as to what particular method we use in averaging bacterial counts is explained after giving this paper this morning.

I am interested in what Dr. Breed has said and I have often wondered how in that laboratory, in the particular piece of work that he cites, they were able to get such consistent results.

It may be interesting to you—these are only part of our figures, as I said—that Mr. Strynadka on a number of milks made duplicate or replicate smears and counted all the bacteria on each smear. We have eliminated, for various reasons of nonuniformity of technic, all but two and I have some summary figures on these two milks here. These are the results of eight smears for each of two milks, each smear being completely examined and the counts based upon a complete examination of the eight smears for each of two milks. In milk No. 1, the lowest count of the eight smears was 9,000; that is not the total number of bacteria on the smear; that is the count per cc in the milk; the highest was 30,000. The largest number of cells in any group found on the first smear was 2, the largest number of cells found in any one group on the other smears was 200. In milk No. 2, done the same way, the lowest count was 25,000, the highest count was 60,000; the smallest group was composed of six cells on one smear—the largest group, I should say—the largest group on the other smears was fifty.

Now I may explain these large numbers of fields that were examined. The standard technic was followed, therefore, the smear was 1 centimeter square. I am afraid that I have used the word "field" meaning two things: all these counts are based upon the diameter of the microscopic field, although the actual counting was done within the circle of the eye-piece micrometer. There were almost exactly 6,000 fields of our particular microscope per smear. When I mention 48,000 fields I multiply 6,000 fields per smear by eight smears per sample to get 48,000 fields per sample of milk. I thank you.

President Johns: Thank you very much for coming, Dr. Thornton, and giving us the results of this very fundamental study on the bacteria population of milk. We hope that as time goes on we may again have an opportunity of hearing from you.

REPORT OF COMMITTEE ON DAIRY AND MILK PLANT EQUIPMENT

LAST YEAR your Committee on Dairy and Milk Plant Equipment started the work of drafting specifications for milk plant equipment. At the annual meeting the Association went on record as favoring this undertaking and instructed the Committee to continue work along this line.

The work done this year includes a further revision of the specifications on inlet and outlet connections for pasteurizers or holders submitted in tentative form last year and the drafting of specifications of general applications to all milk plant equipment and specifications for pasteurizers or holders. To this we have added specifications for weigh cans concerning which manufacturers have requested information as a result of official criticism of existing installations. The specifications are to be submitted later.

We wish to emphasize at this time the fact that this Committee is proposing standard specifications for new equipment and is not proposing a form of ordinance covering equipment. There has apparently been some confusion on this point and we wish to make this distinction clear. In drawing the specifications we have, of course, kept in mind that if the manufacturer follows these specifications strictly, the equipment so manufactured should meet the requirements of practically all milk ordinances.

The question has arisen as to just how far the Committee should go in covering details that are not of direct public health significance. The Committee considers the items questioned to be important in their indirect bearing on public health. For instance, matters affecting the flavor of milk are important because the sale of off-flavored pasteurized milk has frequently been known to lead consumers to drink unsafe raw milk of better flavor.

One point that has caused considerable difficulty is that of being specific. If we say a surface shall be smooth the question immediately arises as to how smooth the surface shall be. To be specific it may be necessary to attempt to specify certain limits of roughness under definite magnifications.

Some cooperative research work is likely to be necessary before such standards can be set.

In addition to undergoing the scrutiny of all the members of this Committee, the specifications in tentative form have been submitted for criticism to the chairmen of the Plant Advisory and Simplified Practice Committee of the International Association of Milk Dealers, to the Technical Committee of the Dairy and Ice Cream Machinery and Supplies Association and to many individual manufacturers of milk plant equipment. We have attempted insofar as is practical to make use of all the constructive criticism that could be obtained. All these agencies have been very cooperative.

Notwithstanding this, the Committee feels that the specifications are subject to further constructive criticism not only at the present time but that they should not remain indefinitely without revision. We anticipate that in the light of further study constructive changes should be made from time to time as may be deemed necessary. Such changes should apply to new equipment. Inasmuch as these specifications should tend to improve equipment, it cannot be expected that equipment manufactured before these specifications are adopted will fully meet such specifications.

The work of the Committee has been handicapped by the necessity of exchanging ideas by correspondence. Since our arrival in Milwaukee it has been possible to get most of the members together for a round table discussion of the general principles involved. We feel that it will be advisable to make a marked change in the form of the specifications with a view to emphasizing that they are intended as a guide to manufacturers in producing better equipment and not as regulations.

In our attempt to be specific, the tentative draft of the specifications has assumed a form that could be easily mistaken for or converted into regulations. We have noticed, in submitting the tentative draft of specifications for criticism, the tendency of many to assume that they are regulations or represent the committee's recommendation as to how regulations on equipment should be drawn.

We would like to incorporate in these specifications many forward looking suggestions which it would not be practical to enforce as regulations at least at the present time.

Many milk control officials do not have the facilities for enforcing, or at least are not enforcing, some very essential regulations and this should be done before we go into more refinements in regulations.

On the other hand the Committee believes that a concrete expression of opinion from the association as to the important principles that should be followed in the manufacture and perhaps in the installation and operation of milk plant equipment will be valuable not only to control officials but to dealers and manufacturers.

Therefore, we intend to change the form of the specifications without changing the purpose. We are also considering the advisability of calling the final product by some name other than specifications if that should be necessary to accomplish this purpose.

At the present time the Committee can only report that progress is being made.

Walter D. Tiedeman, *Chairman*

W. D. Dotterrer	W. H. Marcussen
Leslie C. Frank	Nelson M. Fuller
George W. Grim	George W. Putnam
C. Sidney Leete	V. M. Ehlers

President Johns: If there is no discussion of the report of the Committee we will automatically pass along to the next paper. In this connection, we have to apologize to our guest speaker, Prof. Elvehjem, of the University of Wisconsin. Through a misunderstanding the lantern which we had for the slides this morning was taken away after the morning's session and we are unable to get another within the next few hours. Unfortunately, Prof. Elvehjem has most of his material on slides; however, he has kindly consented to talk to us and try to get over as best he can the findings which are being reported in this paper.

A STUDY OF THE NUTRITIONAL VALUE OF RAW AND PASTEURIZED MILK

C. A. Elvehjem, Ph.D.

University of Wisconsin, Madison, Wis.

THE NUTRITIVE value of milk is a subject which has attracted a tremendous amount of interest. Some of the earliest studies conducted in nutrition laboratories dealt with milk and the construction of the first purified diets used in animal experiments was based upon the composition of milk. The milk protein, casein, and the milk fat, butter fat, have probably been studied more intensively from a nutritional point of view than any other food materials. As each of the vitamins was discovered, investigators immediately turned to milk as a source of these factors in the diet.

The introduction of methods of processing milk naturally aroused concern over the possible destruction or alteration of the essential factors in milk. Studies on the changes produced in milk by pasteurization are as old as the process itself. Theoretically, it should be very simple to measure the biological value of all the nutrients in pasteurized milk and compare these values with those obtained in the case of raw milk. In practice this method is found to be very difficult because we are not aware of all the nutrient factors in milk and because the assay of some of the known factors is far from easy. Until a few years ago no one had been able to rear a mammal from weaning to maturity on whole cow's milk in spite of the exceedingly favorable attitude toward the nutritive value of milk. We now know that milk is deficient in iron, copper, and manganese, that the addition of iron and copper salts prevents the development of anemia, which is so characteristic on unsupplemented milk diets, and that the addition of manganese allows normal growth and reproduction.

In 1932, Kemmerer, Elvehjem, Hart, and Fargo[1] demonstrated that rats and pigs fed milk mineralized with iron, copper, and manganese made gains which were comparable in every way with those made on a diet of mixed foodstuffs. In addition to the rapid gains, it was also evident that the total solids necessary for unit gain were smaller when the milk was fed than when a dry ration was used. Shortly after this, Krauss, Erb, and Washburn[2] reported that there was no difference in the growth of rats fed raw and pasteurized milk supplemented with iron and copper. Since their rats showed a slow rate of growth it occurred to us that any destructive action due to pasteurization could be more readily detected by supplementing the milk with manganese as well as iron and copper. In our first studies[3] we used a typical market type of milk and samples for feeding were collected from the same milk before and after pasteurization. The milk was heated to 145° F. in a vat and held at that temperature for thirty minutes. It was then cooled over a surface cooler to 40° F. Carefully prepared rats were started on the respective mineralized milks at about forty grams in weight and the rate of growth followed for six weeks. Without going into the details, it was again demonstrated that milk produced during September to November and mineralized with iron, copper, and manganese, gave growth in rats entirely comparable with that obtained in rats on a mixed diet. However, the milk produced in February and March was much inferior. The average daily gain for the male rats on summer milk was 4.2 gms., while that for the winter milk was about 2.5 gms. The milk produced during December and January was intermediate in its growth-promoting property. Thus, there is some definite change in winter produced milk which can be demonstrated when milk is used as the sole source of vitamins in the diet of rats.

The results for the pasteurized milk showed that the growth on pasteurized summer milk was identical with that on raw summer milk. However, the gain in weight for pasteurized winter milk was inferior to that for raw winter milk. Pasteurization has practically no detrimental effect, as measured with rats, upon the nutritive value of a milk of high nutritive quality but may further reduce the value of a milk of low nutritive value. Thus, the kind of milk which is used for pasteurization is more important than the changes which may occur during the process of pasteurization. The major problem is that of producing a milk of high nutritive value during the winter as well as the summer months. The type of ration undoubtedly has a greater effect upon certain constituents of milk than we have generally realized.

Further work has shown that the decrease in the growth promoting value of milk when the cows are restricted to dry rations may vary with individual cows. Breed has a very definite effect. The milks of lower fat content have in general given the best results during the winter months. This may be due to the fact that animals consumed a larger amount of low fat milk and thereby ingested a larger amount of the serum in which the factor or factors in question are undoubtedly present. The period of lactation, time of freshening, as well as other factors, are probably operative. Much more work is necessary in order to completely understand these variations.

Aside from the milk produced under ordinary summer conditions, e.g., pasture; and ordinary winter conditions, e.g., dry feed and silage; we have studied the effect of adding A.I.V. silage or artificially dried alfalfa to the winter ration. The milk from cows receiving A.I.V. silage was obtained from a group of investigators studying A.I.V. silage at the University, and the milk from cows receiving artificially-cured alfalfa was supplied daily through the courtesy of Dr. Henry Otterson of the Brook Hill Farms. The inclusion of either of these feeds in the ration definitely improved the value of winter milk. Better results were obtained when A.I.V. silage was used than when the dried alfalfa was fed, but the results in neither case equaled those obtained when the cows had access to pasture. Of course, we must remember that as yet we have not conducted tests when the silage or alfalfa were fed in quantities equal to the dry matter in the grass consumed by cows on pasture. Thus, fresh green forage contains a factor or factors which ordinary roughage does not supply. The active substance may be obtained in juice pressed from fresh green grass. Male rats fed mineralized milk produced by a cow that had been on dry feed for one year grew from 40 to 130 grams in six weeks while males from the same litter grew from 40 to 220 grams when 3 cc. of grass juice was added. Our most important problem, therefore, is to find feeds rich in this factor for winter feeding, especially the development of methods of processing fresh forage which will preserve this factor.

We have conducted similar studies with goat's milk,[4] and the results from this work have given us some knowledge about the factor in question. These studies were initiated in order to determine if the anemia produced on goat's milk was different from that obtained on cow's milk. Several European investigators had concluded that the anemia produced in children and in rats by feeding goat's milk could not be cured through the use of iron and copper salts. They suggested that the anemia was of the pernicious type. We have been unable to verify these conclusions in our laboratory. Rats rendered anemic on goat's milk have responded just as rapidly to iron and copper therapy as those made anemic on cow's milk. However, all the rats showed a very poor

growth, even in the presence of manganese. Most of them lost weight after two to three weeks and were dead before the end of the six weeks' period. They showed no very definite pathological symptoms except emaciation and some muscular weakness. When the goats were fed a high grade alfalfa hay much better growth in the rat was obtained. It is evident, therefore, that the nutritive value of goat's milk can be influenced by feed just as well as cow's milk. The goat's milk showed a greater deficiency than winter cow's milk because the rats actually died rather than merely showing poor growth.

Some attempt was made to determine the deficiency for normal growth in goat's milk by adding various vitamin concentrates. The addition of vitamin B_1 crystals obtained from Dr. Ohdake, yeast, cod-liver oil, or orange juice had no distinct beneficial effect. The deficiency, therefore, cannot be due to lack of sufficient vitamins A, B_1, C, D, or B_2 (G). Liver produced some improvement, but the best results were obtained with brain tissue. Since we have shown that brain tissue is a good source of vitamin B_4 and since the animals showed symptoms somewhat similar to rats on a vitamin B_4 deficient diet, we are inclined to believe that at least one of the deficiencies in goat's milk and winter cow's milk is vitamin B_4. If that is the case we have another vitamin which varies in amount in milks produced under different conditions. Since this factor is readily destroyed by heat, it is logical to assume that a part of it may be destroyed during pasteurization. However, if the original milk contains an ample supply of this factor, the small amount destroyed during pasteurization may be of no practical significance. Our knowledge of the effect of pasteurization on the nutritive value of milk will grow with increased information about the newer factors in the vitamin B complex. In the work which I have described.

methods for detecting the changes in the milk were developed before the factor or factors concerned were identified.

References

1 Kemmerer, A. R., Elvehjem, C. A., Hart, E. B., and Fargo, J. M. The nutritive value and efficiency of mineralized milk. *Amer. J. Physiol.* 102: 319 (Nov.) 1932.

2 Krauss, W. E., Erb, J. H., and Washburn, R. G. The effect of Pasteurization on some of the nutritive properties of milk. *Ohio Agric. Exp. Sta. Bulletin,* 518, 1933.

3 Elvehjem, C. A., Hart, E. B., Jackson, H. C., and Weckel, K. G. The nutritional value of milks—Raw *vs.* pasteurized and summer *vs.* winter. *J. Dairy Sci.* 17, 763 (Dec.) 1934.

4 Kohler, G. O., Elvehjem, C. A., and Hart, E. B. Goat's milk anemia. *Amer. J. Physiol.* 113, 279 (Oct.) 1935.

Discussion

President Johns: I think you will all agree that Dr. Elvehjem's paper is particularly timely at the present moment when there is considerable discussion as to the effect of pasteurization upon the nutritive value of milk. Various research laboratories in different parts of the country and in different countries are working upon this problem. I think the point he has brought out—the salient feature—is the need for study of the effects of different feeds upon the nutritive value of the milk whereby, as he suggests, we may produce a winter milk which will be sufficiently rich in all of the essential elements that the slightest damage which may result from pasteurization will not seriously impair the quality of the milk. I am sure we appreciate very much having Dr. Elvehjem come to us and deliver this talk. The paper is now open for discussion.

Dr. Henry T. Scott: I heard Dr. Elvehjem present a paper before the Food and Nutrition Section Tuesday morning, on the Vitamin B complex. The Vitamin B complex has grown in the past few years and unless you are following the vitamins it may be confusing. We figured up awhile ago that a paper comes out on some phase of the vitamins once every three minutes. In reference to the B complex, I believe if Dr. Elvehjem would take just about two or three minutes and summarize all the factors we have in the B complex for this group it would be very timely, because I am sure that you will have a better understanding of these nutritional factors. The people working on vitamins speak of these factors just like the A, B, C's, but to this group I am sure a few words on this B complex would be very much appreciated.

President Johns: I think that is an excellent suggestion.

Dr. Elvehjem: Originally, we had Vitamin B and in the last few years investigators have attempted to break down Vitamin B into a number of different factors, and although originally Vitamin B referred to the water soluble factor recent investigators seem to want to include all new factors in the Vitamin B complex, so that this has become quite a large family in itself. The first division, of course, was made when we broke Vitamin B down into "B" and "G." The English workers are inclined to use the tem "B_1" for Vitamin B and "B_2" for the "G" Vitamin and out of that has grown the nomenclature B_1, B_2, B_3, B_4, B_5, and even B_6, so you see we have quite a large number of B vitamins. I just want to mention some of the more important ones. B_1 or B is still the anti-neuritic Vitamin which cures polyneuritis. That factor is now isolated in a crystalline form and I mentioned that we fed our rats crystalline B_1, to show that this factor was not deficient in the milk.

B_2 or G is, according to nomenclature in our laboratory at least, still the anti-pellagric factor, which cures pellagra.

B_3 I will not bother you with at the present time, because there is some controversy over its actual existence.

B_4 is the factor that I spoke about and the one we suggested is necessary for growth, or accounts for the difference in growth on milk produced in the winter and that produced in the summer. It has been called the anti-paralytic vitamin—in other words, it cures paralysis, or what is very typical of paralysis in experimental animals. There is a degeneration in the brain and certain parts of the nervous system.

B_5 is also somewhat questionable and the old B_2 has been divided into the anti-pellagric factor and the chemical compound known as flavins. Some workers want to use B_2 for flavins and B_6 for anti-pellagric factor. However, I think it is much simpler to retain B_2 as anti-pellagric. This new group of compounds known as "flavins" is essential in the animal body and in nutrition, but for the time being I prefer to use the term "flavin" for that factor and not to use any alphabetical term so that the four important components of the B complex then are anti-neuritic, anti-pellagric, anti-paralytic factors and flavins, which as yet have not been associated with any definite pathological symptom.

Dr. C. I. Corbin: I would like to raise the question whether any work has been done in the treatment of legumes with molasses as compared with the AIV method.

Dr. Elvehjem: I may say that our feeding work has been limited to the use of AIV silage; that is, legumes preserved with acid, but this year the plan has been extended at Wisconsin and silage has been put up both by the acid method and using molasses. We hope if we have sufficient time and enough experimental animals to test the AIV silage and the molasses, side by side, to see if the two methods preserve the same amount of this factor.

Dr. Shrader: Have you tried those grass juices dried?

Dr. Elvehjem: No, we have not in this work. All we did this summer was to feed the fresh green grass every day and also this grass juice which was pressed out fresh daily. In some of our other work on B_4 we have dried the green grass and we have been able to preserve the B_4 during the drying process, but if that dried grass is allowed to stand around for any length of time—say four or six weeks—it seems to deteriorate and this factor disappears, so that even after the material is dried there seems to be some destruction of this factor.

Dr. Shrader: You do not keep it in a vacuum or dark glass?

Dr. Elvehjem: No, just in an ordinary container. We have indications that B_4 is destroyed through oxidation and that would account for the destruction.

OPPORTUNITIES FOR INSPECTORS TO HELP FARMERS

A. J. Glover

Hoard's Dairyman, Fort Atkinson, Wis.

PRODUCTION of clean, wholesome milk requires an understanding of what constitutes sanitary practices and diseases of animals which may affect the quality of milk. The milk inspector must have a clear, comprehensive understanding of practices in the dairy and barn that must be followed to produce clean milk. He must also be informed on the diseases of cattle that affect the wholesomeness of milk. A knowledge of human nature is by no means a liability to the milk inspector.

The milk inspector who has a clear understanding of these things will find many opportunities to give substantial help to the milk producer. Let us consider some of the most important factors in the production of clean, wholesome milk.

To produce clean milk requires a barn that can be kept in sanitary condition at all times. This does not mean an expensive barn, but one of proper dimensions in every respect, provided with just the right amount of lighting space, ventilated by the best methods, and with floors of approved standards. The ideal barn is a big start toward producing clean milk but it is not fundamental in order to carry out good sanitary practices. The clean barn is indicative of practices which are necessary to follow in order to produce good milk. Clean milk can be produced with dirty cows but it is not wise to try to produce clean milk under such conditions. If a dairy has dirty cows, it is very good evidence that the milk from it will be unclean. It is well, then, for the inspector to insist on clean cows and be able to instruct the farmer on how to keep them clean.

It is quite the general practice among the best dairy farmers to clip the udders, flanks, and tails. This gives opportunity to keep the udders and flanks clean. Cows should be well bedded in clean stalls. It is a simple matter to clean the flanks and udders of cows just prior to milking when they are kept in a clean place. It is important that this part of the work be done carefully, for the most important step in the production of clean milk is to follow the right methods in milking.

How is a milk inspector to educate a milker to do his job in the right way? It has often seemed to me that we give more attention to remote factors which influence production of clean milk than we do to supervising the proper preparation of a cow for milking and carrying out the milking process in the right way. The festooned cobweb in the corner of the barn is not an inviting sight, but it has little or nothing to do with the character of milk produced in that barn. It is essential to require clean hands, clean udders, and clean practices in milking. When we get farmers everywhere to understand and follow the right practices in milking, we will have gone far toward solving the problem of producing clean milk.

The milk inspector should have some method of demonstrating to the farmer the difference between careless milking and that done in the right way, for too much emphasis can not be placed upon the necessity of clean cows, clean hands, clean milking practices. It is, of course, necessary to have sanitary milk pails, cans, strainers, and all other dairy utensils and it is important that they be properly sterilized, whether it be with chlorine, lye, or steam. It is essential that the farmer be taught why the brush is superior to a cloth, and especially the dishcloth; why washing powder should be used instead of soap; why the cans should be thoroughly dried after they are cleaned.

A little time taken to explain to the farmer how a little milky water makes a fine growing place for the bacteria which impair the quality of milk, is well spent and gives splendid results. It is far more important to teach the care and cleansing and sterilization of milk utensils than it is to require the farmer to strain the milk in a building separate from the barn. If a barn is an unfit place in which to strain milk, it is an unfit place in which to milk milk. Requiring the farmer to strain milk in a building separate from the barn is not a request that meets his approval and when the inspector is not in the neighborhood, it is quite likely the farmer will forget the milk house. It is far better to emphasize clean milking, how to prepare the cow for milking, how to keep the utensils clean and under proper conditions after they are clean than it is to require the milk to be strained in a building outside the barn.

To control bacteria, the milk is cooled to sixty degrees or lower soon after milking. This can be done without great expense or much effort. It is my opinion that the milk inspector should assist the farmer to an understanding of the importance of cooling milk and the best ways of doing it.

To produce wholesome milk requires healthy cows. The time is not far distant when no milk will be sold from cows with an ailment that may influence the wholesomeness of milk. Diseases which have received most attention to date are tuberculosis, Bang's disease, and mastitis. Tuberculosis is fast being eliminated from all our herds. We now have twenty-two states that have been accredited, which means that tuberculosis in dairy herds has been reduced to less than one-half of one per cent.

Much attention is being given to Bang's disease. The federal government has made liberal appropriations for indemnities for cattle that have reacted to the blood test. Just what will be the final solution of this disease, no one is wise enough yet to anticipate. It may be it will be handled through immunization; it may be that we shall continue to eliminate this disease in the same way that

we have tuberculosis and thus destroy Bang's disease contagion. There is no question but that this disease should be eliminated from herds producing fluid milk for market, although the danger of such milk being injurious to the consumer has been overemphasized. You have run a thousand times more risk of losing your life or being injured in an automobile than you have from using milk from cattle suffering from Bang's disease. It is an economic rather than a health question. It is the farmer who will be benefited most by freeing his herd from Bang's disease.

Mastitis is a disease of the udder of which we know but little. Cows suffering from it should be separated from the herd and their milk destroyed. If it is the virulent type, it is perhaps well to get rid of those animals having the disease. Just how to treat it is not known. Frequent milking is about the only treatment we have. It is caused, so we are told, by bacteria but just why some cows have mastitis and others do not, just what creates conditions for germs to enter the udder and build their nests, no one has fully discovered. It is held by some that mastitis is due to the lack of proper nutrition. For example, if cows are fed too much protein and an insufficient quantity of carbohydrates, it produces an acid condition of the udder and an acid condition of the udder invites the germs of mastitis, which exist in the air like pneumonia germs, to enter and begin their devastation. It is known by feeders that there is more udder trouble when cows are overfed or fed too much protein than when they are given a balanced ration and not fed too much. It will take much research before we have very much, if any, understanding of the causes and prevention of mastitis. When cows are suffering with this disease, it is better to keep them separate from the rest of the herd and milked last. Care should be taken in the handling of their milk to prevent spread of the infection to animals free from mastitis.

It is quite evident that the milk inspector is an important factor in securing a clean, wholesome milk supply. The service he renders to the dairy farmer will depend on what kind of a teacher he proves himself to be. The milk inspector is employed to see that certain rules and regulations of the health department are carried into effect but without giving the farmer proper education in the handling of his herd, his milk utensils, and making the proper tests to locate disease, little can be accomplished by the inspector who fails to give this education and depends upon the force of law or regulation to accomplish the desired results. Comparatively few milk producers desire to place on the market a food that is unclean and unwholesome. Imperfect work is invariably due to a lack of understanding. The milk inspector who takes the right attitude toward his job, feels his responsibility, will not neglect the opportunity of becoming a capable and sympathetic teacher to the man who is producing fluid milk for the market.

Discussion

President Johns: I think you will all agree that it a long time since we have been given a talk with as much meat in it as the address we have just listened to by Mr. Glover. It simply bristles with points that the inspector is running up against every day and gives us the frank, candid opinion of a man who is on the other side of the picture, who is doing the essential work of the dairy industry in producing a good, safe, clean milk. I want to extend our sincere thanks to Mr. Glover for coming to our meeting and giving us this most interesting talk. As I say, this paper touched on so many vital points that I am quite sure there are some in the audience who will want to get up and comment on certain of the points that have been raised, so Mr. Glover's paper is now open for discussion.

Dr. Brooks: I am not a milk inspector; never was, so I really should not discuss Mr. Glover's talk. I greatly enjoyed it and agree with almost everything he said, but I think even a guest speaker of his distinction expects somebody to take issue with him on something. He probably would be disappointed if somebody did not. I am just going to take a little issue with his point of view on the significance of milkborne infection. That is a subject the rest of the folks know I am frequently harping on. In general, I agree with what Mr. Glover said, even on the subject of the communicable disease, but there is another point of view and Dr. Ramsey, who was here yesterday, described some recent milkborne epidemics of septic sore throat which we have had in New York State and we are having about three a year there pretty regularly, while other states have none, for some reason. Dr. Ramsey pointed out what it meant to the people, for instance, in one of the villages where of 3000 people they had an epidemic of about 400 cases of septic sore throat. Septic sore throat is a serious disease where they are always sick and the deaths that occur during the epidemic do not represent the actual deaths resulting from it, because months afterward people may be dying from the complications: streptococcus infection. The point is that the 400 people in that village certainly thought that was a very important matter.

On the subject of undulant fever, there is a man in the audience whose wife for several months has been suffering from undulant fever and she also is in Milwaukee; she went out shopping with my wife and I learned yesterday that along about the middle of the day, even though her infection was acquired months ago, she begins running a temperature and has to come back and lie down until it subsides and then she can start shopping again. It takes a whole lot to keep a woman from shopping. From her standpoint—and there are a great many like her—undulant fever is rather an important matter.

Mr. Glover: Dr. Brooks, I quite agree with you but it has been my desire not to overemphasize the danger of contracting undulant fever through drinking milk. It seems to me Bang's disease is more of an economic question than one of health. I recognize that occasionally a person contracts undulant fever through drinking milk and that this has been pretty well demonstrated. We farmers must be directed to having all our cows free from disease. It is to our advantage to eliminate all diseases. We save by such a course and increase the consumer's confidence in our product, which helps to increase consumption of dairy products.

Dr. Holford: I would like to ask Mr. Glover if he does not think it is rather misleading in speaking of the difference in the price the producer receives and the price the consumer pays for a bottle of milk, due to the fact that only a certain percentage of the amount of milk the dealer purchases is sold in bottle form? In other words, the amount the producer receives and the amount the dealer receives is not the difference between the producer's price and the price of a bottle of milk. I believe that very often the public gets the idea that this spread is "dealer profit," which is not true.

Mr. Glover: I quite agree that making this statement without any qualification is perhaps unfair and misleading. A higher price is paid for milk that goes into bottles than for milk sold for other purposes. I know there have been many unfair statements made against the milk distributor. It is not my purpose to indulge in this kind of discussion. We do have the problem of getting our milk from the farm to the consumer's table at a lower cost. It is a problem that concerns the milk distributors as well as the producer. We all recognize that the present system of distributing milk is expensive.

In my little city, for example, I have been selling milk for 2.7 cents a quart and handle all the surplus myself. The dealer gets 8 cents a quart. In my close contact with the market, I know this dealer is not getting too much but I think you can all appreciate that when I receive 2.7 cents a quart, I am not being overpaid.

Dr. Grim: I feel after Mr. Glover's very illuminating address that many of us as milk inspectors may be placed on the defensive. Mr. Glover pointed out very vividly the difficulties of enforcing some of our requirements. He speaks very disparingly about the festooned cobwebs in the barn, and about those of us who preach the gospel of the straining of the milk in the milk house.

He emphasizes the point that if the barn is clean enough for the milking it should be clean enough for the straining. Our attention is directed to the problem of education of the dairyman. I think most inspectors have been trying to educate dairymen concerning methods of clean milk production and that Mr. Glover's address throughout indicated the urgent need for them to continue their efforts along educational lines with special emphasis upon cleanliness in milk production, clean cows and clean hands—but it seems to me it would be overdoing the job quite a bit were we to insist that the barn be kept as clean as would be required of a milk house or milk straining room.

One of the difficult things in a dairy stable is to keep flies out of the milk. There is no practical way I know of to keep flies out of the average cow stable. Therefore it follows, if the milk is to be strained in the cow stable there is no way to keep the flies out of the milk. No one would question seriously the feasibility of excluding flies from a small, well-screened room such as the regulation milk straining room or milk house under proper management. In such a room the dairyman can easily strain his milk under well-controlled conditions where flies can be kept out with a resonable degree of certainty. We know that many dairymen do not like to carry the milk pail from pail to the straining room or milk house for straining. But regardless of the likes or dislikes, it will be observed that the dairyman who consistently produces clean milk is the dairyman who keeps his cows clean, keeps his cow stable clean, and carries his milk to the milk house or straining room as soon as the pail is full. The difficulties in producing clean milk when straining is done in the feed alley, on the back platform or beneath the forbay are only too well known. The narrow platform, the swishing tail, the greedy fly, make easy prey of the open strainer. But these are the conditions with which we must be content and so I must confess not a little surprise in view of the emphasis put on clean milk that it would be suggested we could strain milk in the cow stable and still keep the milk clean; because experience in inspecting many farms over many years has been that this is a thing that can not successfully be accomplished. Whether the farmer likes it or not we must insist that the milk be removed from the cow stable for straining. Within reason we must do our best to have the cow stable kept clean at milking time. We can not be unreasonable in cleanliness with respect to cow stables but we can insist that the dairyman provide a really clean place to strain his milk.

Unfortunately the dairy cow is one of our dirtiest domestic animals. The sooner we can draw her milk and remove it from the cow stable to a clean place the greater will be our chances of preventing contamination.

President Johns: In that connection, I was fortunate enough to get out to see Mr. Howard Greene's Brookhill Certified Farm at Genessee Depot and was interested to note that straining was being done right on the alley.

Dr. Grim: Were they straining or pouring from one can to another?

President Johns: They were pouring into a can with the strainer. The strainer was simply sitting on the can. I think I would like to hear a little more discussion on the point Dr. Grim brought out—the fly problem—at this time.

Mr. Glover: I would like to ask if any one ever found a milk house on a dairy farm that was entirely free from flies. It is possible, of course, to keep their number reduced but when we go from the barn to the milk house to strain the milk, constantly opening and closing the screen door, a few flies are bound to get into the milk house. They soon find their way to the milk strainer. An arrangement can be made for keeping flies away from the milk strainer by simply taking a piece of cheese cloth large enough to cover the strainer, fastening it to a wire that can be raised and lowered by an attachment which operates with the foot.

To me any barn that is clean enough in which to milk, is clean enough in which to strain milk. When we make too great demands upon the producer, we sometimes defeat the very purpose we desire to accomplish. We can all agree that we should keep flies away from the strainer, and a covering of cloth over the strainer will accomplish this purpose admirably. It will appeal to the farmer more than carrying his milk from the barn to the milk house to strain it. It has been my experience that nine-tenths of the farmers will carry out sound and fundamental practices for the production of clean milk. The other one-tenth we might as well give up. They will never take instructions that will help to produce a clean fluid milk for the market. We might as well recognize this from the beginning.

Dr. Grim: In the East, many dairymen strain milk in the milk house. Here in Wisconsin, in Indiana, in Minnesota, Michigan and Ohio, where milk houses if provided at all are frequently 100 yards or more from the barn and I do not imagine dairymen carry the milk, pail for pail, to the milk house for straining. In the Central Atlantic States we have plenty of milk houses conveniently located but frequently experience difficulties in the matter of straining milk. We conduct inspections quite early in the morning and late in the evening. We find quite often that the milk has not been strained in the milk house. We penalize for this offense by not allowing the milk to be marketed. We can not insist that the cow stable conform to the various details of sanitation necessary to provide a cow stable as clean as it should be for straining the milk. I think cows ought to be milked in a clean room used for no other purpose than milking and return to the customary environment and their dirty habits during the interval between milking but at least for the present we must adapt ourselves to conditions as they exist. We should give the dairymen all the help and information we can to get him to keep his stable clean and to provide a reasonably clean footing for the cows. We should teach him concerning the necessity of keeping the bedding clean and the necessity for having a reasonable amount of light and fresh air in the cow stable. The dairyman should be taught why he should clip the cow's udders and flanks; why it is necessary for him to keep his milk stall clean, wash his hands before milking and carry his milk to the milk house or straining room where the pail is filled.

Mr. Yates: This is a very interesting subject. I have always wondered: why a strainer? I have been preaching clean milk for the last twenty-five years and during that time we have been talking on the farms about producing milk in a cleanly manner and we have been improving strainers daily, to have them take some of the dirt out that gets into it. It is not an impossible task. There is a milk plant in the city of Baltimore that has seventy producers, none of which use a strainer. They only use a net wire mesh strainer in their plant and they successfully put out milk that is acceptable and free from dirt, so it is possible to do it.

Mr. J. M. Lescure: I think that is correct, but I think we are wasting a lot of time talking about a strainer. Why fool ourselves? When you finish straining the milk you have clean dirt anyway and the best thing to do is to take the cans right into the barn, forget the strainer, lift the lid, and pour the milk. If you produce milk the way it is supposed to be produced you do not have to strain it.

Dr. Grim: The certified dairies have never been able to get away from strainers and I had supposed that the cleanest milk produced on any farm was from certified dairies.

Dr. Parker: The chief reason for getting on my feet is to say that I am glad to see Mr. Glover again. Years ago I used to meet him on farms in the Illinois milkshed and part of the dairy education that I received was watching Mr. Glover, particularly in the way he interested the farmers in the production of clean milk and in making them take pride in their work. I then conceived a very high opinion of the work he was doing and it has been enhanced as years went on.

With regard to the fly question: Florida has flies the year around and we have to fight them the year around. Our best way of doing so is with a mixture that we make up of five quarts of syrup, one pint of

Cooper's Cattle Dip, which contains arsenic, and four gallons of water. If you can get the dairymen to take the broom and dip it in this mixture and shake it on the barn floor after it is cleaned and the cows are turned out, the flies come and eat and die. If there are many flies about our dairies we know the farmer is not using this Cattle Dip; but with all that, when the milk is strained—and it sometimes is—in the barns and we happen in and see, we find a lot of flies on the strainer.

The way we educate our dairymen is to make them hate flies, and very few of our dairymen (only the class that Mr. Glover says ought to be out of the milk business) are willing to strain their milk in the dairy barn. Our milk houses are located not more than ten feet away from the barn and are free from flies most of the time. I say "free from flies" —in my house we always have a fly for breakfast Sunday morning and in the same way two flies in the milk house, but the fly contamination is not as great as it would be in the barn. In Florida our barns are like milking barns: wide open; the breezes turn a good many flies away, but some come in when the cows are brought in for milking.

It seems to me that the question of equipment for barns is of vital importance in the producing of clean milk. We all know that it is possible to produce clean milk in a barn that we will say is insanitary, but it takes a lot of work to do so and we have found if we build a barn that is convenient to work in, easily kept clean and looks well, the farmer will take a pride in keeping it clean. He is proud of his plant, invites his neighbors and his customers to come and see it, and we have gone a long way in the battle to get clean milk. I have in mind just at this moment one dairyman who for years was in the class of dairymen that is just hopeless to expect cleanliness about the place; he was a poor man, but he finally got money enough together to biuld a new plant: a little barn and milk house built in accordance with our specifications. He built them himself; instead of buying lumber he cut down trees on the farm, built rafters himself and he put up a clean, sanitary barn. Since he erected that barn, and milk house for straining the milk, we have had no trouble with him; his milk is up to grade and he is just as proud of them as a person is with a new Cadillac. He flashes them in the eyes of his customers and his friends and says: "Look what I have!"

I think Mr. Glover's points are thoroughly sound. We do insist on points that are unessential and we forget a good deal of the time the essential points, but milk inspectors are learning and so are farmers; we are being educated together. We are educating each other, and I would say that we are less impractical than we were in the days when I used to have the pleasure of meeting Mr. Glover at work in the Illinois milkshed.

I think we want to keep in mind Mr. Glover's points. We want to be sure that the things we recommend are practical and do have a bearing on good milk. I feel we are making progress, and largely because such men as Mr. Glover have been in the field.

President Johns: I think Mr. Parker has accurately summed up the discussion on this question. Have you any points that you would like to reply to in particular, that have been raised, Mr. Glover?

Mr. Glover: Well, Mr. Chairman, I do not think there is enough disagreement among us to get up a real good debate. Mr. Parker, I think, pointed out some of the things I emphasized and mainly for the purpose of showing the necessity of directing ourselves to the fundamental things in the production of clean milk. The festooned cobweb has little or nothing to do with the production of clean milk. It can be said that clean barns are indicative of the kind of farmer who is producing the milk. It is unfortunate that some inspectors emphasize what I consider nonessentials quite as much as essentials. When this is done, the sensible farmer loses confidence in the inspector's advice which we can all agree does not help to accomplish the purpose of inspection.

For example, New Jersey requires a certain type of milk stool and New York requires another type. Dairy farmers producing milk for both New Jersey and New York must keep two types of milk stools. Why?

At this point Dr. Grim asked the source of his information about the stools.

Mr. Glover: Dr. Moore, late Dean of the Veterinary School at Cornell, gave me this information when we were traveling together from Philadelphia to Washington. I had great confidence in Dr. Moore and I do not doubt but that his report concerning milk stools for New Jersey and New York was accurate. My only purpose in mentioning milk stools is to bring out the fact before this body that we do have inspectors emphasizing non-essentials more than the essentials for the production of clean milk.

REPORT OF COMMITTEE ON SANITARY CONTROL OF ICE CREAM

THIS YEAR your committee has divided its report into two parts:

First—The appraisal form for ice cream plants.

Second—The pasteurization of ice cream mix in the plant where the mix is frozen.

Appraisal Form for Ice Cream Plants

At our annual meetings held in 1932 and 1933, your Committee gave each member present a copy of the Sanitation Manual for Ice Cream Plants prepared by the International Association of Ice Cream Manufacturers. In the Foreword of the manual it is stated that the purpose of this Sanitation Manual is to assist ice cream plant operators to conduct their plant operations so as to conform with the terms of Sanitary Regulations for Ice Cream and also to assist regulatory officials in their work. For this latter purpose it is felt that the appraisal form in the back of this manual will be especially valuable. A plant operator would also do well to see that some one used this form regularly in inspecting his plant.

Copies of the Sanitary Regulations for Ice Cream referred to in the manual were given to the members of our Association present at the annual meeting in Cleveland in 1929.

In commenting upon the appraisal form, the Committee of the International Association of Ice Cream Manufacturers observes "As a matter of fact, it is impossible to draft an appraisal form or score card that can be used advantageously as one goes through a plant. Doubtless the best method is to take notes as one visits the different rooms and note anything wrong and later sit down and fill out the appraisal form from these notes, going back into the plant and checking up on any items that may have been missed." The Committee believes that this plan for making plant inspections is worthy of serious trial.

During the past two years the Committee distributed a number of the appraisal forms for the use of inspectors in various parts of the country. These were to be used and returned with the criticism of the inspectors. We have received appraisal forms from twenty-one state or municipal inspectors giving the results of the inspection of 102 ice cream plants located in sixty-four municipalities in four states. These inspections cover both large and small plants. Also plants handling both milk and ice cream are included.

The comments of the inspectors are summarized as follows:

1 The Manual should describe ideal conditions so that the inspector may have a goal to attain.

2 The appraisal form is too comprehensive for the making of frequent inspections of the same plant. It is suggested that this complete form be used once each year and that a more abbreviated form be prepared for follow up inspections during the year.

3 A "Yes" or "No" answer to some questions is not correct. For example, question 25—"Are can liners properly stored and handled?" In plants where liners are not used a "Yes" or "No" would be incorrect. The inspector must note "Not used" or some similar term to convey the real condition. Some suggest a third column providing space following each question for placing such words as "None," "Not used," etc.

4 Some inspectors recommend that the "Yes" and "No" columns be omitted. Following each question there would be space for a brief answer and it would be necessary to answer each question. If the item was fulfilled in a satisfactory manner the notation O.K. or something similar would appear. It is claimed that this method will provide a larger space for comments by the inspector and gives him greater latitude in answering questions.

5 The appraisal form should indicate whether or not the plant is in operation at the time of inspection, the source of materials used in the preparation of ice cream, where the mix is pasteurized, if not pasteurized on premises where it is frozen and such laboratory analyses as are available.

6 Under the heading "Premises" it is desired that general directions be given for the proper construction of rooms in which ice cream mix is prepared or frozen or ice cream is placed in containers.

7 Under Item 19 the Manual requires that "Ice cream manufacturing plants shall be equipped with facilities for supplying and using an abundance of hot water and live steam for cleansing and sterilizing purposes." Item 22 states that "Live steam, boiling water or chlorine sterilizing solutions shall be used for sterilizing equipment thoroughly." It is believed that item 22 makes item 19 unnecessary when it allows chlorine to be substituted for hot water or steam.

8 Item 23, paragraph (a) No. 6, states "It will usually be found unnecessary to use any cleaner when washing cans that have contained fluid milk." This is not in accord with the experience of some of the Inspectors. They believe a cleaner is necessary for washing cans in which milk is delivered by the producer.

9 A wash bowl and single service towels are recommended for use in the mix room, freezing room, and packaging room.

10 Item 24 states "No partially filled cans or containers of bulk ice cream shall be delivered to the dealer." Item 33 states "Broken packages and partially empty cans should not be accepted from dealers." The Manual should indicate what the distributor should do with one-half of a gallon of ice cream remaining in a five-gallon can when a full can is delivered to take the place of the partially filled can in the cabinet.

Pasteurization of Ice Cream Mix in the Plant Where Frozen

A majority of your Committee recommends that ice cream mix be pasteurized in the plant where the mix is frozen. No doubt this subject will receive further attention next year.

Ralph E. Irwin, *Chairman*

A. D. Burke	Horatio N. Parker
F. W. Fabian	Harold T. Pratt
J. M. Lescure	F. P. Wilcox

Discussion

Mr. J. W. Yates: I would like to ask Mr. Irwin if Pennsylvania accepts Kleinen sterilization of ice cream plants?

Mr. Irwin: On certain equipment.

INTERSTATE UNIFORMITY OF MILK LAWS AND REGULATIONS

WHO WANTS UNIFORMITY AND WHY?

C. I. Corbin

Sheffield Farms Co., New York City

THE HEALTH of our people depends so much upon an adequate supply of pure dairy products that even a scarcity is usually attended by suffering and death. Increased consumption should be the aim of public health officials as well as the dairy industry. Why should not there be a uniformity in the laws and regulations surrounding the production, processing and delivery of milk in states supplying a common market?

1 New Scientific Findings

Almost every week new discoveries are announced by milk scientists which apply to the production of milk and the regulations, surrounding that production and distribution. Take the old regulation on sterilization of dairy equipment which calls for exposure to live steam or water at 180° F. To apply this regulation to insulated tanks would be impossible. The discovery of chemical germicidal agents such as, chlorine, should be immediately recognized. The use of such agents, their application and germicidal strength should be determined. As long as the equipment shows it has been subjected to a solution showing the right residual strength and germicidal quality, why should there be any question on a trivial point as to whether the agent producing the chlorine is in the form of a powder, liquid or gas?

Single service strainers, milk enzymes, bacterial enzymes, bacteria of the coli-aerogenes group, mastitis, milkborne diseases, insulated glass lined equipment are recognized by our milk scientists as factors important in their relationship to the quality of milk. State lines or control officials in a common area can not ignore the new findings of our scientists if public confidence is to continue to grow in dairy products.

2 New Dairy Products are being Introduced every Year

The food value of dairy products is becoming more and more known through the work of such research workers as McCollum and Sherman. These authorities tell us that milk is lacking an essential Vitamin D. Some control officials are still prohibiting the sale of milk in their municipalities which has been fortified properly with the required amount of this vitamin in spite of the fact that the municipalities surrounding them permit the sale of this product. Is this lack of uniformity right or is it wrong? Can these things be ignored when the duty of every public control officer is to see that the health of the people is improved? New regulations should be required immediately and uniformly, and the product accepted by all health officials or none, in a common area. Chocolate drinks have found an important place in the milk field recently. This and other new dairy products need proper laws and regulations to insure the correct method of manufacture, distribution and labeling.

In this day many cities are not alone in a locality. They may be surrounded by other cities or incorporated municipalities either in their own state or other states and probably all under some public health supervision. Take cities like Boston, Philadelphia and New York and even Milwaukee with St. Paul only a few miles away they are all interdependent. Uniformity of milk laws and regulations in a common area is the solution to this complicated situation.

Dairy products are moved long distances in a short time. Due to good roads, the development of insulated tanks for trucks and railroad cars, milk can be moved to any market. A few years ago it moved only by railroad to definite points. Why should this valuable, universal food not be so regulated and controlled that it can be moved into any common area, in any direction? Uniformity of standards and regulations will simplify this important problem.

3 Control Officials

In Bergen County, New Jersey where I live, there are eighty-seven health units. What do they do? A control official is created for the purpose of providing a reasonable and considerate protection for the interest of the consumer and the general public. The consumer should be educated to demand a safe, wholesome and unadulterated milk supply. There are many health control departments without adequate funds. Duplication of inspection increases the cost of this essential article of diet and naturally tends to defeat efforts to increase its consumption. The standard milk ordinance can not be adopted nation-wide. In New Jersey we have been shaping into recognition a state officers association. In New York the county health units have been functioning splendidly. There is not any question but what the leaders enforcing milk laws and regulations see the great need of such a body. Public control officials in a common area have come to believe in the necessity of uniformity of standards and regulations. Why should there be any question about certain standards? We must recognize such authorities in the dairy field as your President, Mr. Johns, Dr. Breed, etc.

4 The Dairy Farmer

The dairy farmer needs help. He can not be driven to meet certain standards. He is the most important link in the production of a quality product. We need uniformity in standardizing the equipment and the methods used on the dairy farm. The farmer is completely lost when certain equipment and methods will not meet qualifications of two or more markets. Essential changes usually follow new discoveries. New personnel on the farms have to be educated. Farm agencies such as the Farm Bureau, Granges, Experiment Stations and Colleges are continually giving advice and instructions. There may be agreement or disagreement which takes time and force in many instances to straighten out. The farmer needs good counsel and advice because his confidence and cooperation is needed in the production of high quality milk. The dairy farmer receives too many conflicting instructions. When he is visited by a representative from several different agencies, each one asking and demanding something different, he immediately becomes suspicious and loses confidence. He feels that the official visiting him is just filling a position. On the other hand, the inspector who visits the farm with definite information about the product produced on that farm and with a sympathetic attitude toward the farmer can make reasonable and helpful recommendations to correct any trouble. Such helpful criticism is not routine and immediately the dairyman gains confidence in the inspection and requirements. However, unless uniformity of standards for dairy farmers in a common market is established, the farmer is the loser by having to shoulder additional investment and expense which may not be essential in the production of high quality milk.

5 The Distributor

The distributor is between the devil and the sea. His inspectors go through the country with an armful of books and score cards for each municipality so that the milk from that point may be distributed. He is asked what it is all about and he answers that it is the law of that municipality. What can be accomplished by this picture? Nothing but confusion and complications. The large distributors probably are the worst sufferers. This confusion and over-lapping can be overcome only by *uniform regulations* in the common area. The distributors are broadening out more and more from their original function of merely collecting and delivering fresh milk to a function of aiding and educating the farmers for a larger and more stable fluid milk market as well as cooperating with the control officials to improve this valuable product so that we may have a healthier and better people. Large commuting centers are likely to receive their milk supplies from more than one state. Economic operation will hardly permit separate plants for separate municipalities. All milk should be safe and pure. Distributors want better and better milk supplies. They want the milk they use produced under the best scientific methods for all communities they serve. Interstate uniformity of milk laws and regulations is desired by scientists, municipalities of the same area, control officials, the dairy farmer and the distributor.

INTERSTATE UNIFORMITY OF MILK LAWS AND REGULATIONS

WHAT ARE THE OBSTACLES IN THE WAY?

RALPH E. IRWIN

State Department of Health, Harrisburg, Pa.

DR. CORBIN, in closing his discussion, has named those who want uniformity. Introductory to my discussion I will name those who do not want uniformity. Strange as it may seem the names are the same.

1 STATES DO NOT WANT UNIFORM LAWS

Uniformity in interstate requirements removes the excuse for farm and plant inspections in other states to exclude out-of-state milk. Differences in state requirements provide an opportunity in a political campaign for state office to promise protection for the milk producer by excluding milk from other states, protection for the distributor by requiring all milk to be processed within the state, and protection for the consumer against alleged inferior out-of-state milk supplies. Several candidates for state office have used such campaign material successfully.

2 MUNICIPALITIES DO NOT WANT UNIFORM LAWS

The election of a city council or the appointment of a city health officer may be based on the exclusion of milk from dealers in other cities. Also producers and distributors now furnishing the city with milk are assured a market restricted to their products in return for political goodwill.

A municipality claims the right to provide inspection and regulations according to its financial ability. A poor community must take what is handed out. A residential district composed of wealthy home owners may insist on the producers and the distributors meeting requirements far more strict than those of adjoining municipalities or the state in which it is located. It is claimed that since the cash is available for additional supervision, the municipality should not be prevented in its efforts to obtain a superior quality of milk.

3 Milk Distributors do not Want Uniform Laws

The distributor desires differences in requirements for building, equipment and producing territory to give economic protection. Distributors enjoying a profitable return on present buildings and equipment object to the installation of improved buildings and equipment that may lower the cost of plant construction, operation and distribution. There are many examples of this. The distributor says to the health officer: Have I not cooperated with you in every way and spent thousands of dollars in making the improvements you suggested or demanded? Have you not approved my plant and equipment? Therefore I object to having my investment jeopardized through plant design and the use of equipment that cheapens the cost of processing and distribution and directs the consumer's attention to more modern facilities. Then the distributor acts singly or in groups to prevent additional plants, major changes in equipment and additional territory for the purchase of milk. This results in the passage of municipal and state laws or regulations to prevent the sale of milk when the milk is processed in equipment differing from that in use in their plants. Also it prevents the approval of plants located in other states or the entrance of milk from other producing territories.

4 Manufacturers and Salesmen of Equipment do not Want Uniform Laws

Each manufacturer or salesman strives for the approval of his equipment and the disapproval of other equipment. The sale of territorial rights for the use of equipment is common and appeals to the distributor. Changes in the design of equipment provide sales arguments, give style and modernized appearance and appeal to the consumer.

5 Producers' Associations do not Want Uniform Laws

The most nearly perfect association of producers is the association that is ever changing farm requirements to prevent the approval of other producers and thereby maintains a restricted supply at an advanced price to the distributor and the consumer. The almost continuous battle between groups of producers is well known to the members of this Association.

6 Milk Consumers Object to Uniform Laws

Why should regimentation or communism rule the housewife in the purchase of a bottle of milk? Each desires and demands the right to tell her friends of the superior quality of the milk in the community where she lives and in particular of the "perfectly delicious" milk delivered by the distributor she has selected.

The appearance of the bottle and the designations placed on the cap are attractive to the discerning housewife. She appreciates the shape and color of the container and the various methods said to be used in its preparation. So the salesman hands her a Pyroglazized, Diversolized, Yundtized, Laboratorized, Divcoized bottle. Her attention is directed to the cap proclaiming a Supervised, Countryized, Clarifized, Mineralized, Alphabetized, Vitamized, Pricized, Bugized, Homogonized, Taylorized, Pasteurized, Creamlinized, Antarcticized, Byrdized, Goldenized Guernseyized Milk. No wonder the housewife is troubled with "overweight."

No longer will the housewife be satisfied with Vitamin B milk since Dr. Elvehjem told us we have vitamin B_1, B_2, B_3, B_4, B_5, B_6. Also we must add his recent vitamin discovery called, "Flavins." This last term, "Flavins," is worth a year's salary to any milk salesman.

Each housewife wants the school teacher to take her child to visit the plant where the milk she purchases is processed. "The best is none too good" is her slogan. There is no "best" in uniformity.

7 Milk Inspectors Dare not have Uniform Laws

How can a municipal inspector justify his existence if he accepts state regulations *in toto?* How may his director of public safety recognize his ability as an inspector if he can not indicate the superiority of his local milk supply by excluding supplies meeting state requirements or supplies approved by inspectors in adjacent cities? How can East meet West if the cities and states in the east have the same requirements as the western states? Here today in our midst we see state and municipal inspectors who live only a few miles apart back east now on their way west to inspect the same farms, the same receiving stations and the same treatment plants. And why not? This is a beautiful country. Indiana, Wisconsin, Minnesota, Iowa are beautiful states filled with producers and plant operators worth meeting. Then too there are attractive parks, the best of highways and beautiful lakes filled with gamey fish. With a market in the east, inspectors plentiful, surplus cream in the west and dealers ready to advance traveling expenses, why talk uniformity?

Who pays the municipal inspector? Is he not paid from city taxes? Who pays the state inspector? Is he not paid from state taxes? Should not the taxpayer be protected? No round-about answer or argument is allowed. It is yes or no. So the local producer and the local plant owner—taxpayers—must be protected. If our interstate commerce laws are troublesome, just reduce the required number of legs on the milk stool or increase the number of square feet of window light in the plant.

We have federal milk inspectors. Do they want uniform laws? Never. Once uniformity arrives, they are through, out of a job. Last Thursday, Mr. Frank gave us his paper on "Planned Control." A plan is a scheme or means or steps for arriving somewhere. He assures us that the Public Health Service Milk Code is in a "state of flux." Therefore the "code" is a "plan." And, true to the "plan," the Mayor Kelly Milk Ordinance of Chicago, referred to Thursday, and today, differs from any federal, state or city milk code ever written. We are further informed that Mr. Frank's board of advisers, representing the inspector, the producer, the distributor, the manufacturer of equipment and the consumer is eager for constructive criticism. Therefore, he concludes with an international call for suggestions that will improve the code. A milk ordinance, law or code written today will be out-of-date tomorrow. Changing, ever changing. Who mentioned uniformity?

INTERSTATE UNIFORMITY OF MILK LAWS AND REGULATIONS

WHAT SHOULD BE DONE ABOUT IT?

LESLIE C. FRANK

Sanitary Engineer in Charge, Office of Milk Investigations, U. S. Public Health Service

IN A PAPER given several days ago, entitled "The Coordination of American Milk Control Effort," I attempted to show that the coordination of American milk control effort is a vital necessity if we are to enable the American milk consumer everywhere to select safe milk intelligently, and if we are to increase milk consumption to the optimum and thus further most effectively the welfare of the dairy industry.

Most of you will probably agree, too, that if we are to coordinate American milk control effort wisely it will be imperative for us to agree upon some uniform method of milk control, in other words, upon a uniform ordinance or set of regulations.

Of course, we must expect that every human undertaking will elicit both approval and objection. On the side of the industry I have heard three types of objections raised to the program of unification. Two of these relate to the present Public Health Service program. They are:

1 That the requirements are not severe enough and

2 That the requirements are too severe.

Of course these objections were not raised by the same section of the industry and one can readily understand that such opinions will vary with individuals. It is only fair to state that these types of objections were heard more often before than since the appointment of the

Public Health Service Milk Sanitation Advisory Board, which includes in its membership three representatives of the industry and one representative of the United States Department of Agriculture. The time will probably never come when there will not be some individuals both among health authorities and among members of the industry who disagree sincerely with certain details of any uniform plan which may be proposed or adopted. I admit freely that I myself am not in 100 per cent accord with every detail in the present Standard Code. But I think we should all submerge our individual detailed preferences and agree to go along with group expert judgment. This is especially fair and proper since any standard code should be constantly subject to amendment so that it will be a progressive code. If any of us object to certain things in the Code at any given time the National Advisory Board has its ears open at all times to receive proposals for modification. It asks merely that we support our proposed modifications with ample and convincing evidence.

The other objection which I have heard from time to time from certain sections of the industry is that *any* standardization of milk control is unwelcome, irrespective of its nature. I have been frequently told, though not publicly, that standardization is not desired because it would tear down the so-called Chinese walls around local milk sheds, walls which have been built up to maintain certain price levels within them. It is feared that if standard milk sanitation regulations are adopted by all cities in the country there will no longer be a public health excuse for denying entry to outside milk supplies.

I can easily sympathize with this point of view and this fear. It is not difficult to imagine the mental attitude of the milk producer within the wall who is afraid that if he and his fellow producers do not organize to raise that wall as high as they can, they will be flooded with outside milk.

But I do not think these men have envisioned the entire picture. In the first place they have confused the present outside milk supplies, often subject to little or no sanitation requirements and therefore produced at low cost, with the future outside milk supplies after uniform sanitation requirements have been applied. Then, too, the fact has been overlooked that if we set up a Chinese wall around ourselves and thereby artificially boost prices above the level which would obtain were competition entirely unrestricted, this can only be a temporary situation and eventually the inside producers will find themselves at an even more serious disadvantage. For the very thing which is sought, artificially higher prices, must necessarily result in artificially higher profit for milk production within the wall, and thus automatically in turn attract a greater amount of dairying within the wall. The end result will therefore be that the producers within the wall will have exchanged an intermittent outside competition which is naturally penalized by long distance freight rates, for constant inside competition which is not penalized by such rates. Furthermore, the producer seems to have lost sight of the fact that milk consumption is a very sensitive phenomenon, and tends to shrink quickly under price advances.

I have never been able to believe, therefore, that in the long run Chinese walls are anything but a curse in disguise to the producing industry. They certainly are no benefit to the distributors, and least of all can they be considered as a blessing to milk consumers. Milk sheds which erect walls are usually the higher cost producing areas, and milk prices remain high as long as the walls remain.

Dr. Corbin and Mr. Irwin have already discussed many of the "pros" and "cons" but I wish to emphasize the tremendous advantage to the industry of doing away with the present conflicting sanitary standards since these will always be an unfortunate barrier to the free flow of the milk business. Furthermore, we must not lose sight of the benefits to the industry as a whole which will result from uniform sanitary standards and the destruction of the present Chinese walls. For thereby we will prevent the further increase of milk production in the areas least adapted to milk production, namely the areas inside some of the present Chinese walls. I am sure the American dairy industry sees now or will soon see that the more it increases the percentage of the total American milk supply produced in relatively high cost areas, the greater must be the average price in order to net a given profit. It must be obvious that this is diametrically opposed to maximum consumption.

Now let us consider somewhat more in detail the relationship of the consumer to the plan of unification.

Certainly those American citizens who travel, and that means most of them, will find nothing but advantage from the adoption of a uniform method of milk control throughout the country, provided only that the method selected is a good one. Such a method, if properly carried out, will mean that a given grade label will carry approximately the same definition all over the country. If there is made available to every citizen ratings of the excellence with which the definition is being enforced locally, we will then have reduced the buying of safe milk to ideally simple terms.

The principal objection we hear from certain health officers to the present public health service unification plan is that it embodies degrading as a means of punishing violations. These health officers are opposed to degrading because they feel that degrading implies the existence of lower grades, and they conceive that this would be regarded as a reflection upon the perfection of their milk control work.

This point of view does not take into account the following considerations:

First, that the use of the degrading device does not bar the health officer from the use of the permit revocation device. He has both at his command, and can limit the sale of lower grade milk to temporary periods of "grace."

Second, that in any case there is always a residual fraction of the supply which does not fully comply with the requirements and it is better to label this with a lower grade than to ignore it.

Third, that any city is permitted under the present plan to limit itself to permit revocation as Chicago has done.

Another objection raised by some health officers is typified by the following:—

The health officer of one of our larger cities has recently asked us approximately this question:—"Would you if you were in my place adopt the public health service milk ordinance? The milk supplies of my city are, I feel, quite safe and palatable. Why should I change?"

Our answer was that we would nevertheless adopt the ordinance because:—

1 It is better to rely upon group expert judgment than upon individual judgment, or even individual expert judgment. I would rather trust the judgment of the group of eleven experts who constitute the Public Health Service Milk Sanitation Advisory Board, than my own judgment, or the judgment of any single expert.

2 Even though the present methods of milk control in a given city may be preventing milkborne disease and may be producing a palatable milk supply so would the standard method recommended by the National Advisory Board.

3 No person or community can best exist to itself alone. Something is due the common welfare. Citizens of your city do venture outside and when they do, they are at the mercy of the general public health status of the outside community, and certainly at the mercy of the outside milk supplies. Therefore, it behooves every such city to help lift that status to as high a level of excellence as possible. This can not be done by a haphazard, chaotic, "every community to itself" method. The better communities must encourage the poorer communities to adopt a uniform, good method by being willing to adopt it themselves. In other words, all of the municipalities of the country could with advantage to themselves and to the country as a whole cooperate in a program for the voluntary adoption of a uniform milk control plan.

This applies with particular force to the cities which feel they are already doing good milk control work. Certainly all of us are aware that there are many municipalities which are doing unforgivably poor milk control work, and that not only the traveling public, but also their own citizens are often entirely unaware of that fact. In numbers of cases milkborne outbreaks must remain undiscovered, or perhaps even covered up. Unless the better cities help us promote the use of some such plan as the present public health service milk sanitation program, these backward communities can with entire impunity continue to neglect their milk supplies without the knowledge of their populations or of the traveling public.

To sum up, therefore, it seems to me that the unification of milk control methods has many advantages to recommend it to both the members of the industry and the consumers of milk, and that there is not a single real disadvantage which will operate to the detriment of either producer or consumer. As to what should be done about it, I wish again to voice the plea that we all submerge individual ego, accept group expert judgment, put our shoulders to the wheel, and help attain this brilliant objective to which we have all given so much thoughtful consideration.

Discussion

President Johns: I am sure you all wish to join with me in thanking the three gentlemen who have taken part in this symposium. As is perfectly obvious, the whole question of uniform regulations is—as Mr. Yates has remarked, like a bundle of fireworks and we could undoubtedly discuss it here until tomorrow afternoon without any let-up. However, many of us are anxious to catch trains leaving at noon and those who take part in the discussion from the floor will confer a favor by being as brief and to the point as possible.

Dr. Brooks: I am not going to apologize for jumping immediately into this discussion because, in the first place, it is a habit with me and in the second place, I had quite a lot to do with the formulation of the questions propounded in this symposium and with the selection of the folks who were selected to answer the questions.

As I listened to Dr. Corbin's interesting discussion of milk and uniformity in general and as he approached the end of his discussion I began to fear that he had overlooked the question: "Who wants uniformity," but in his last sentence he did answer it by taking the broad and very safe, if not quite correct position, that everybody wanted it—as I understood his answer. I have gotten quite a different impression, one that has been very well supported by Mr. Irwin's discussion. I have had quite a lot to do in New York State with an effort to get uniformity of regulations within the State and for several years now have been a member of a committee that has been working on that with considerable success—that is, uniformity between our state regulations and the municipal regulations, including the city of New York. But, thinking now of uniformity between states, as time has gone on I have formed quite a definite impression not only that everybody did not want uniformity but that the ones who did want it, and practically the only ones who did want it, were the large milk distributing and producing organizations and they would like the kind of uniformity—if I interpret their attitude correctly—which will permit their milk to go out but which will not permit other milk to come into New York State. That is a kind of uniformity that is very difficult to get.

I can readily understand how out here in what I have looked upon as the Middle West (Mr. Glover says this is not West) where I understand that they produce a lot more milk than they can use, they would be highly in favor of absolute uniformity. On the other hand, I can not conceive of organizations, for example, like the Dairymen's League, the Sheffield Farms Company and the Sheffield Farms producers' organization being in favor of uniformity, because that would immediately permit this milk from the Middle West to come into New York State and I am quite sure they do not want that.

The obstacles in the way were quite fully covered by Mr. Irwin and I do not think it was all irony—I think he was very frank—but there is one point that I do not think he brought out, that is, if we were to put in our regulations only those things which are fundamental and essential (and I will say that is what I would personally like to see done—I believe in it, certainly in principle) the thing that would immediately happen would be that the other states and within the states, the municipalities, in the first place, would jump into the situation and add the details which we omit in our fundamental and essential regulations, because there are always going to be people who think milk stools and milk houses are fundamental, while others do not. The only way to get uniformity is to add all possible details and when you do that you are immediately barraged with criticism of the regulations on the ground that they contain unessentials.

Then, as Mr. Irwin brought out, the local groups (this applies to states as well as municipalities) want special and irregular regulations, simply because it will shut out outsiders. When it comes to the question of what is to be done about it, of course we know perfectly well what Leslie Frank will tell us: to adopt the standard ordinance! But, after we have done all that, (and I have no doubt we will if Leslie's health and strength hold out!) we are still not going to have uniformity. In the first place there is this state of flux that has been referred to; this Advisory Committee goes down to Washington once every year and if they can convince Mr. Frank, they get changes made in the standard ordinance; those changes become effective, as I understand it, only when new states or municipalities adopt the ordinance. The changes are not necessarily made in the places where the ordinance is already in effect—at least not for several years—so there is immediately a lack of uniformity. Then there comes the question of uniformity of enforcement and someone in one of the talks or discussion yesterday said that a certain thing was a requirement of the standard ordinance but it was not feasible to enforce it in his state and, therefore, it was not being enforced, so there is another difficulty in getting uniformity, even under the standard ordinance.

Dr. Shrader: I think it is a principle of Herbert Spencer's philosophy that nothing is wholly good nor wholly wrong and the corollary of that is that there is something good in everything. The thing in the present situation, which has been interestingly and instructively expressed this morning, is that—in spite of the confusion—there are certain elements of soundness that we can not escape and one of those, I think, is the fact that uniformity is essentially foreign to the American principle. If we stand for anything, we Americans, it is the idea of competition; we resent regimentation. One of the strong objections that a lot of young fellows have to military life is that it is deadening standardization. In educational work we bump into it municipally, where we resent what we call the educational mills, where they send children in to go through the graded schools, go through standardized instruction and are turned out apparently alike but actually, of course, not alike.

I can not conceive how we can foster the competitive principle without acknowledging that differences and therefore lack of uniformity must exist as a stimulus to that competitive principle. With uniformity, it seems to me, all incentive to competition disappears. But individualism in standards can be carried too far and it seems to me that the difficulty, as brought out this morning, is an application of the extremes of practice in an effort to attain that original desiderata of competition. I think that the public, as a whole, want competition and therefore lack of uniformity, but in applying that to the situation as confronting dealers and producers, I think that a line of advance can be taken, not by attaining strict uniformity but by removing conflicts.

I look at the situation this way. Supposing a given municipality requires that milk houses must be provided; another municipality, whose milk shed overlaps this first municipality, requires that milk houses must be provided with one door and one window. Those two requirements do not conflict. Supposing a third municipality sets up a requirement that there shall be milk houses provided but must have only one door, which is the only opening in the milk house. There is no conflict set up in the first two instances, because the difference is a question of difference of degree, but what this third municipality set up was an impossible situation, a direct contradiction between the second and third instances.

It is in the interest of all groups, as Dr. Corbin pointed out, to eliminate the contradictions and it is not in the interest of everybody to eliminate differences.

Mr. Paul F. Krueger: I look at this from an entirely different standpoint than I have in the past when we have had these same discussions. The reason I look at it differently this year is because we have had our baptism of Standard Ordinance, having passed the first of the year, and its requirements placed in effect to a very considerable degree. We have had the opportunity to observe the workings of the

Standard Ordinance in a large city and these things we are discussing this morning are most interesting to me.

As you know, we have had considerable trouble and are having it right now in our own milk shed. It was difficult to get away, but I thought possibly I might add something to this discussion—I have certainly learned a great deal about it—because of what we have gone through. I think one of the first things I should say is the advantage of this system of standardization. Standardization is a submergence of the individual's idea to group ideas—I think that is the one thing we can say is the benefit to be derived, and that we have derived from following the standard ordinance.

Mr. Frank has said many times during the program that he does not approve of it 100 per cent and undoubtedly we have feelings along that same line. When the program was first approached we had many ideas and many thoughts about the Standard Code. We even thought in some cases it was ridiculous and when we put those same requirements into effect we learned ourselves of their advantages and learned the reason for their being.

One of the things that Dr. Shrader has brought out right in this same connection: we removed conflicts. We are not saying that in standardizing we are going to standardize every single item. We have differences in our ordinance from the Standard Ordinance (we call them upward revisions, but call them what you will) but not in the fundamentals. We have a belief, for example, that the citizens are entitled to fresh milk and we have a dating on the cap. That is just one of the items that I think of now which is not contained in the Standard Ordinance. But the fundamental philosophy of that ordinance is: let's put down the essentials and work to that point.

I am very enthusiastic about it and I am only using this time (I know you are in a hurry to get away) for one purpose. I have listened to these discussions for many, many years and I have heard both sides and now for the first time I am in a position where I can talk about some of the advantages that we have learned from a program of this kind. The first speaker, Mr. Corbin, mentioned that we should have uniformity, but gave us no indication of what that uniformity should be. I do not know what it should be. It is not my individual idea, but we should work to some common end, some common purpose, some common program.

A point was raised by Mr. Irwin of the various things that work against it. We have had those same things come up. In the past we thought we had a good milk supply (we thought we had the best) and as we got into this program and started working on it we learned a lot of things. We are willing to admit that—we must, because we have been making improvements and making improvements that, as I say, have not in one single case been found to be wrong by the producer, the industry or the distributor after they found out the true value of it.

I merely want to point out that this trouble we have been having in the milk strike you have been reading about is entirely a group conflict, a group fighting for the control of an organization of farmers, and there has been a lot of head-cracking going along with this conflict, but not once has any group or individual criticized the ordinance or any part of it, nor has that had any part in this conflict. I think that in itself shows that the producer and the distributor are sold on it.

Under the point just brought up that even though we have a Standard Ordinance some cities may not enforce certain parts of it, that is true of any ordinance, but that can be determined very readily upon examination and certainly we have something definite on which to work and if it is not enforced, then we can easily determine that for ourselves. The point was brought up this morning (Mr. Glover mentioned it too) of having our own men selling sanitation, showing the producer just why these things are necessary. In our first inspections under this Code that is what we did; our men were first given schooling and training and then they went out to sell these items. The first reaction, of course, was: all these new things coming on, what purpose do they have, etc. After we got the producers and the dealers sold on the idea, however, the equipment was provided. We have not had any reaction (and, gentlemen, I say that with no reservations of any kind) against the requirements and things we have been asking for.

I only wish I could say that we have complied 100 per cent, which of course we have not, but we are very well along toward it and before more than several months we will be able to comply. In our territory we have quite a number of plants that have other inspectors; we have some plants with as many as five markets and when we see and hear of the things that we do, where one health department says: "You can not use a covered top pail" and another says: "You must use it," the producer is in the middle; he does not understand it; does not know why. When he asks or when we ask the objection to the covered pail we are told: "It is not seamless; it is difficult to clean." This program of ours provides that they have methods for washing and sterilizing the equipment. Certainly that will overcome that objection and the advantages will more than offset any possible objection.

In connection with the milk stool, some will say: "You can not use a metal top milk stool." "Why?" "Because it is cold in winter and the producer may put a burlap sack or something on top of it." Certainly it would be just as easy to use a milk stool with metal legs and a wooden top, the idea being something that can be kept clean. If we stress the essentials, the rest will take care of itself. I just want to leave this thought: it is getting away from the individual ideas that we have as pet hobbies, or things that we believe sincerely, ourselves, to be right and yet when we have this mass reaction we oftentimes find we are not right.

Dr. Brooks: I would like to ask Paul Krueger if Chicago will now accept milk from any state where the Standard Milk Ordinance is in effect.

Mr. Krueger: I do not know. I think I have your point—we have a milk strike and during that strike we looked to communities with a standard ordinance that could supply us with our grade of milk. Now, that again just in the past week, has been a very good point in favor of the so-called standardization. I do not call it standardization; I say it is a meeting of, or straightening out of, individual differences on a common ground, which will work to the advantage of the producer and the distributor.

President Johns: I am very glad that Mr. Krueger was able to be with us today and particularly since he has been able to bring to us the experience of Chicago with the standard ordinance. It is particularly interesting to me, as a "foreigner," to follow this question of standard ordinance versus local and while Mr. Frank will vouch for it that there are certain items in his standard ordinance that I do not see eye to eye with him, I do believe he is doing a very valuable thing in his attempt to justify every item in the standard ordinance. So many regulations merely state that so and so shall be this or that or done in a certain way, with no attempt to justify it.

Mr. Glover referred to educational work as being the primary function of the inspector. How can you educate a man unless you can give reasons why a certain thing should be done, not merely an arbitrary: "It has to be done that way because I say it has to be done!" I think that is one point that the standard ordinance must be given credit for; it is attempting to bring out reasons why these things should be done, and the point has been stressed by so many people that the only way in which progress can be made toward the avoidance of conflict and attaining a measure of agreement is by substituting group expert opinion for the opinion and, too often, the prejudice of the thousands of people who are writing individual milk ordinances.

Dr. Grim: I am very much interested in the points that were raised by Messrs. Corbin, Irwin and Frank. I am also interested in Mr. Krueger's remarks. It just happens that I have been able and have had the opportunity to look over quite a number of dairy farms, both in the South, where the Standard Ordinance is in effect and in North Illinois and Wisconsin as well as the Central Atlantic States.

Recently Chicago has adopted the Standard Milk Ordinance. The provisions of the new Ordinance require that radical changes be made in methods in use upon the dairy farm. Formerly Chicago insisted that the milk pails and cans be stored on racks outside the milk house, that the cans be sterilized at the milk receiving station and little attention was paid to the matter of where the milk was stored.

For years Eastern inspectors have been working with Western dairymen in an effort to improve sanitary conditions upon their dairy farms. We have insisted upon milk houses of adequate size in order that milk utensils might be kept in the milk house, that cans be properly cleaned and sterilized at the milk receiving station and that sanitary conditions be maintained constantly in the milking stable. It has been a problem to educate the farmer to the point where he was able to appreciate the necessity of keeping his utensils in the milk house. It was difficult to get some of the creamery operators to appreciate the value of an effective can washer. These difficulties were met however and considerable progress was being made.

During July of this year I visited a number of creameries which formerly had shipped their product East but which were now striving to conform to the new requirements which had been placed in effect in Chicago.

I found in many instances most deplorable conditions. The new Chicago regulations require all utensils to be kept in the milk house and that in addition the utensils including the milk cans be washed and sterilized in the milk house and not at the dwelling. Apparently there are no requirements or standards with respect to the size of the milk house. Farmers in order to meet the new requirements were installing considerable new equipment in their milk houses without enlarging their dairy buildings. The result was serious overcrowding. Many of the milk houses were too small even for the pails and milk cans. Notwithstanding this double compartment wash tubs and water heaters were being crowded into the small buildings in such a manner that it was questionable whether they could be used for any purpose other than a storeroom. At no place did there seem to be an effort to sell the farmer with the idea of constructing a two-room milk house. The straining of milk in the milk house or straining-room was insisted upon and dairymen in a number of instances were building straining rooms. The same mistake was being made in permitting the dairymen to build miniature straining rooms, some of them not larger than 20x24 inches as was made when the milk house was constructed some years before.

I am convinced that the procedure which is now being followed can not in any way improve the Chicago milk supply because of the impractical requirements which are exacted from dairymen. It is unfortunate, I believe, that the opinion of an Advisory Health Council should be taken by the Public Health Service in matters of farm inspection when few if any of the members of the Council have any knowledge or experience concerning average conditions under which milk must be produced the year round. It sounds well to speak of group thinking and indicate that we are following the advice of many of experience but when those who advise us are lacking in experience and practical knowledge we are sure to encounter difficulties.

Might I ask, first of all, whether the gentlemen who comprise the Advisory Council have among them a person who actually inspects fifteen or twenty farms at least every four or five days or whether the Board is not comprised of persons who rarely if ever make dairy farm inspections?

Mr. Frank: No. Some of them do, but not as local city inspectors.

Dr. Grim: I am talking about people who actually have to solve these problems, deal with them when we meet them and get results.

I am told that the necessary equipment that the farmers have to meet for the inspection of the City of Chicago costs $34. If a farmer purchases this equipment he may enter the Chicago market. For the present there is no insisting upon a standard for bacteria or sediment and certain creameries which have for years paid premiums for milk on a bacteria basis are losing their patrons to the creamery shipping to Chicago which is apparently willing to pay the premium regardless of whether the dairyman earns it or not so long as he provides the required equipment.

Many of us in the East are unalterably opposed to washing dairy utensils in the milk room. We feel that if the utensils are to be washed in the milk house a two-room milk house should be provided. There has been repeated objection to coal, oil or gasoline stoves in both the wash room and milk room and we feel where fuel must be burned for heating water or sterilizing the stove should be in a room by itself.

Many of us are convinced that a dairy farmer can not improve the sanitary conditions of a milk can which has been properly washed and sterilized in a well constructed and operated can washer at the milk receiving station. Because of our convictions we insist that cans be washed and sterilized at the milk receiving station only and that stoves or fuel burning heaters be kept out of the milk room. We have insisted on these things both in the East and in the West for many years and have steadfastly refused to accept oil stoves in milk houses and the washing of utensils in the milk room.

Our investigations in the Chicago Milk Shed this summer reveal a new order. The receiving station operator if he cares to ship to Chicago must violate the regulations which are quite uniformly imposed upon him by the Departments of Health of the eastern cities. We find that the plant that endeavors to qualify for the Chicago market is immediately forced to disqualify himself for his eastern market.

I am told the Chicago ordinance has been adopted for the sake of uniformity. It seems to me that the result is a marked lap of uniformity and it would not surprise me a bit if it were suggested that we in the East change all of our dairy farm regulations in an endeavor to secure uniformity. Certainly no serious thinking person would consider uniformity of that kind.

Frankly I have no quarrel over many of the provisions contained in the Standard Milk Ordinance. They are the provisions found in any effective milk regulations. The important thing after all is enforcement. That is what appears to me to be most necessary. While we may be obtaining uniformity on one particular milk shed such as Chicago we at the same time travel afield from uniformity in another plant, and I had rather felt that Chicago was better off from the standpoint of dairy farm methods before they had undertaken to enforce their new requirements. I have heard a good bit of comment along the same lines from other inspectors who actually worked day by day inspecting western supplies.

Mr. Krueger: It is again that submergence of individual ideas. We believed the same way you do; we did not want the oil stoves or gas stoves in the milkhouse; we thought it was wrong, but we found out that it does not make any difference.

I might mention that if you made your inspections in July that was when we were getting started and as we have gone along more and more changes are being made.

Mr. Palmer: In the state of New Jersey, we had the subject of uniformity and regulations come up in a very concrete form when seventeen bills on milk were introduced in the Legislature in 1932 by various interests, and it can be imagined just what that did for uniformity. Finally the health officials took the matter up and drafted a bill, putting in specific requirements. The bill was taken up with the agricultural interests through the Farm Bureau, State Grange, Department of Agriculture, a conference with the industry, meaning the dealers and their attorneys, and finally we got a bill that was agreeable to every one. However, we could not get complete uniformity into that bill, even with many of the major things that would apply as uniform requirements in the fundamentals of milk production. Such an important thing as cooling and storage temperatures of milk by dairymen was debated very much. The dealers who were doing business in South Jersey, the section below Trenton, stated they did not want any cooling requirement, they would not stand for 50°F., nor 60; 70 would not do; and they further stated that all of the milk that came into the plants in that district had a bacterial count under 5,000. Asked how these things were attained, the reply was "they were attained." Therefore, a section was put into that statute which stated that cooling requirements for milk should be specified in local ordinances where the milk is distributed.

In the northern section of the State, ordinances in effect for many years require milk to be cooled below 50° F., for Grade A and below 60° F. for Grade B. Under the conditions cited enforcement of these standards immediately excludes the milk from the southern part of the State.

Another thing, in this matter of uniformity, we find that an ordinance is no better than its enforcement. As an example, on application for local license inspection was made of a supply produced within the State and proposed for local distribution. It occurred that a state health department inspector called at the office on another matter, so it was arranged that both go to the source of supply, a large dairy with about 100 head of cows and a pasteurizing and bottling plant. Both made inspections, wrote reports and copy of the local department report was submitted to be filed with the State Inspector's report. The supply under the existing conditions, with or without an ordinance, could not be approved because of the obvious contamination of the milk due to filthy methods and conditions prevailing. The local license application was disapproved. Later at a conference on uniform enforcement by the state and local health officers, inquiry was made as to what happened about that particular dairy and milk supply and the information was given that nothing had happened because certain other communities wanted it.

This matter of having uniformity on paper is one thing, but actually having uniformity in quality of products; uniformity in enforcement of regulations, is another thing, so I am very glad to hear Mr. Krueger express confidence in the fact that his city could accept milk from some other district simply because there was a similar ordinance adopted in that particular section. I am wondering whether he can make official inquiry and get reliable information as to just what the quality of products and degree of enforcement of the ordinance are, and what it means to the maintenance of the quality of the milk—those are the things we are all interested in.

In order to get uniformity, New Jersey and New York have appointed committees; and it was expected that Pennsylvania would do likewise, and it was the intent that these committees would hold joint sessions and endeavor to make regulations uniform.

The question is: who wants uniformity, what is uniformity, and how is it going to be attained?

Dr. Parker: It seems to me in this discussion of uniformity we think too much of it as a matter of ordinances and laws. To me uniformity has always seemed largely a figment of the imagination, because in the last analysis the condition of or the reaction of the community to the ordinance determines very largely what it is and how it is secured. Any one who has had the pleasure of working in different states, as Mr. Frank has, knows that the reaction, we will say of men from Albany, from Florida, from Massachusetts, or from Connecticut is entirely different. Their mental workings, so to put it, are different and, it seems to me, that the amount of uniformity that is to be secured is going to be determined by the way the population and the enforcing authority react to the written ordinance.

I think if Mr. Frank lives, we will say, fifty years and gets forty-eight states and the outlying island possessions under his standard ordinance he will still have forty-eight different ordinances plus the ordinances from the different island possessions, because this standard ordinance will be interpreted and lived up to in an entirely different way in the several communities. Now, through the standard ordinance we can get over some of our difficulties. It is, perhaps, beneficial to a certain extent to substitute group thinking for individual thinking, but not always. Both group thinking and individual thinking have their advantages. I am not ready to accept unqualifiedly any group thinking and, of course, I do not accept entirely the thinking or the teaching of any one individual. The whole thing, to my mind, comes down to a psychological reaction or solution. We can, by conference, and perhaps Mr. Frank's organization offers as good a meeting point for conferees as any other, iron out a good many difficulties but after we iron out our major differences and have our milk houses so that they are acceptable to everybody, and our milk pails straightened out, we shall still be far from having uniformity, for the sort of response given the laws by the people determines the uniformity that may be secured.

President Johns: I see Mr. Burrell is here and I think perhaps we will let him have a minute or two to express the views of his group.

Mr. Loomis Burrell: I have just two points in mind and I am not going to keep you. First, I heartily agree with what has been said, that we do not want uniformity if we mean by that that every detail is prescribed and we are all to have equipment and operate just alike. This country has progressed, the dairy industry has been developed because of individuality and initiative, and if we are to continue to progress most rapidly we need that same competition and the drive and ability of individuals, but it certainly seems to me that we do not want each state to have different requirements and regulations. We should decide what is essential and fundamental and make those into regulations that can be adopted by all.

The second thought was touched upon by our President, Mr. Johns, right along this very line and that is that I want to pay my respects to Mr. Leslie Frank and thank him for the education that he has been able to effect all over this country through the Standard Ordinance and Code.

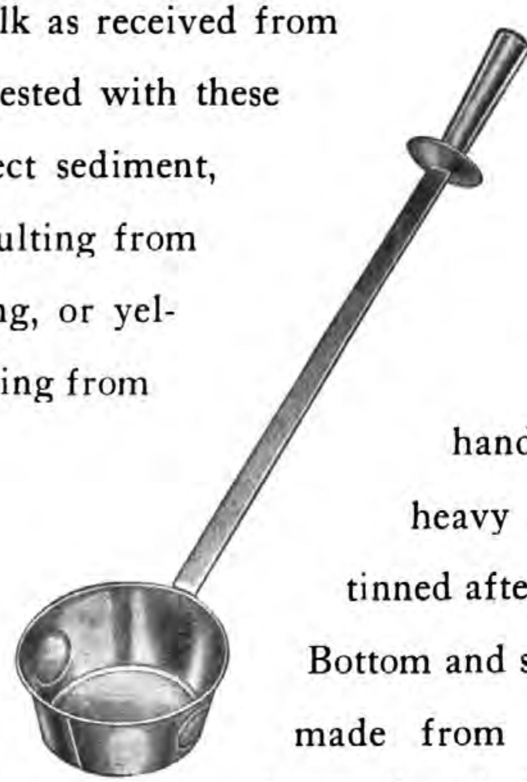
I have been connected with this industry for a great many years and I am sure you gentlemen will agree with me that there is nothing that has ever been brought to the attention of this industry that has so developed the ideas of what are essential and necessary for the protection of health in the construction of dairy equipment as the things that have been brought out in the United States Public Health Service Code. This has resulted in a new consciousness among all machinery manufacturers and has certainly produced results.

President Johns: Thank you, Mr. Burrell. Before we come to a close there is just one suggestion I would like to make and that is, that the Executive Committee in making arrangements for the program would be greatly helped if you members would indicate to them subjects or topics along the line of which you would like to hear a discussion. We want to try to make the programs interesting to everybody, to have at least one paper that will be of interest to everybody, no matter how specialized or generalized his interest may be, and I think I can speak for the incoming executive when I say that your suggestions as to topics will be welcome.

I have certainly enjoyed being able to be here and preside over these meetings. I hope you have got as much out of them as I have and I want to urge that everybody do his best, now that we appear to be on the upgrade again, to strengthen the Association by active interest and support, by bringing in other men who are in the same line and in general furthering the interests of the milk inspectors—or dairy and milk sanitarians—which you prefer.

Atlantic "Strip" Dipper

Each can of milk as received from patron can be tested with these Dippers to detect sediment, white flakes resulting from improper cooling, or yellow flakes resulting from Mastitis.



Body and handle made of heavy steel and tinned after assembly. Bottom and side screens made from 100 mesh brass wire cloth.

Goods bearing this label are guaranteed by
ATLANTIC STAMPING CO.
ROCHESTER, NEW YORK, U. S. A.

LONG-WEAR
ATLANTIC
METAL-WARE

"When Writing Mention This Report"

ICE CREAM CONTAMINATION BY DIPPERS

(In Retail Stores)

David W. Horn, Ph.D.

Bryn Mawr, Pa.

THE DATA for this paper consist largely of 501 bacterial counts from the public records of what I take to be a fairly representative suburban population.* They cover a period of over six years. The samples that were counted bacteriologically were all taken by a health officer † and each was poured directly from the dipper holder into a sterile bottle. During delivery to the laboratory, the samples were iced. They were plated promptly, by the writer, in accordance with Standard Methods.‡

The bacterial condition of the dipper waters brought to the attention of the Board and was first objected to by some ice cream manufacturers whose product has showed excessive counts when sold at certain stores. The Board of Health, after informing itself by the early examinations, took the point of view that the matter could best be dealt with "educationally." The major burden of instruction fell upon the health officer. Recalcitrant dealers however had at times to be brought before the

* Haverford Township, Delaware County, Pennsylvania.
The population is about 23,000 living in a territory of about 10 square miles. The seat of government is about 8 miles distant from that of the city of Philadelphia. Like other Pennsylvania "Townships of the First Class," Haverford uses the commission form of government, and its Board of Health is appointed by the president of its commissioners.

† Mr. J. C. Stauffer, Oakmont, Pa.

‡ Standard Methods of Milk Analysis, 6th Ed., 1934. American Public Health Association.
In tabulating bacterial counts for statistical purposes, Standard Form (or Scientific Notation as it is also called) commends itself as preferable to the logarithmic form recommended by the United States Public Health Service. There seems to be no need for carrying more than one digit in the Head Number of the Standard Form when used to express plate counts.

Board of Health to show cause why their ice cream licenses should not be revoked. Such measures were the only ones used by the Board.

In going over this 501 bacterial counts certain questions naturally arose, and this paper is planned accordingly. Each question propounded is answered by a table of data. The explanations necessary accompany each table.

QUESTION 1. How were the samples distributed throughout the months of the years?

Table 1

NUMBER OF SAMPLES EACH YEAR, BY MONTHS

Year	1929	1930	1931	1934	1935	Monthly Totals
January	2	12	15		35	64
February		14	15		5	34
March		14			3	17
April		14	29			43
May	20	31	5		5	61
June	11	15	6	5	5	42
July	11	17	7	5	5	45
August	11	15	6	5	5	42
September	12	16	6	5		39
October	11	14	7	5		35
November		15				15
December	13	15		34		62

The irregularity in distribution of the samples, records variations in interest and in funds. The spread over so many years gave results with possibly greater significance than would have attached to the same number of results in a sudden drive. It will be noticed that no samples were taken in 1932 and 1933. Each monthly designation means all the months of that name in which any samples were taken, throughout the 6½ years covered; thus *June* in Table 1 stands for five Junes,—one June for each of the five years in which samples were collected in June. The average monthly total of samples was 41.7 samples.

Question 2. How did the seasons affect the bacterial counts?

Table 2

Monthly Average Bacterial Counts

	Average Number of Colonies per cc.	Deficit or Excess as measured by the average value
March	40,000	—
February	70,000	—
April	100,000	—
October	200,000	—
November	200,000	—
January	400,000	—
June	400,000	—
August	500,000	±
December	600,000	+
July	700,000	+
September	800,000	+
May	1,000,000	+

In Table 2, the monthly average bacterial counts are arranged in the numerical order of the increasing counts. There is no consistent evidence that the size of the counts varied with the seasons; other factors outweigh that of outdoor air-temperature. Thus January showed as high count as June, and for December the count was higher than for August. While the local standard for the dipper waters was set at "not more than 100,000 colonies per cc" (because the local standard for ice cream called for "not more than 100,000 colonies per gram"), this standard was realized only three months out of the twelve. August, the average month, showed 500,000 colonies per cc.

Question 3. How were the bacterial counts distributed as to magnitude?

Table 3
DISTRIBUTION OF THE BACTERIAL COUNTS AS TO MAGNITUDE

Year	Counting 10,000 or less	Counting more than 10,000 but not more than 100,000	Counting more than 100,000 but not more than 1,000,000	Counting more than 1,000,000	Total number of separate counts
	Number of separate counts				
1929	26	19	27	19	91
1930	68	41	59	24	192
1931	49	16	25	6	96
1934	18	23	10	8	59
1935	26	23	11	3	63
	187	122	132	60	501

It is evident in Table 3 that as years passed, relatively more and more of the dipper water samples proved to be satisfactory, i. e., to count not more than 100,000 per cc. This is brought out even more clearly in Table 5, but the facts in Table 3 are an essential part of this report.

QUESTION 4. Did the vendor's experience as a food handler influence the counts?

Table 4
PERCENTAGES OF SATISFACTORY SAMPLES FROM DIFFERENT GROUPS OF VENDORS

	Number of Vendors in each Group	Percentage of Samples in each per individual vendor Group	Percentage of satisfactory samples from each Group
Restaurants	11	7.2	69.6
Pharmacies	16	9.4	67.6
Confectioneries	15	9.6	60.4
Stores	31	4.1	52.0
Average or Total	73	6.9	61.9

The data in Table 4 show that the samples from restaurants, where presumably there is the widest experience in handling food, were satisfactory in the largest percentage of cases. And the data also shows that the samples from stores, where various articles not intended

immediately for food constitute the principal items in the business, were the least satisfactory of all. It was discouraging to find that the druggists, who have received in Colleges of Pharmacy more or less instruction in bacteriology, were as a class not the most cleanly in this matter of dipper water.

QUESTION 5. Did the bacterial counts change for better or worse as time passed?

Table 5

PERCENTAGES OF SAMPLES SHOWING COUNTS OF DIFFERENT MAGNITUDES, AND PERCENTAGES OF SATISFACTORY SAMPLES

Year	Number of separate vendors from whom samples were taken	Percentage of samples counting 10,000 or less	Percentage of samples counting over 10,000 and under 100,000	Percentage of samples counting over 100,000 and not over 1,000,000	Percentage of samples counting over 1,000,000	Percentage of samples found to be satisfactory
1929	19	28.6	20.9	29.7	20.9	49.5
1930	38	35.4	21.4	30.7	12.5	56.8
1931	41	51.0	16.7	26.0	6.3	67.7
1934	34	30.5	39.0	16.9	13.6	69.5
1935	38	41.3	36.5	17.5	4.7	77.8
For all 5 years		37.3	24.4	26.3	12.0	61.7

The data in Table 5, especially in the right hand column, show clearly a steady progress with time. The percentage of satisfactory samples has risen steadily from about 50 per cent to about 78 per cent, in spite of the constantly changing personnel of the vendors.

It may well be stated here that repeated trials in the laboratory demonstrated the entire absence of any one-to-one connection between the turbidity of a dipper water and its bacterial condition as shown by plate count.

QUESTION 6. Did the dippers contaminate the ice creams, or the ice creams contaminate the dippers?

Table 6

PERCENTAGES OF SATISFACTORY SAMPLES OF DIPPER WATERS AND OF ICE CREAMS FROM 1929 TO 1935

	Percentage of Dipper water samples found to be satisfactory	Percentage of ice cream samples found to be satisfactory
1929	49.5	83.9
1930	56.8	78.2
1931	67.7	82.4
1934	69.5	86.0
1935	77.8	100.0

These figures leave no doubt that the dipper waters contaminated the ice creams. The ice cream samples, it should be stated, were all dipped by the vendor from the larger stock containers directly into sterile jars. The difference between the standard of "not more than 100,000 colonies per cc" for the dipper waters, and "not more than 100,000 colonies per gram" for the ice creams, is not great enough to account for the great differences in the percentages of satisfactory samples found in each of them.

QUESTION 7. How was the success of the educational program tested?

Table 7

PERCENTAGES OF SATISFACTORY DIPPER WATERS FROM THE SAME 10 VENDORS IN 1929 AND IN 1935

Year	Percentage of Samples counting 10,000 or less	Percentage of samples counting over 10,000 and not over 100,000	Percentage of samples counting over 100,000 and not over 1,000,000	Percentage of samples counting over 1,000,000	Percentage of samples found to be satisfactory
1929	35	25	25	15	60
1935	75	20	5	0	95

The fact that the number and personnel of the vendors was constantly changing was previously brought out in answering Question 5. But a direct comparison between 1929 and 1935 became possible when the Board of Health directed two complete samplings from all dealers in

December 1934 and January 1935. Direct comparison is possible only with ten vendors, for only ten vendors have persisted in business throughout the 6½ years of this work. For each of these ten vendors, the two earliest samples in 1929, and the two samples in these recent complete samplings, could be and were compared. The Table shows that for this select group, the percentage of satisfactory samples rose from 60 per cent in 1929 to 95 per cent in recent samples. These figures establish the fact that the "educational" method of dealing with the problem was a success.

REPORT OF COMMITTEE ON MILK PLANT PRACTICE *

THE EFFORT of the milk inspection service is directed toward producing a higher quality milk supply, and quality in milk includes richness, safety, cleanliness, and keeping quality.

Richness

During the past twenty years the fat content of the milk coming to the cities has very generally affected the price paid to the producer. Under this system of payment there has been a slow and steady increase in the fat content of the average milk supply, which means that its richness or food value has increased.

The fat content is measured almost universally by the Babcock test and the attention of the inspection service is given to insure the accuracy of the samples and the accuracy of the Babcock testing.

It is generally recognized that variations in the samples are apt to be wider than in the testing of a given sample. It almost necessarily follows that samples for Babcock testing are taken from the container in which the total milk delivered by a single farmer is weighed.

Extensive studies have been carried out in a number of states searching for factors which influence the accuracy of the Babcock sample. While these studies have not been entirely accordant, it appears that the form of the weighing container has an important influence upon the accuracy of the samples. A relatively deep, approximately square or round container permits a thorough mixing of the incoming milk, while the shallower and flatter the container, the more tendency to irregular distribution of the fat.

* This report was submitted but not read at annual meeting.

It seems likewise to have been demonstrated that where the strainer through which the milk passes into the weighing container is immersed in the milk it interferes materially with the uniform distribution of the fat.

Where the weighing container is objectionable from one or both of these standpoints, agitation in the weighing receptacle seems desirable in providing uniform distribution of the fat.

Safety

Since the presence of disease germs in the milk is a clear-cut menace to the health of the community this element of milk quality is of special interest to sanitary inspectors.

Improvement of Health of Cattle

The tuberculin testing of cattle is now widely carried out. State and Governmental agencies are generally keeping the records on these tests, but continued watchfulness is ncessary on the part of the Milk Inspection Service to insure that these tests are repeated at proper intervals.

Bang's disease testing is gaining headway in many states. In some cases it is now practicable to insist that all milk sold as raw shall come not only from tuberculin tested cattle, but from cattle not responding to the Bang's disease test. As rapidly as practicable all milk should be obtained from cows free from these diseases.

The examination of cows for mastitis is beginning to get under way in some places. This work is hampered by the lack of any single dependable test for recognizing and excluding such cows. Milk from an udder where the physical appearance is altered is not suitable for human food. We should probably exclude cows before the product reaches this condition, but as yet much technical skill must be combined with the available tests in order properly to locate cows which should be removed. Abnormal milk should not be used as food for humans.

Main Reliance on Pasteurization

Because of the present unsatisfactory condition of much of our knowledge regarding diseased cows and partly because of the probability that there are other objectionable ailments of cows which have not yet been recognized, and due to the fact that safety of the great bulk of market milk can only be assured by pasteurization, it is highly desirable that all milk intended for city trade should be properly pasteurized. Now that the American Association of Medical Milk Commissions has authorized the pasteurization of certified milk there is no longer any practical reason for making any objections to the demand for pasteurization of milk supplies wherever practicable.

Because of the importance of pasteurization in protecting the consumer it is important that inspectors give careful attention to important items connected with the process.

They should give attention to the presence of proper valves, properly placed.

Recording thermometers should invariably be present, and the scale on these thermometers should have one degree divisions throughout the pasteurizing range; these divisions to have a width of 1/16 inch. Such thermometers are readily available from the various makers, and there is no good reason why their use should not be insisted on.

Flushing the milk line with water at 180°F shortly before beginning the pasteurizing process is desirable in removing from the apparatus possible contamination resulting from human contact.

Heat treatment of the bottles into which the pasteurized milk is to be placed should be sufficient to guarantee their safety. The state of Pennsylvania has established an excellent precedent by requiring in the soaker type bottle washer an exposure of at least 165°F for at least three minutes.

Avoiding Human Recontamination

It should be kept constantly in mind that the continued protective influence of pasteurization ceases when pasteurized milk is contaminated subsequent to pasteurization. Accordingly, after the milk leaves the pasteurizer it should be carefully protected against the possibility of human recontamination. With this in mind, covered coolers or coolers placed in specially protected rooms should be insisted on.

Mechanical capping of all bottles should be required, and finger capping or any adjustment of caps whereby the fingers come into contact with the milk should be prohibited.

There is now a common requirement that in the better grades of milk, hood caps shall cover and protect the pouring lip of the bottle. This requirement might well be extended to cover all grades of milk since the consumer of the standard milk is entitled to as much health protection as the consumer of the richer grades. The only real objection to this lies in the cost of the hood caps. The cost of such hoods is decreasing and may not be an obstacle for long.

Cleanliness

The dirt encountered in milk is very largely finely ground soil particles or particles of boiler residue brought into the plant apparatus through the steaming process. These soil particles are so fine that they tend to pass through milk filters and much of this material is not removed by the clarifier. Accordingly, if we are to provide the consumer with milk which is essentially free of visible foreign matter we should give much attention to obtaining a clean raw milk supply.

Just as the practice of making a part of the price to the consumer depend upon the fat content, the physical cleanliness of the milk can be most effectively improved by an arrangement whereby the cleanliness of the milk modifies the price to the producer.

In the case of the fat content, the Babcock test provided a convenient standard for determining the richness.

In the case of the cleanliness of the milk the sediment pad offers the best available means of classifying the milk with regard to cleanliness. The standard photographs of such pads provided by the American Public Health Association, are, at present, the best standards for such classification. Studies are under way which will result in improvement of these photographic standards for this purpose.

The present tendency seems to be toward grouping sediment pads into four classes; clean, acceptably clean, dirty, and very dirty.

While the methods of payment for milk are not under the immediate supervision of milk inspectors, they would do well to encourage the modification of milk prices on the basis of the cleanliness of the incoming milk.

Keeping Quality

The ability of milk to stay sweet and in satisfactory condition depends very largely upon the germ life present in the milk. Accordingly, any test of keeping quality is an attempt to forecast the activity of this germ life.

There have been wide differences of opinion as to the methods to be followed in taking samples of incoming milk for keeping quality examination. Recent extensive studies conducted in Pennsylvania and New York seem to indicate that samples taken from the weighing container will be fair to all parties concerned.

Bacterial Plate Count

In the past the bacterial plate count has perhaps been most widely used for this purpose. It was found helpful in connection with earlier studies of raw milk. However, the process of pasteurization results in a marked change in the germ life in the milk. Recent careful studies of this question have shown that the bacterial plate count of pasteurized milk is subject to a number of limitations which seriously reduce its value for forecasting keeping quality.

The composition of the standard media now provided by Standard Methods tends to discourage the growth of the forms most common in pasteurized milk.

The construction of incubators for laboratory use is such that there are wide ranges in temperature within the empty incubator and these ranges increase in amount as the incubator is more and more completely filled. It is doubtful whether there is available, upon the market, an incubator which will maintain a single temperature throughout the incubation chamber.

Of the germ life appearing upon the standard agar plates rather more than twice as many colonies would develop if the incubation temperature was reduced about 10°C.

In all pasteurized milk there is a variable proportion of the germ life which will not develop colonies on plates within two days at 37°C. Higher temperature is required for such development.

It is plain that there is no single incubator temperature at which one can expect colony development by all of the germs normally present. The present tendency is toward the use of a lower temperature of incubation which will undoubtedly produce higher counts in the case of the incoming raw milk. This lower temperature will not permit the development of colonies of the heat loving forms in the pasteurized milk, and will, accordingly, show

the presence of only a fraction, and usually a very small fraction, of the germ life present in such milk.

Direct microscopic examination of pasteurized milk offers the best available method of determining the numbers of germs present, except in those instances where the amount of germ life is extremely low.

The methylene blue test apparently offers the best available index of the keeping quality of the milk as it reaches the milk plant or receiving station from the producer. The results of this test are less useful where the milk is held for some time in closed tanks.

The inspectors should strive to bring about physical cleanliness of all apparatus coming into contact with the milk, particularly at the milk plant. They should insist upon the removal of milk stone.

The flushing of the milk line with hot water immediately before starting, as recommended under Safety, is also very useful in improving the keeping quality of the finished product.

In some plants chlorine will be used in place of hot water. The o'tolidin test is apparently still the most dependable test at hand for available chlorine, but it should be remembered that any measure of available chlorine is at best a poor index of the effect of the chlorine solution upon germ life in the apparatus.

It has long been recognized that the milk cans going back to the farms are the source of much of the germ life later received with the raw milk. Drying of these cans so as to prevent growth of germ life is very effective, following proper washing. Continued attention of the inspector to the dryness of the outgoing cans is important.

H. A. Harding, *Chairman*

C. Sidney Leete	A. R. Tolland
William H. Price	C. B. Matthews
Paul F. Krueger	D. K. Douglas
H. R. Estes	F. L. Mickle

REPORT OF COMMITTEE ON INTER-STATE SHIPMENT OF CREAM *

PREVIOUS reports of this Committee have thoroughly and accurately depicted the present factors and problems involved in the interstate shipment of cream. It is believed timely in this year's report to discuss more in detail one of the most important items involved in a consideration of the subject, namely, that of uniform requirements. The following quotations from previous reports indicate how strongly the committee feels on this important subject.

> Your committee is impressed with the lack of uniformity in the laws and regulations covering the movement of milk and cream. While it is admitted that not all of these requirements have been enforced up to the present time, it is quite likely that state or city authorities may attempt such enforcement at any time. . . . No one can object to a uniform, sound basis of control that would safeguard public health. . . . It is evident that more laws and barriers will be made to restrict the free flow of interstate commerce unless some effort is made, in a broad way, to standardize the methods of inspection. . . . Federal legislation, licensing and control has been suggested as a remedy. It seems most absurd for dairy farms or shipping plants to be inspected by as many as six health officials from as many cities or states. Federal control of interstate cream shipments, to be effective, must go back to raw milk and its production in much the same way as is the case under the Federal Import Milk Act now in force. Some authorities may argue the impossibility of such a plan but we must not lose sight of the fact that we have had an efficient Federal Meat Inspection Law since 1906.
>
> Inspectors from several cities, working under different codes, visit the same territory and give orders that are, in part, conflicting, thus producing confusion. Furthermore, the expenses of these inspections are often, perhaps usually borne by the shippers. It seems to some of them that federal inspection would solve the difficulties of the situation.

It is apparent that uniform regulations are but part of the problem involving also, as it does, uniform enforcement of such regulations.

The thought of promulgating some federal plan, as suggested, is well worth further study. The inspection of

* This report was submitted but not read at annual meeting.

cream by federal agencies would necessitate first, the adoption of necessary legislation, together with suitable appropriations. This plan would not be met with a great deal of enthusiasm on the part of local and state supervisory forces. Many of the latter believe, and rightfully so, that such supervisory work should be done by the local agencies who are directly charged with the responsibility of the health of the people they serve.

It would seem that the best method for securing the advantages of a uniform plan which might be brought about through federal aid would be in local and state enforcement of minimum requirements promulgated by a representative agency of the Federal Government. These requirements, to be effective, must include not only the essentials of production, handling and care on the part of the producer and distributor, but also the work necessary on the part of the enforcement officials.

The U. S. Public Health Service has developed, for the use and adoption by cities and states, a uniform or standard milk control code based upon the fundamental requirements for the proper production, handling and supervision of dairy products, so far as public health is concerned. It is a code that is recommended to cities and states for their adoption and enforcement. It has the singular advantage of making demands not only upon the producer and the distributor, but upon the enforcement agency as well.

Reasonable minimum standards are proposed which, when followed by the producer and distributor, may be assumed to provide a safe and wholesome supply of dairy products. It is flexible enough to fit into conditions as they exist in the various parts of the country and into both large and small communities. Records may be routinely and easily kept of the actual field work done and of the results secured.

While not all of us may agree that each and every feature of the standard milk code is necessary or best, it is the product of the best thoughts of a large group of widely scattered health officers and individuals interested in proper milk control activities. Merely because one community has adopted the code does not imply that some other community shall accept products therefrom in interstate shipment, but it may easily ascertain whether or not such an ordinance is being effectively enforced.

The criticism formerly made of the Standard Code was that, while applicable to smaller communities, it could not be adapted to large cities and is being answered, at the present time in Chicago, where all milk and milk products sold will soon conform to its Grade A requirements.

The views of the U. S. Public Health Service may be assumed to represent the health officer's side of what the essentials are in milk control work. They are the one federal agency whose interests are identical with those of local milk inspection forces. The only object involved is that of protecting public health. We should not lose sight of that fact in milk inspection work, and should adhere, as closely as possible, to that one objective of protecting the public health.

The report presented above does not represent the unanimous opinion of the Committee; it is rather a majority report.

Views expressed by a few of the members differ from those given in the report. It appears that the views held depend considerably upon whether the markets in the communities represented by the members produce more cream than is consumed locally or whether just about enough cream is produced during most of the year.

The thoughts expressed by the members not entirely endorsing the report, as presented, are also given, so that all of their ideas are expressed herewith:

I feel, at this time, that the subject under discussion is one that should possibly be given further consideration. . . . due to the fact that we have, all over the United States today, many control agencies, such as State Milk Control Boards.

From experience, I feel fully justified in saying that the adoption of an ideal ordinance would not solve the problem. There are at least two practical reasons for this: (1) many officials believe that the matter of proper inspection is of more importance than the wording of the ordinance; (2) many areas do not desire the free interstate shipment of cream. The establishment of State Milk Control Boards indicates this.

Assuming that these obstacles to the free movement of cream do exist, I believe that we should endeavor to work out a plan which will be acceptable both to those areas which have a large and attractive market and to the areas which now are not able to ship to such markets.

To accomplish this, it is probably necessary to classify cream as to its use, viz: "fluid" or "market" cream and "manufacturing" cream. From a practical standpoint I do not believe that in the immediate future we will see a free movement of "market" cream from points far distant from the point of consumption.

At present "manufacturing" cream enjoys practically free movement. However, there is a movement not yet very widespread or definite, to restrict this class of cream. Would it not be well for us to consider this phase of the subject, with the idea, perhaps, of at least being prepared to counteract this movement, if desirable?

My suggestion is that we discuss the two classes of cream mentioned and attempt to draw up reasonable regulations governing the shipments and sale of "manufacturing" cream. This, to me, would be a practical job to undertake and also a pertinent one, which might have practical and immediate results.

Personally, I do not wish to sanction such a report in its entirety. Neither do I wish to criticize too seriously.

I suggest that we consider selecting from the Public Health Service Code and other sources, what the Committee believes to be minimum requirements for milk and cream and then recommend that when an emergency milk and cream is desired by a municipality or factory, that such supplies be obtained from sources meeting the minimum requirements established by our Committee. This will make a start at least in some direction and will, no doubt, include material other than that in the Public Health Service Code.

It is agreed that the Public Health Service Milk Code "is the product of the best thoughts of a large group of widely scattered health officers and individuals interested in proper milk control activities." However, state and municipal ordinances do not often follow the Code, nor is such expected.

I spent some time as a member of a committee studying the Public Health Service Code during its early days. At that time I do not believe any one thought that they were engaged in the preparation of an ordinance that could be adopted *in toto* throughout the United States, or throughout any state having 500 or more municipalities.

The Code is built more like an encyclopedia—it gives a comprehensive interpretation of terms and methods from which we may select a few that are believed to apply to a given community. And, like an encyclopedia, it must be rewritten from time to time or it becomes out of date and useless.

We should remember that no one wants uniformity in the direct sense of the word. . . .

Federal supervision is frequently carried on for the promotion of something foreign to state interests. . . .

My reference to the Code is for the purpose of indicating its real merits. It should be in more general use and I believe its use will be more successful when used for the purpose indicated. I am in hopes, therefore, that in another year our Committee may have an opportunity to study the Code in reference to interstate shipments and also bring before the Committee the views of any community using what may appear to be a fairly successful procedure.

I would say that the report does not seem such as I would care to indorse. . . .

To return to USPHS, I would say that I can consider it a good one but that there are others that are good and it is difficult to secure the adoption of the ordinance in the form that Mr. Frank has written it. We are operating under a modified USPHS ordinance here. It works very well but I can see how improvements in it might be made.

We feel that uniform federal inspection is something that we should make an earnest desire to see in effect. I happen to know that some of the eastern boards of health do not seem to be in accord with the standard milk ordinance. Of course, it might be possible to sell these folks on this ordinance as time goes on, but I think your report should carry at least another paragraph and attempt to suggest a method of establishing a federal inspection bureau that would be accepted by all boards of health.

Paul F. Krueger, *Chairman*

H. N. Parker	C. Sidney Leete
H. E. Bremer	John M. Scott
H. B. Switzer	H. E. Erickson
William H. Price	C. L. Witham
Ralph E. Irwin	Clyde Beardslee

L. C. Bulmer

REPORT OF COMMITTEE ON FOOD VALUE OF MILK AND MILK PRODUCTS *

THAT the nutritional needs of a family are best served when adequate amounts of milk are used has been well established. Among families of moderate and low economic status especially is it important to stress the fact that milk is not an expensive food, but one which yields a greater return for money expended than any other food.

In his discussion of diet and personality, Bogert [1] stated that food is a matter in which everyone has a vital interest and decided likes and dislikes; hence people naturally have pet ideas and unreasoning prejudices on this subject. Food fads and fallacies relating to milk were considered in one of the National Dairy Council Digests.[2] The inconsistency of those who avoid fish and milk combinations has been noted by government nutritionists. Such persons, it was pointed out, "will eat fish chowder, made with milk, but seem afraid to drink milk at a meal where they have, say fried fish. They may not worry about crab or lobster or shrimp when served a la Newburg, but they shudder if ice cream is served after any sea food." [3] That the fruit-milk fallacy is unfounded is exemplified by present day methods of infant feeding. One method widely used is that of adding acids directly to the milk before giving it to babies. Friedman [4] pointed out that as many as four acids are used in this country for the artificial acidification of cow's milk for infant feeding:—"lactic, hydrochloric, acetic, and citric."

Proteins of milk have superior value in the adult human diet. An interesting study which seems to em-

*This report contains the review of timely reports contributed by committee members as follows: Milk with Enhanced Nutritive Properties, G. C. Supplee, Ph.D. and S. Ansbacher. D.Sc. (by invitation). The Dry Milk Co.: The Processed Milks, James A. Tobey. Dr.P.H., The Borden Co: Special Laboratory and Field Studies, J. H. Shrader. Ph.D., Sealtest System Laboratories. Inc., New York. Milk and Health Protection, Ira V. Hiscock, Yale School of Medicine, Chairman
Submitted but not read at annual meeting.

phasize this value over vegetable proteins and over certain other animal proteins has been reported by Mann in England.[5] The significance of the role of calcium is still generally unrecognized according to a New York physician [6] who for several years has studied the calcium metabolism of over 4,000 patients in the New York Hospital. Two years ago, Bernheim published a preliminary report of her observations, in which she pointed out the common deficiency of the adult diet, the very great need of the body for calcium, and the difficulty of obtaining a sufficient amount in the diet without the use of milk and/or cheese. Her last report gives added suggestions for meeting the adult calcium requirements. To assure adequate calcium intake for the adult, Bernheim recommends one quart of milk daily, or one pint of milk and 1/8 pound of cheese.

The excellent food qualities of butter are reviewed in a comprehensive manner in a recent *Dairy Council Digest.*[7] It is observed that the daily use of butter to add flavor to meals has become a habit in most families. In considering the item of butter in low cost meals, Sherman warns [8] that "any substitution of cheaper fat is dubious economy until there is every assurance that the dietary as a whole provides an abundance of the fat soluble vitamins." Butter is a rich, stable and palatable source of Vitamin A. It contains some amount of Vitamins D and E.

Pasteurization

For many years the value of pasteurization as an added safeguard for milk has been stressed in the reports of this Committee. Emphasis has likewise been given to the fact that the effect of pasteurization on the food value of milk is too slight to be apparent even in specially designed experiments or in observations on children living under ordinary American conditions.

The American Medical Association, through a resolution adopted in 1929, supported the efforts of public health authorities to provide safe milk for human consumption. This resolution by implication endorsed pasteurization, which has been strongly favored by the American Child Health Association, the American Public Health Association, and the Conference of State and Provincial Health Authorities of North America.[9] Direct endorsement of pasteurization is embodied in a decision of the American Medical Association Committee on Foods.[10]

An important and far-reaching event in the progress of certified milk, and of milk sanitation generally, was the approval given to permissive pasteurization by the American Association of Medical Milk Commissions and the Certified Milk Producers Association of America, meeting jointly at Atlantic City in June, 1935. Following a remarkable program of papers devoted to this topic, the former Association voted unanimously to include in its Methods and Standards, definitions and specifications for Certified Milk—Pasteurized.

> For more than 40 years certified milk has been recognized as a superior grade of market milk. It was developed as a quality milk supply in which physicians, sanitarians, and the public might have confidence, and it has always been produced by leaders in the dairy industry in accordance with uniform, national standards. . . . Despite the high quality and excellent sanitary record of certified milk, and despite the somewhat limited sale of this necessarily more expensive product, many health officials have felt that pasteurization of it would be desirable and logical, since this process would add the final factor of safety to a clean milk of unusual quality. Numerous scientific investigations have shown that pasteurization would in no way impair the excellent nutritional qualities of certified milk.[11]

Enhanced Nutritive Properties

During the past year the number of papers emphasizing the benefits derived from Vitamin D and milk has considerably increased; the papers cited below are indicative of the trend of work in progress. The recognized value of milk in the diet of all children has become even greater since methods for increasing its Vitamin D potency has been developed. According to Harris [12] Vitamin D milk is essential in its function of providing adequate quantity of suitable proportions of calcium and phosphorus, not only in the prevention of rickets, but also in the formation of sound teeth and well formed bones. Furthermore, for the pregnant and nursing woman, Vitamin D milk is valuable in preventing depletion of her own system while providing for her child.

In following up to the work of the late Dr. A. F. Hess,[13] Drake, Tisdall and Brown [14] studied the relative antirachitic value of cod-liver oil, viosterol and irradiated milk. No moderate or severe rickets developed in any infants receiving from 1.5 to 12 drops of 250D viosterol, or irradiated milk containing 35 Steenbock units of Vitamin D per 20 ounces, while only three out of the 137 receiving cod-liver oil developed rickets. Difficulty in the administration of a suitable dose of cod-liver oil may account for these three cases. One teaspoonful of cod-liver oil was as efficacious as three in preventing rickets. "In irradiated Vitamin D milk we have a valuable addition to our present antirachitic armamentarium."

A comparative study of the antirachitic value of irradiated yeast was reported by Gerstenberger and co-workers.[15] Forty Steenbock rat units per day of either milk was found to produce satisfactory healing in the blood in from forty-eight to sixty-two days and in the bone in from 10.5 to 11 weeks, 720 cc. of the yeast milk being required as against 480 cc. of the irradiated milk to provide this unitage. The authors conclude from their observations that there is no practical difference in the antirachitic efficiency of yeast milk and irradiated milk when equal numbers of Steenbock rat units of Vitamin D are given, although there may be a slight superiority in the irradiated milk.

Wyman and coworkers [16] also compared "yeast milk" and irradiated milk and were unable to find indication of any difference in their clinical antirachitic potency.

The confusion as to the Vitamin D equivalents of the various types of Vitamin D milk in terms of cod-liver oil still exists. A clarification of this question would undoubtedly contribute to the more rapid acceptance of Vitamin D milks. An important contribution to the subject is a paper by Lewis [17] who reports clinical experiences with crystalline Vitamin D.

Nine rachitic infants who received 90 units of crystalline Vitamin D in 24 ounces of milk daily showed definitely better healing than did nine other infants receiving the same amount of crystalline Vitamin D in corn oil. This result corroborated the findings of other investigators which have shown that when irradiated and yeast milks are used in infant feeding, a lower number of rat units is required to bring about healing of rickets.

Furthermore, infants receiving only 45 units of crystalline Vitamin D in milk, a dosage below the therapeutic level, showed better utilization of the antirachitic factor than did the group of infants receiving 90 units in corn oil; with 900 units in oil, however, satisfactory healing resulted in nine of ten rachitic infants.

These results indicate that the medium of milk allows for better utilization of the antirachitic vitamin than does the medium of corn oil and thus offers an explanation for the greater effectiveness, from the standpoint of rat units, of antirachitic milks as compared with viosterol.

These results are in harmony with the hypothesis described in the twenty-third annual report of this Association,[18] namely that the inherent composition of milk influences the Vitamin D potency.

In discussing the Vitamin D milk control, Brooks [19] calls the unit of measurement the most confusing factor complicating official control. He suggests therefore that the actual number of units should not appear on the milk bottle caps. Tobey, in discussing the above paper, decries the requirement of unitage statements on labels.

During the past year an instrument was adapted for the control of the milk irradiation process. Supplee and Rentschler report:[20]

The recording photo-electric ultra-violet meter permits the measurement and automatic recording of the intensity and relative character of the radiation emitted by commonly used sources. The practical utility and apparent reliability of the results as obtained under laboratory or prevailing conditions of routine use, seem to warrant the conclusion that such an instrument may serve a useful purpose for facilitating the study, supervision and control of irradiation process where maintenance of uniform intensity is a determining factor necessary for the assurance of a properly treated product. That such a requirement is important in the irradiation of milk is shown from the data disclosed herein as well as that reported elsewhere. In view of the available evidence it is probable that milk irradiated with approved apparatus operated under approved conditions and wherein the intensity of the applied radiation is automatically recorded by an appropriate meter, carries greater assurance of uniform Vitamin D potency than can be guaranteed by time consuming and infrequent bio-assays.

Among milks with enhanced nutritive properties, iodized milk deserves mentioning. Weston [21] believes, as a result of many investigations, that iodine deficiency, especially in children, is much more prevalent than the presence of goiter would suggest.

As milk is the most universal food, especially for children, and since it is a particularly good source of iodine, efforts have been made to produce a high iodine dried milk, which has been given to children with excellent results. Better growth and general health, absence of iodine deficiency, and improved calcium-phosphorus balance have all been observed in infants and children receiving this iodine rich milk, a powdered milk (Dryco) produced in South Carolina. The author points out that the administration of inorganic iodine has not been successful, since the body is able to store only organic iodine in the tissues as a reserve supply.

The mineralization of milk was again discussed by one of the Wisconsin workers [22] who proposes to fortify milk with iron, copper and manganese by making use of the following recipe: 8 gm. of iron pyrophosphate, 0.4 gm. of copper sulfate and 0.4 gm. of manganese sulfate are dissolved in water and diluted to 250 cc.; 1 teaspoonful of this mixture is added to each quart of milk. In spite of the beneficial results which the author claims for this mixture, the Council on Pharmacy and Chemistry of the

American Medical Association has not changed its committee decision which was reported in the 22nd Annual Report of this Association,[23] namely not to recommend the addition of minerals, neither to foods in general nor to milk.

The Processed Milks

The processed milks, including evaporated, powdered, and condensed milks, continue to find favor with the consuming public and to enlist the professional interest of clinicians and scientists. Since the importance of any milk product is measured to some degree by the attention given to it in medical and scientific literature, it is interesting to note that seventy-one references to the concentrated milks have been included in these committee reports during the past four years. Of these references, forty-seven have been concerned with reports of clinical or laboratory studies on evaporated milk, a product that has shown a consistent and rather striking increase in distribution since 1929.

Evaporated Milk

In order to eliminate milkborne disease, the more general use of lactic acid evaporated milk formulas is strongly urged by Davison,[24] who states that this product not only is the best artificial food for infants, but is also bactericidal or antiseptic. That the lactic acid in such mixtures does have a bactericidal effect has been shown by the recent studies of Rothey,[25] who inoculated lactic acid formulas with various organisms and demonstrated that milk containing 0.66 per cent or more of acid is satisfactorily bactericidal.

A suggestion that lactic acid used in evaporated milk formulas be buffered with sodium hydroxide is made by Smyth and Hurwitz,[26] who report the successful use of such formulas in the feeding of twenty-two premature infants and 117 full-term infants. From the results it is concluded that buffered acidified milks produce less initial loss of weight, more rapid recovery of birth weight, and more substantial gains.

Good results in infant feeding with evaporated milk acidified with lemon juice have been announced by Baker,[27] who compared 120 infants fed on this type of acidified evaporated milk with an equal number on "simple formulas." He states that this method gives a buffered solution, provides the necessary Vitamin C, and reduces the incidence of gastrointestinal upsets.

The advantages of evaporated milk as a sterile milk supply, especially in the medical treatment of gastric and duodenal ulcers, ulcerative colitis, catarrhal colitis, and similar conditions, have been pointed out by Soper.[28] This author believes, moreover, that raw milk is unfit for human consumption, and that pasteurized milk as it reaches the consumer usually contains pathogenic bacteria and is not to be relied upon as a safe food. In support of this latter contention he reports bacterial analyses of thirteen samples of pasteurized milk in St. Louis which showed various types of organisms. In a reply to this article, Arnold [29] states that the bacteria mentioned by Soper are nothing to get excited about, and that pasteurized milk is safe and wholesome. This writer strongly advocates an increased consumption of milk, particularly by adults. The greater use of evaporated milk in school lunches is recommended by Eichelberger.[30]

Two significant investigations on the value and efficacy of irradiated evaporated milk have been published during the year. While these studies may properly belong under the discussion of Vitamin D milks, they also bring out the general efficiency of evaporated milk as an infant food, as well as the favorable antirachitic properties imparted by the process of irradiation. Thus Rapoport, et al [31] fed irradiated evaporated milk to twenty-three negro infants and found from this severe test that it was an adequate agent for the prevention of rickets in colored infants, although not reliable for the cure of the disease. Strong, et al[32] gave irradiated evaporated milk to twenty-two normal infants and achieved complete protection in 90 per cent of the cases. In the Rapoport study the potency of the undiluted milk was nine USP units of Vitamin D per ounce, while in the Strong investigation it was about ten USP units per ounce.

Hypersensitivity to milk proteins, or milk allergy, can be successfully treated or overcome by using evaporated milk in the diet, according to the studies of Ratner, as published in two recent papers.[33] In the opinion of this investigator, it is not the casein but the lactalbumin and the lactoglobulin of milk that cause trouble, and these two proteins are so altered physically in the process of evaporation that their sensitizing ability is markedly reduced. In the routine treatment of infantile eczema, which is an allergic manifestation, formulas of evaporated milk, or in more severe cases, mixtures of one-half skimmed powdered milk, are advised by Stoesser.[34]

Last year mention was made in our report of studies showing that liberal quantities of evaporated milk in the diet were useful in decreasing the worm burden of children afflicted with intestinal parasites. Since that time, Abbott[35] has issued a further report on this subject, with particular reference to hookworm infestation, which was materially reduced by means of an adequate diet containing ample quantities of evaporated milk. The general role of milk in coping with various forms of intestinal parasitism has likewise been outlined by Tobey[36] in a more popular article.

Powdered Milk

Unlike the evaporated milks, which are distributed only as whole milks with part of the natural water extracted, the powdered milks are available either as dry whole or skim milks. The latter product, even with the fat removed, has many nutritive virtues, since it contains the proteins, minerals, lactose, and vitamins of milk, with the exception of Vitamin A. Dry skim milk is, in fact, especially valuable in relief work, and for supplementing institutional diets. Roberts, et al [37] have reported excellent results by enriching children's diets in this manner, using this method to supplement rather than to replace the milk already being consumed.

The economical advantages of powdered milk, particularly for military use, have been described by Platt [38] who points out that packages of dried milk occupy only one-eighth as much space as their equivalent in fluid milk and have only one-half the bulk of their nearest competitors among the concentrated milks. In connection with the military employment of powdered milk, it is interesting to note that the Italian army is said to have been supplied with large quantities of dried milk for use in its African campaign.

Further studies on the enrichment of powdered milk in iodine and the opportunities for such milks as aids in the solution of the iodine deficiency problem have been published during the past year. Weston [39] reports that dried milk from herds in South Carolina, where feeds are rich in iodine, shows a high potency of iodine in favorable organic form, which prevents symptoms of iodine deficiency when fed to infants. Such iodine-rich milk promotes rapid growth, high hemoglobin, and positive calcium-phosphorus-magnesium balance. It also prevents thyroid enlargement and goiter.

The successful use of iodized dry milk for cattle feeding in order to increase the iodine content of fluid milk has been reported by Hanford, Supplee and Wilson,[40] who found that the iodine concentration of the milk is distinctly influenced by this process, although the output of iodine does not parallel the amount ingested. Whether this method has practical applications or not is a matter for future determination, although some improvement in the iodine content of many milk supplies is probably desirable.

Condensed Milk

There has been only one reference to condensed milk during the past year, but it is significant. In the course of a comprehensive article on infant feeding, which very ably recounts the historical background and modern principles of this important subject, Powers [41] mentions metabolism experiments with five infants fed on formulas of sweetened condensed milk. These tests showed that retentions of nitrogen and of calcium and phosphorus by these babies were satisfactory and adequate, and compared favorably with the results from infants given evaporated milk formulas with 6 per cent sugar. This investigation proves that the protein and mineral requirements of infants can be satisfied when condensed milk is employed.

Special Studies

Flavor

So much emphasis has been given in the past to the sanitary quality of milk that it is interesting to note the increasing attention now being given to the palatability of milk. Thurston and Barnhart [42] report that the phospholipoids of milk contribute to the richness of flavor of milk products. For example, they consider that the reason that the buttermilk from sweet cream has such a rich flavor is because of the presence of a relatively high percentage of these compounds which were left in the buttermilk when the fat was removed by churning.

A so-called caramel flavor in dairy products is reported by Leitch,[43] who believes the cause is a lactic acid coccus.

It stimulates *Streptococcus lactis* except that it has the peculiar faculty of imparting a burnt flavor to milk and whey. The organism is frequently present in the milk before it leaves the udder.

The so-called oxidized flavor has come in for a great deal of discussion. Guthrie and Brueckner [44] reported that about one-fifth of the samples from a herd developed distinct "oxidized" flavors at the end of a three-day storage period. These flavors seem to be independent of breed, period of lactation or age of the cow. Their intensity was greater in winter than in summer. Some of these flavors persisted for several weeks and some were erratic. Pasteurization decreased or prevented a development.

Kende [45] describes a so-called emery flavor which he attributes to oxidation which is instituted by heavy metals particularly copper. He considers this emery flavor to be analogous to the tallowy defect of cream, butter and dry milk. He thinks that there is a reciprocal catalytic action between a true enzyme-oleinase and certain metals, and that natural protective substances will determine whether or not the off flavor develops. He holds that it is possible to avoid such milk by the feeding of fresh meadow hay, or concentrates poor in easily oxidizable fat before the handling of milk in aluminum or stainless iron or if the milk of each cow is tested for metal sensitiveness. He recommends that a bacterial culture such as *Reducto bacterium frigidum neutrale* of Kertesz, is effective to prevent the development of the flavor.

Ritter and Christen [46] report that the so-called emery flavor is caused by the chemical oxidation of milk fat. They extracted hydroquinone from Kende's culture.

Kertesz [47] contends that the protective compounds are formed in the cultures by bacterial metabolism.

Csiszar [48] contends that this emery flavor is an oily-rancid flavor caused by a hydrolysis of fat, or is an oilytallowy flavor resulting from oxidation of the fat. This can be prevented by proper selecting of the cows or by pasteurization, and the second can be prevented by avoiding the contamination of the milk with metals.

Proks and Groh [49] state that only the milk from part of the cows of the herd is defective and that these off flavors are sporadic and are usually found in late lactation. Holding the milk at 10° C. is favorable to the development of the off flavor and pasteurization prevents it. Contact with metals accelerates it. Lactic acid organisms reduce the rate of development of the flavor but do not prevent it.

Pien and Herschdoerfer [50] list the various causes for these off flavors and cite methods for preventing them, but add no new material.

Krauss and Washburn [51] report that the copper content of fresh milk throughout the year varied from 0.14 to 0.17 milligrams per liter. On the basis of rat experiments, pasteurized and raw milks were of equal value in the blood regenerating factor.

Metals

The subject of metals in milk has been studied particularly from the standpoints of the so-called natural content of metal in milk, the effect of milk on metallic containers and equipment, and the effect of metallic contamination on flavor.

Grimmer [52] found that the iron content of three cows ranged from 0.40 to 0.67, and the copper content ranged from 0.19-0.34 milligrams per liter. He reports on the solution of iron and copper in metal dairy equipment under plant conditions. A metallic flavor always appeared in butter when the amount of iron exceeded 2.5 milligrams per kilogram but a tallowy, metallic taste might appear with less iron.

Mohr and his coworkers [53] found that several stainless steels, aluminum alloys and tin sheets were resistant to corrosion whereas, nickel, copper, brass and zinc were affected at all temperatures. The latter affected the taste. Iron in combination with aluminum is attacked at room temperature; other metals when connected to a more electro positive one are stable.

Whitfield and associates[54] report that out of a list of corrosion studies on copper, nickel, Inconel, Allegheny metal and Aluminum 3S, the only metals that corrode are nickel and copper. Copper was brighter and nickel was darkened by exposure to the milk. Copper always affected the flavor causing a tallowy flavor to develop within 18 to 24 hours and its intensity varied with the time of exposure and the length of the storage period after the exposure. Nickel produced an off flavor only occasionally and then only when corrosion was great.

Miscellaneous

Jones[55] reports that the proportion of solids-not-fat is always less during the summer months and frequently falls below the normal value of 8.5 per cent. Davies[56] points out that the usual bacterial plate is not a good indicator of milk quality. He states that much more valuable information is given by comparing bacterial plate counts before and after pasteurization. By this practice he is able to locate those sources of milk which produced poor quality.

In view of the emphasis in some quarters of the virtues of goat milk, it is interesting to note that Van Haam and Beard[57] report that in many instances goat milk produces a severe anemia but that this was produced less frequently by cow's milk.

Digestibility

A great deal of interest in the digestibility of milk seems to be evident by an increasing amount of work which is being reported on soft curd and homogenized milks. Ogilvie and Peden [58] report that the digestibility of boiled milk by infants does not differ appreciably from that of raw milk, when pH, peptic activity, free and total acidity, total chlorine, soluble calcium and non-protein nitrogen of the gastric contents are used as indexes of the course of digestion.

Cannon and Espe [59] report that pasteurization of milk at 61° for thirty minutes reduced curd tension about 20 per cent; boiling the milk reduced it by 80 per cent; while autoclaving the milk at 116° for fifteen minutes reduced the curd tension to 0. Raw milk required 12-18 hours to pass from the stomach while boiled milk required only 8-12 hours. Pasteurized milk was very similar in digestibility to raw milk.

Fluckiger [60] was granted a U. S. patent for improving the digestibility of milk by homogenization. A soft curd milk with a permanent and uniform curd tension below 45 grams is obtained by this treatment.

Babcock [61] shows that homogenization causes the development of rancidity in raw milk and that this can be overcome by pasteurization either before or immediately after homogenization. The sediment which is frequently shown in homogenized milk consists largely of leukocytes and epithelial cells. These occur in milk which is not homogenized but they are not noticeable because the cells are kept in suspension with the rising fat globules.

Charles and Sommer [62] likewise report on the sediment in homogenized milk. They state that clarification of the hot milk directly after homogenization appears to be a practical method to prevent it.

Caulfield and Martin [63] report that homogenization at higher temperatures produces a greater reduction in curd tension. Pasteurization effectively prevents the development of rancid flavor.

Berry [64] finds that colostrum formed a very hard curd particle. Pasteurization temperatures had no measurable effect on the curd whereas heating to 180° F. had a marked softening effect. The curd tension was the highest for the first few days after freshening. In feeding tests with rats, natural soft curd milk had no tendency to produce rats with larger gains in weight than did normal hard curd milk or normal hard curd milk which had been rendered soft curd by heat or pressure. Neither kind of milk was consumed by rats at different rates.

Doan and Welch [65] report that hard and soft curd milks are similar in all respects except in casein content. When the casein content was equalized by dilution of water, the difference in rate of digestion and curd tension largely disappear. However, if the curd is artificially softened by heating, acidulation, homogenization, base exchange, etc., then the casein content plays only a minor role in the rate of digestion. Homogenization reduced curd tension, the most effective treatment being to preheat to 180° F., cool to 100° F. and homogenize at a pressure of not less than 2000 pounds. The curds obtained from the stomach after feeding low curd milk were more friable and looser in makeup than those from high tension milk. Soft curd milk produces poorer weight gains in calves than did hard curd milk. During digestion soft curd milk exposes a greater surface per unit of protein to the digestive juices than does hard curd milk. Infants having a higher gastric pH than adults exhibit a more favorable response to the feeding of soft curd milk than do adults. Adults whose gastric acidities are high will also tolerate soft curd milk better than hard curd.

Doan and Welch [66] find that soft curd milk is mainly characterized by low casein condition. There was no relation between udder disease and low curd tension. Digestion tests showed that soft curd milk is more rapidly acted upon by the digestive juices and leaves the stomach in a shorter time.

Hess and his coworkers [67] fed cow milk which had been treated by the process of base exchange (so called Zeelite treatment) to a normal growing infant and found a positive calcium and phosphorus balance. This utilization is attributed to the increase in the amount of soluble calcium and the formation of a soft curd, in spite of the fact that the total calcium of the milk had been reduced.

Ira V. Hiscock, *Chairman*

James A. Tobey	G. C. Supplee
M. O. Maughan	J. B. Hollingsworth
J. H. Shrader	A. R. Ward

References

1 Bogert, L. J., Ph.D. Diet and Personality, The Macmillan Co., New York, 1934.

2 Dairy Council Digests, National Dairy Council, Chicago, No. 6, Vol. 6, February, 1935.

3 Bureau of Home Economics, U. S. Dept. of Agriculture—Food Fallacies, Fads, and Falsities, The Market Basket, Jan. 30, 1935.

4 Friedman, Samuel, M.D. Infant Feeding and Nutrition, *Am. J. Dis. Child.* 49:153, Jan. 1935.

5 H. C. Corry Mann, O.B.E., M.D., M.R.C.P. *Lancet,* Jan. 19, 1935, p. 145.

6 Bernheim, Alice R., M.D. Calcium in Nutrition. *The Health Examiner,* Vol. 4, No. 9, Dec. 1934, N. Y. Acad. Med.; and Calcium Need and Calcium Utilization, *J.A.M.A.,* 100:1001, April 1, 1933.

7 Dairy Council Digests, National Dairy Council, Chicago, No. 1, Vol. 7, Sept. 1935.

8 Sherman, H. C. Food and Health, The Macmillan Co., New York, 1935.

9 Proceedings, 49th annual meeting, Conference of State and Provincial Health Authorities of North America, 1934, p. 69.

10 Pasteurization of Certified Milk, *J.A.M.A.,* Aug. 24, 1935, Vol. 105, p. 601.

11 The Pasteurization of Certified Milk, *Am. J. Pub. Health,* Vol. 25, No. 8, Aug. 1935.

12 Harris, W. L., Vitamin D and Vitamin D Milk; *Virginia Med. Mo.,* 61, 344, 1934.

13 Hess, A. F. and Lewis, J. M. An Appraisal of Antirachitics in Terms of Rat and Chemical Units. *J.A.M.A.,* 101, 181, 1933.

14 Drake, T. G. H., Tisdall, F. F. and Brown, A. A Study of the Relative Antirachitic Value of Cod Liver Oil, Viosterol and Irradiated Milk. *Canad. M. A. J.,* 31, 368, 1934.

15 Gerstenberger, H. J., Horesh, A. J., Van Horn, A. L., Krauss, W. E. and Bethke, R. M. Antirachitic Cow's Milk. Comparative Study of Antirachitic Value of Irradiated Cow's Milk and of Milk Produced by Cows Fed Irradiated Yeast. *J.A.M.A.*, 104, 816, 1935.

16 Wyman, E. T., Eley, R. C., Bunker, J. W. M. and Harris, R. S. A Comparison of "Yeast Milk" and Irradiated Milk in the Treatment of Infantile Rickets. *New England J. Med.*, 212, 257, 1935.

17 Lewis, J. M. Clinical Experience with Crystalline Vitamin D: The Influence of the Menstruum of Milk on the Effectiveness of the Antirachitic Factor. *J. Pediat.*, 6, 362, 1935.

18 23rd Ann. Rep. Intern. Assoc. Dairy and Milk Insp., p. 253.

19 Brooks, P. B. Vitamin D Milk Control. The Administration Aspects. *New York State J. Med.*, 35, 776, 1935.

20 Supplee, G. C. and Rentschler, H. C. The Value of the Recording Ultra-Violet Meter in the Irradiation of Milk. *M. Rec.*, 142, 267, 1935.

21 Weston, W. Special Milk in the Solution of the Iodine Deficiency Problem. *Arch. Pediat.*, 51, 683, 1934.

22 Hart, E. B. Mineralization of Milk; Certified Milk, 9, 5, 1934.

23 22nd Ann. Rep. Intern. Assoc. Dairy and Milk Insp., p. 47.

24 Davison, W. C. Elimination of Milk-borne Disease. *Am. Jour. Dis. Child.* 49:72, Jan. 1935.

25 Rothey, K. B. Is the Benefit of Lactic Acid Milk in Infant Feeding Due to the Bactericidal Action of the Lactic Acid? *J. Pediat.* 7:60, July 1935.

26 Smyth, F. C. and Hurwitz, S. Buffered Lactic Acid Evaporated Milk in Infant Feeding. *J.A.M.A.*, 105:789, Sept. 7, 1935.

27 Baker, J. B. Infant Nutrition, with Reference to Lemon Juice Feeding. *Delaware State M.J.* VII:303, Jan, 1935.

28 Soper, H. W. Milk. *Am. J. Digest Dis. & Nutrition,* 2:113, April 1935.

29 Arnold, L. What Should be the Per Capita per Day Milk Consumption of our Population? *Am. J. Digest Dis. & Nutrition,* 2:416, Sept. 1935.

30 Eichelberger, M. More Milk in the School Lunch. *Nation's Schools.* 15:51, Feb. 1935.

31 Rapoport, M., Stokes, J., and Whipple, D. V. The Antirachitic Value of Irradiated Evaporated Milk in Infants. *J. Pediat.* 6:799, June 1935.

32 Strong, R. V., Naef, E. F., and Harper, I. M. The Antirachitic Properties of Irradiated Evaporated Milk Fed to Normal Babies Under Home Conditions. *J. Pediat.* 7:21, July 1935.

33 Ratner, B. and Gruehl, H. L. Anaphylactogenic Properties of Milk. *Am. J. Dis. Child.* 49:287, Feb. 1935.

Ratner, B. Treatment of Milk Allergy and its Basic Principles. *J.A.M.A.*, 105:934, Sept. 21, 1935.

34 Stoesser, A. V. A Routine Treatment for Infantile Eczema. *Arch. Pediat.* LI:777, Dec. 1934.

35 Abbott, O. D. The Effect of Improved Diet on Children With a Moderate Degree of Hookworm. *Jour. Home Ec.* 26:577, Nov. 1934.

36 Tobey, J. A. Milk in the Prevention of Intestinal Parasites. *Cert. Milk,* April 1935.

37 Roberts, L. J., Carlson, L., and MacNair, V. The Supplementary Value of Dry Skim Milk in Institutional Diets. *Jour. Home Ec.* 10:317, Nov. 1934.

38 Platt, W. Powdered Milk for Field Service. *Mil. Surgeon* April, 1935.

39 Weston, W. Special Milk in the Solution of the Iodine Deficiency Problem. *Arch. Pediat.* LI:683, Nov. 1934.

40 Hanford, Z. M., Supplee, G. C., and Wilson, L. T. The Iodine Content of Milk as Affected by Feeding Iodized Dry Milk. *Jour. Dair. Sci.* XVII:771, Dec. 1934.

41 Powers, G. F. Infant Feeding. *J.A.M.A.,* 105:753, Sept. 7, 1935.

42 Thurston and Barnhart, *J. Dairy Sci.* 18, 131-7, 1935; (see also pp. 301-6).

43 Leitch, *Scottish J. Agr.* 17, 293-6, 1934.

44 Guthrie and Brueckner, *Cornell Univ. Agr. Expt. Sta. Bull.* 600, 3-10, 1933.

45 Kende, Osterr. *Milchwirtschaft. Ztg.* 41, 277-80, 1934.

46 Ritter and Christen, Schweiz. *Milchztg.* 60, 373-4, 407, 1934.

47 Kertesz, Schweiz. *Milchztg.* 60, 397, 455, 1934.

48 Csiszar, Osterr, *Milchwirtschaft Ztg.* 42, 41-4, 1935.

49 Proks and Groh, Lait 15, 370-81, 1935.

50 Pien and Herschdoerfer, Lait 15, 143-59, 257-64, 1935.

51 Krauss and Washburn, *Ohio Agr. Expt. Sta. Bull.* 352, 63, 1934.

52 Grimmer, Milchw. *Forsch.* 16, 435-9, 1934.

53 Mohr and coworkers, 10th World Dairy Congress; Food 4, 10, 1934.

54 Whitfield and associates, *Milk Dealer* 24, No. 2, 34-5; No. 3, 40-2, 1934.

55 Jones, *Dairyman,* Jan. 1935.

56 Davies, *J. Roy. San. Inst.* 54, 486-501, 1934.

57 Van Haam and Beard, *Proc. Soc. Exper. Biol. & Med.* 32, 750-3, 1935.

58 Ogilvie and Peden, *Lancet,* 1934, II, 76-8.

59 Cannon and Espe, *Ia. Agr. Expt. Sta. Report of Agr. Research* 25-6, 1932; cf. C. A. 26, 2496.

60 Fluckiger, U. S. 1, 973, 145, Sept. 11.

61 Babcock, U. S. Dept. Agr., *Tech. Bull.* 438, 11 pp., 1934.

62 Charles and Sommer, *Milk Plant Monthly* 24, No. 4, 26-7, 32, 1935.

63 Caulfield and Martin, *Milk Plant Monthly* 23, No. 12, 24-8, 1934.
64 Berry, *Milk Plant Monthly* 23, No. 10, 30-3, No. 11, 50-5, 1934.
65 Doan and Welch, *Pa. Agr. Expt. Sta. Tech. Bull.* 312, 3-35, 1934. See also Chambers, *J. Dairy Sci.*, 18, 457, 1935.
66 Doan and Welch, *Pa. Agr. Expt. Sta. Bull.* 293, 19, 1933.
67 Hess and coworkers, *Am. J. Dis. Child.* 48, 1058-71, 1934.

The following Committees did not submit reports:

DAIRY FARM METHODS

Ernest Kelly, *Chairman*

George W. Grim
J. M. Lescure
C. P. Osgood
Russell Palmer
W. A. Shoults

METHODS OF IMPROVING MILK SUPPLIES IN SMALL COMMUNITIES

Leslie C. Frank, *Chairman*

C. A. Abele
H. E. Bremer
J. R. Jennings
Max Heinzman
H. J. Barnum
M. H. McCrady
W. A. Shoults
Ernest Kelly
C. Sidney Leete

PUBLICITY AND PUBLIC RELATIONS

George W. Grim, *Chairman*

Paul B. Brooks
M. A. Heinzman
A. R. Tolland
Harris Moak
Paul F. Krueger
Ivan G. Martin

MILK ORDINANCES

William B. Palmer, *Chairman*

Ernest Kelly
J. H. Shrader
F. D. Holford
James A. Tobey
A. R. B. Richmond
V. M. Ehlers
Leslie C. Frank
H. N. Heffernan
Paul B. Brooks

International Association of Dairy and Milk Inspectors

CONSTITUTION AND BY-LAWS

CONSTITUTION

ADOPTED OCTOBER 16, 1911
(Amended October 20, 1932)

NAME

This Association shall be known as the International Association of Dairy and Milk Inspectors.

OBJECT

The object of this Association shall be to develop uniform and efficient inspection of dairy farms, milk establishments, milk and milk products, and to place the inspection of the same in the hands of men who have a thorough knowledge of dairy work.

MEMBERSHIP

There shall be two classes of membership in this Association: Active and Associate.

The active membership shall be composed of persons who are officially engaged in dairy or milk inspection, or the laboratory control of, or the administration of such function for any country or any subdivision thereof, and of persons who are officially engaged in research or educational work related to dairy or milk inspection for any country or subdivision thereof, provided, however, that all persons who at the time of the adoption of this amendment are members of the Association, shall be active members.

The associate membership shall be composed of any persons not eligible for active membership, who are interested in the promotion of dairy sanitation. Associate members shall not be eligible to vote, serve as officers, hold the chairmanship of any committee, serve on the Resolutions Committee, or serve as majority members of any committee of this Association.

Any properly qualified person may make application for active or associate membership to the Secretary-Treasurer and if application is accepted by the Membership Committee, said applicant may become an active or associate member, as the case may be, upon payment of the annual dues of five dollars ($5.00).

OFFICERS

The officers of this Association shall be a President, three Vice-Presidents, a Secretary-Treasurer, and two Auditors, who shall be elected by a majority ballot at the Annual Meeting of the Association, and shall hold office for one year or until their successors are elected. An Executive Board, which shall direct the affairs of the Association when not in Annual Session, shall consist of the President, the three Vice-Presidents, and the Secretary-Treasurer.

AMENDMENTS

This Constitution may be amended by a two-thirds affirmative vote of those active members of the Association who register their votes with the Secretary. Any member proposing amendments must submit the same in writing to the Secretary-Treasurer at least sixty days before the date of the Annual Meeting, and the Secretary-Treasurer shall at once notify all members that the proposed amendments will be open for discussion at the Annual Meeting immediately succeeding such notification. After discussion at the Annual Meeting such amendments, upon a majority affirmative vote of the members in attendance shall be, within 90 days, submitted to the entire membership of the Association by the Secretary-Treasurer. All members voting on such amendments shall, within 60 days after receipt of such notification, register their vote in writing with the Secretary-Treasurer on blanks furnished by the Association. These ballots shall be opened and recorded by the Executive Committee, and the results shall be reported by the Secretary-Treasurer at the next Annual Meeting: and if the amendments are passed they shall become a part of the Constitution from the date of such report by the Secretary-Treasurer at the Annual Meeting.

BY-LAWS

ADOPTED OCTOBER 25, 1913

ORGANIZATION

The Constitution shall be the basis of government of this Association.

ARTICLE 1

MEMBERSHIP

SECTION 1. Any person eligible for membership under the Constitution who shall file an official application, accompanied by the first annual membership dues of five dollars, and whose application for membership shall have the approval of the Membership Committee, may become a member of the Association for one year.

SECTION 2. Any person having once become a member may continue membership in the Association so long as the annual membership dues are paid. Any member who shall fail to pay annual dues within thirty days after having been notified by the Secretary that said dues are due and payable, shall be dropped from membership. Any member so dropped may, within ninety days, be reinstated by the Membership Committee, upon application filed in due form and accompanied by the annual membership dues for that year.

SECTION 3. A member of the Association may be expelled for due cause upon recommendation of the Membership Committee, and a majority vote of the members at any annual meeting. Any member so expelled shall have refunded such *pro rata* part of his membership dues as may not be covered by his term of membership.

HONORARY MEMBERS

SECTION 4. Members of the Association may elect as honorary members, at any stated meeting, on the recommendation of the Membership Committee, those whose labors have substantially added to the scientific knowledge of milk supply betterment, or those who have been of pronounced practical influence in the improvement of the milk industry. From such members no dues shall be required. They shall have the privilege of attending the meetings of the Association, but they shall not be entitled to vote.

ARTICLE 2

OFFICERS

SECTION 1. The officers of this Association shall be a President, a First, Second, and Third Vice-President, a Secretary-Treasurer, and two Auditors, who shall be chosen by ballot at the annual meeting of the Association, and shall hold office for one year, or until their successors are duly elected.

SECTION 2. The Executive Board shall consist of the President, the three Vice-Presidents, and the Secretary-Treasurer.

SECTION 3. The Membership Committee shall consist of the President, the three Vice-Presidents, and the Secretary-Treasurer.

ARTICLE 3

DUTIES OF OFFICERS

SECTION 1. It shall be the duty of the President to preside at all meetings of the Association. He shall examine and approve all bills previous to their payment, appoint all committees unless otherwise directed by vote of the Association, and perform such other duties as usually devolve upon a presiding officer, or are required of him by the Association.

SECTION 2. The Vice-Presidents, in the order of their selection, shall perform the duties of the President in his absence.

SECTION 3. The Secretary-Treasurer shall record the proceedings of the Association. He shall keep a list of members, and collect all moneys due the Association, giving his receipt therefor. He shall record the amount of each payment, with the name and address of the person so paying. He shall faithfully care for all moneys entrusted to his keeping, paying out the same only with the approval of the President, and taking a receipt therefor. He shall, immediately after his election to office, file with the President of the Association a bond in the sum of five hundred dollars, the expense of which shall be borne by the Association. He shall, at the annual meeting, make a detailed statement of the financial condition of the Association.

It shall also be the duty of the Secretary-Treasurer to assist in making arrangements and preparing a program for the annual meeting, and to compile and prepare for publication all papers, addresses, discussions and other matter worthy of publication, as soon as possible after the annual meeting.

SECTION 4. The full management of the affairs of the Association when the Association is not in session shall be in the hands of the Executive Board, as provided in the Constitution.

SECTION 5. It shall be the duty of the Auditors to examine and audit the accounts of the Secretary-Treasurer and all other financial accounts of the Association, and to make a full report of the condition of the same at the annual meeting.

ARTICLE 4

MEETINGS

SECTION 1. The annual meeting of the Association shall be held at such time and place during the month of October of each year or at such other time as shall be designated by the Executive Board.

SECTION 2. Special meetings of the Association may be called by the Executive Board, of which due notice shall be given to the members by the Secretary.

SECTION 3. Quorum.—Twenty-five per cent of the membership shall constitute a quorum for transaction of business at any annual meeting. Voting by proxy shall not be permitted.

ARTICLE 5

These By-Laws may be altered or amended at any annual meeting of the Association. Any member proposing amendments must seasonably submit the same in writing to the Secretary-Treasurer, who shall then give notice of the proposed amendments by mail to each member of the Association at least thirty days previous to the date of the annual meeting.

MEMBERS

Abele, C. A., Director of Inspection, State Dept. of Public Health, 519 Dexter Ave., Montgomery, Ala.

Allard, E. U., Chief Milk Inspector, City Hall, Quebec.

Arrell, Dr. T. J., Dairy Farm Inspector, Health Dept., Hamilton, Ont.

Babcock, C. J., Associate Market Specialist, Bureau of Dairy Industry, Washington, D. C.

Baldwin, E. St. J., Sanitary Control Representative, Borden's, 110 Hudson St., New York City.

Baril, W. A., Vice-President, Wieland Dairy Co., Inc., 3014 N. Tripp Ave., Chicago, Ill.

Barnum, Harold J., Dairy Inspector and City Chemist, Health Dept., Ann Arbor, Mich.

Bemis, Robert E., Inspector of Milk and Bacteriologist, 24a City Hall, Cambridge, Mass.

Bent, Leslie D., Dairy Inspector, Dept. of Health, 94 Valley Rd., Montclair, N. J.

Bolling, Geo. E., Director of Laboratory and Inspector of Milk, City Hall, Brockton, Mass.

*Bourbeau, E., General Cheese and Butter Inspector, Department of Agriculture, St. Hyacinthe, Quebec.

Bowman, Herbert E., Box 33, North Acton, Mass.

Bremer, H. E., Supervisor of Creamery Inspection, Vermont Department of Agriculture, Montpelier, Vt.

Brooks, Dr. Paul B., Deputy Commissioner, State Department of Health, Albany, N. Y.

Buckley, James P., Bacteriologist and Chemist, Supplee-Wills-Jones Milk Co., 15 S. 34th St., Philadelphia, Pa.

Bulmer, L. C., Director, Food and Dairy Inspection, Jefferson County Board of Health, Birmingham, Ala.

Burgwald, L. H., Department of Dairy Technology, Ohio State University, Columbus, Ohio.

Burke, Prof. A. D., Head of Dairy Dept., Alabama Polytechnic Institute, Auburn, Ala.

Bushong, Dr. J. P., Veterinarian and Sanitary Inspector, Los Angeles County Medical Milk Commission, 414 N. Larchmont Blvd., Los Angeles, Cal.

Butler, Dr. W. J., Executive Officer, Montana Livestock Sanitary Board, Helena, Mont.

Campbell, H. C., Assistant Professor in Milk Hygiene, University of Pennsylvania, 23d and Locust Sts., Philadelphia, Pa.

Carman, H., Milk Inspector and Bacteriologist, City Hall, Newport, Ky.

Carpenter, W. H., City Milk Inspector, 703½ W. First St., Hastings, Neb.

Chandler, L. Van D., Health Officer, 90 Essex St., Hackensack, N. J.

Cook, Alfred S., Walker-Gordon Laboratory Co., Plainsboro, N. J.

Costello, John L., Inspector of Milk, Department of Health, Binghamton, N. Y.

Daley, John P., Milk Inspector, Beverly, Mass.

Demaree, C. C., Bacteriologist, City Health Department, City Hall, Asheville, N. C.

Dinneen, Maurice, Inspector of Milk, Town Hall, Winchester, Mass.

Dotterrer, W. D., Bowman Dairy Co., 140-158 W. Ontario St., Chicago, Ill.

* Deceased.

Dougherty, William L., Chief Milk Inspector, Department of Health, 125 Worth St., New York City.
Douglas, D. K., Milk and Dairy Inspector, Department of Health, City Hall, Regina, Saskatchewan.
Dugan, Mrs. Sarah Vance, Director, Bureau of Foods, Drugs and Hotels, State Board of Health, Louisville, Ky.
Dumont, Dr. Louis J., Health Officer, New Britain, Conn.
Dusterhoft, Herman W., Dairy and Milk Inspector, City Hall, Waukesha, Wis.
Dwyer, R. M., District Supervisor, City of St. Louis, 709 N. Fourth St., St. Charles, Mo.
Ehlers, V. M., Director, Bureau Sanitary Engineering, State Dept. of Health, Austin, Texas.
Erickson, H. E., Chief, Food and Dairy Division, Bureau of Health, Public Safety Bldg., St. Paul, Minn.
Eriksen, H. C., Dairy and Milk Inspector, Health Department, City Hall, Santa Barbara, Cal.
Estes, Howard R., 719 Kennesaw St., Birmingham, Mich.
Evans, Dr. Fred, 603 Summit Ave., North Sioux Falls, S. Dak.
Fabian, F. W., Associate Prof. of Bacteriology and Hygiene, Michigan State College, East Lansing, Mich.
Fee, Kenneth F., Director, Dairy and Food Bureau, State Department of Agriculture and Markets, Albany, N. Y.
Fisher, Dr. Milton R., Milk Inspector, 4405 W. Pine St., St. Louis, Mo.
Flanagan, Thos. F., Food and Milk Inspector, 550 Main St., Hartford, Conn.
Frank, Leslie C., Sanitary Engineer in Charge, Office of Milk Investigations, U. S. Public Health Service, Washington, D. C.
Franklin, U. D., Dairy Inspector, Jefferson County Health Dept., Birmingham, Ala.
Frayer, James M., Dairy Bacteriologist, Agricultural Experiment Station, Burlington, Vt.
Fuller, Nelson M., Sanitary Engineer, Cattaraugus County Board of Health, Olean, N. Y.
Fulson, J. K., Milk and Food Inspector, Bolivar County Dept. of Health, Cleveland, Miss.
Gavin, Joseph S., Inspector, Gavin Dairy Lab., 200 Stockbridge Ave., Buffalo, N. Y.
Gauhn, Emmett R., Chief, Dept. of Sanitation, Monroe County, 435 E. Henrietta Road, Rochester, N. Y.
Giraud, Julius F., Chief Inspector, Division of Inspections, Dept. of Agriculture, Box 67, Fulton, S. Dak.
Gomila, Madeline C., Asst. City Chemist, 811 Louisa St., New Orleans, La.
Griffith, R. L., Chief, Dairy and Milk Inspector, City Health Department, Oakland, Cal.
Grim, Dr. Geo. W., Milk Control Officer, Board of Health, Milk Control District No. 1, Ardmore, Pa.
Gruber, Dr. J. T., Dairy and Food Inspector, Dept. of Health, Marion, Ohio.
Hardenbergh, Dr. John G., Director of Laboratory, Walker-Gordon Laboratory Co., Plainsboro, N. J.
Harding, Dr. H. A., Chief, Dairy Research Bureau, The Mathews Co., P. O. Box 517, Detroit, Mich.
Harding, H. G., 762 Roslyn Ave., Akron, Ohio.
Harris, R. M. C., Chief Dairy Inspector, City Health Bureau, City Hall Annex, Richmond, Va.

Heffernan, H. D., Director, Bacteriological and Chemical Work, Pure Milk Society, 6269 Colbert St., New Orleans, La.
Heinzman, M. A., Milk Inspector, Ventura County Health Dept., Ventura, Cal.
Hiscock, Prof. Ira V., Professor of Public Health, Yale University, School of Medicine, New Haven, Conn.
Holford, Dr. F. D., Chief Veterinarian, Borden's Farm Products Co., 110 Hudson St., New York City.
Hollingsworth, Dr. J. B., Chief Food Inspector, City Hall, Ottawa, Canada.
Holmquist, C. A., Director, Division of Sanitation, State Department of Health, Albany, N. Y.
Honholt, Herman J., Asst. Mgr., Laboratory Field Service, Pure Milk Association, Chicago, Ill.
Hood, Dr. A. J. G., Superintendent of Food Inspections Division, City Hall, Montreal, Canada.
Horn, Dr. David W., Chemist, Boards of Health Townships of Lower Merion and Haverford, Box 666, Bryn Mawr, Penn.
Hudon, M. H., Inspector General of Dairy Products and Secretary to Quebec Dairy Commission, Department of Agriculture, Quebec.
Hunt, Dr. F. J., Veterinary Farm Supervisor, St. Louis Health Dept., Medora, Ill.
Irwin, Ralph E., Chief Engineer, Division of Milk Supply, State Department of Health, Harrisburg, Pa.
Jennings, J. R., Chief, Milk Division, City Health Dept., Louisville, Ky.
Johns, C. K., Asst. Agricultural Bacteriologist, Central Experimental Farm, Ottawa, Canada.
Johnston, John F., Inspector of Milk, Health Department, Newport, R. I.
Kagey, Dr. J. F., Food and Dairy Inspector, Kingsport, Tenn.
Keith, J. I., Associate Prof. of Dairy Mfg., Agricultural Experiment Station, Stillwater, Oklahoma.
Kelly, Ernest, Chief, Division of Market Milk Investigations, Bureau of Dairy Industry, U. S. Department of Agriculture, Washington, D. C.
Kelsey, Harold C., Deputy Commissioner, Dairy and Food Commission, Hartford, Conn.
Knobel, Dr. Ed., Inspector of Milk, Box 175, Dedham, Mass.
Kohler, Roy W., City Dairy and Milk Inspector, 2403 N. 70th St., Lincoln, Neb.
Krog, Andrew J., Health Officer, Plainfield, N. J.
Krueger, Paul F., Assistant Director, Bureau of Dairy Products, Department of Health, Chicago, Ill.
Larner, Herbert B., American Research Products, Inc., 117 Liberty St., New York City.
Lawrence, Dr. Robert P., 299 Bloomfield Ave., Verona, N. J.
Lazarus, Nathan E., Director of Lacteal Analytical Laboratories, Inc., 176 Franklin St., Buffalo, N. Y.
Leahy, H. W., Sanitary Bacteriologist and Chemist, Rochester Health Bureau, Rochester, N. Y.
Leete, C. Sidney, Associate Milk Sanitarian, Bureau of Milk Sanitation, State Department of Health, Albany, N. Y.
Lehmkuhl, Henry W., 73 Howell St., Rochester, N. Y.
Lescure, John M., Director, Bureau of Milk Control, City Health Dept., Baltimore, Md.
McCrady, M. H., Chief of Laboratories, Provisional Bureau of Health, Province of Quebec, 89 Notre Dame East, Montreal, Canada.
McGlinchey, Dr. F. T., Milk Inspector, Health Dept., Waltham, Mass.

Marcussen, W. H., Vice-President, Borden's Farm Products Co., 110 Hudson St., New York City.
Martin, Dr. Ivan G., Veterinarian in Charge, Farm Inspection Dept., Gridley Dairy Co., Milwaukee, Wis.
Matthews, C. B., Chief, Bureau of Dairy Inspection, 261 N.W., 36 Court St., Miami, Fla.
Maughan, M. O., President, American Dairy Foundation, 228 N. LaSalle St., Chicago, Ill.
Melican, Geo. D., Milk Inspector, Room 6, City Hall, Worcester, Mass.
Merchant, Dr. I. A., Prof. of Veterinary Medicine, Iowa State College, Ames, Iowa.
Mickle, F. Lee, Director of Laboratories, State Department of Health, Hartford, Conn.
Miller, Milton M., Assoc. Milk Specialist, U.S.P.H.S., 2001 Daniels St., Vancouver, Wash.
Mitchell, Dr. H. B., Milk Supervisor, City Hall, Lancaster, Pa.
Morrow, Dr. A. C., District Veterinarian, Butte District, Dillon, Mont.
Mott, Frank E., Chemist, Health Department, and Inspector of Milk, 1104 City Hall Annex, Boston, Mass.
Myers, Chas. E., Milk Inspector, City Dept. of Health, Detroit, Mich.
Nicholas, H. R. H., Health Officer, Englewood, N. J.
Ocker, Harry A., Meat and Dairy Inspector, Department of Health, Cleveland, Ohio.
Oldfield, H. G., Associate Sanitarian, Div. of Sanitation, University Campus, Minneapolis, Minn.
Osgood, Clayton P., Assistant State Dairy Inspector, Dept. of Agriculture, Augusta, Maine.
Ownbey, James E., Dairy Inspector, City Board of Health, City Hall, Louisville, Ky.
Palmer, Russell R., Chief Milk Inspector, City of Detroit, 3919 John R. St., Detroit, Mich.
Palmer, Wm. B., Executive Officer, Milk Association of the Oranges, City Hall, Orange, N. J.
Parfitt, Dr. E. H., Dairy Bacteriologist, Purdue Univ., Lafayette, Indiana.
Parker, Horatio N., City Bacteriologist, Engineer Building, Jacksonville, Fla.
Pearce, Dr. C. D., Chief Veterinarian, The Borden Company, 350 Madison Ave., New York, N. Y.
Pease, Dr. Herbert D., Director of Pease Laboratories, 39 W. 38th St., New York City.
Pike, Adna B., State Dairy Inspector, New Hampshire Dept. of Agriculture, 329 S. Main St., Laconia, N. H.
Pilgrim, Dr. S. L., Chief, Bureau of Food and Sanitation, Health Department, Milwaukee, Wis.
Powell, Richard, Food, Drug & Milk Inspector, 174 West End Ave., Newark, N. J.
Prentiss, Russell I., Supervising Inspector, Div. of Dairying and Animal Husbandry, Dept. of Agriculture, State House, Boston, Mass.
Price, Dr. Wm. H., Ira Wilson & Sons Dairy Co., 5255 Tillman Ave., Detroit, Michigan.
Prucha, Prof. Martin J., Professor of Dairy Bacteriology, University of Illinois, Urbana, Ill.
Putnam, Geo. W., Director of Research, The Creamery Package Mfg. Co., 1243 W. Washington Blvd., Chicago, Ill.
Quigley, J. V., President, Country Club Dairy Co., 5633 Troost Ave., Kansas City, Mo.
Rath, Floyd C., Chemist, Board of Health, 311 State St., Madison, Wis.
Redfield, Dr. H. W., Mendham, N. J., R. F. D. 1.

Regan, Dr. J. J., Chief Veterinarian and Director of Labs., Dairymen's League, 11 W. 42nd St., New York City.

Richmond, Dr. A. R. B., Chief, Division of Food Control, Department of Public Health, City Hall, Toronto, Ontario.

Rigby, Dr. E. J., Dairy Inspector, Department of Health and Public Welfare, Parliament Building, Winnipeg, Manitoba.

Robertson, Dr. A. H., Director, Food Laboratory, State Dept. of Agriculture and Markets, Delmar, N. Y.

Scheldrup, Carl J., Health Inspector, City Health, Albert Lea, Minn.

Scofield, W. W., Chief, Bureau of Food and Drugs, State Department of Health, State House, Trenton, N. J.

Scott, John M., Chief Milk Inspector, 230 E. Main St., So. Gainesville, Fla.

Shaw, Alex. G., State Dairy and Milk Inspector, Tampa, Fla.

Sheehan, James F., Inspector, Milk, Food and Vinegar, City Board of Health, Everett, Mass.

Shere, Lewis, c/o Diversey Mfg. Co., 53 W. Jackson Blvd., Chicago, Ill.

Shields. Fred M., Dist. Supervisor, City Health Dept. of St. Louis, Pacific, Mo.

Shoults, Dr. W. A., Director, Division of Food Control, Department of Health and Public Welfare, Winnipeg, Canada.

Shrader, Dr. J. H., Secretary, Sealtest System Laboratories, Inc., 120 Broadway, New York City.

Shutt, Donald B., Dept. of Bacteriology, Ontario Agr. College, Guelph, Ontario.

Smith, D. R., Zone Mor., Southern Dairies, Inc., P. O. Box 152, Miami, Fla.

Smith, John F., Inspector of Pasteurizing and Ice Cream Plants, Health Dept., City Hall, Worcester, Mass.

Supplee, Dr. G. C., Director of Research Laboratory, The Dry Milk Company, Bainbridge, N. Y.

Switzer, H. B., U. S. Department of Agriculture, Appraiser's Stores Bldg., 201 Varick Street, New York, N. Y.

Taylor, John, Bureau of Dairy Products, Indiana Div. of Public Health, Indianapolis, Ind.

Thomas, R. C., Asst. Milk Specialist, U. S. Public Health Service, Washington, D. C.

Thomson, James E., Manager, Department of Milk Supply, Borden's Farm Products Company, 110 Hudson St., New York City.

Thornton, Prof. H. R., Prof. of Dairying, Univ. of Alberta, Edmonton, Alta.

Tiedeman, Walter D., Chief, Bureau of Milk Sanitation, State Department of Health, Albany, N. Y.

Tobey, Dr. James A., Director, Health Service, The Borden Company, 350 Madison Ave., New York City.

Tobin, Michael F., Inspector of Pasteurization, 245 Canal St., Providence, R. I.

Tolland, A. R., Supervisor of Pasteurization, Health Department, Room 1102, City Hall Annex, Boston, Mass.

Trish, Dr. Karl A., Food and Dairy Inspector, Health Department, City Hall, Kenosha, Wis.

Trotter, Dr. A. M., Chief Veterinary Inspector, Corporation of Glasgow, 60 Melbourne St., Glasgow, Scotland.

Voorhees, Dr. L. A., Chemist to the Department of Health, P. O. Box 114, New Brunswick, N. J.

Walker, J. Edward, Milk Inspector, City Health Department, Detroit, Mich.

Wallis, Wm. H., Inspector of Milk, 19 Leonard St., Somerville, Mass.
Walmsley, Dr. F. D., Borden's Farm Products Company of Illinois, 326 W. Madison St., Chicago, Ill.
Ward, Dr. Archibald R., Consultant on Problems of Handling Market Milk, 1986 Waverly Ave., Detroit, Mich.
Ward, Willard E., Agent for Milk and Food Inspection, Board of Health, 14 Town Hall, Brookline, Mass.
Washburn, Prof. R. M., Albert Verley Co., St. Paul, Minn.
Way, H. O., Director, H. O. Way Laboratory Service, 309 Western Reserve Bldg., Cleveland, Ohio.
Webney, Hugh W., Chief Inspector, Health Dept., 1002 Tacken St., Flint, Mich.
White, Thos. G., Milk Inspector, 1130 Seward Ave., Detroit, Mich.
Wickham, Dr. J. C., in charge of Quality Milk Control, Producer's Milk Co., 4227 W. 36th St., Cleveland, Ohio.
Wilcox, Dr. F. P., Chief, Division of Dairy Products, Los Angeles County Health Department, Hall of Justice, Los Angeles, Cal.
Williams, Dr. R. W., Deputy State Veterinarian, P. O. Box 923, Eldorado, Ark.
Winslade, Dr. A. W., Veterinary Farm Inspection, City of St. Louis, Sparta, Ill.
Woodward, E. G., Dairy and Food Commissioner, Hartford, Conn.
Wyatt, W. J., Milk Control Div., State Health Dept., Oklahoma City, Okla.
Yale, Dr. Maurice W., Bacteriologist, New York State Agricultural Experiment Station, Geneva, N. Y.
Yates, J. W., General Laboratories, Inc., 1000 Widener Building, Philadelphia, Pa.
Young, J. L., Chief Inspector, State Department of Agriculture, Trenton, N. J.

HONORARY MEMBERS

Evans, Dr. Wm. A., Health Editor, *Chicago Tribune*, Chicago, Ill.
Pearson, Dr. R. A., President, University of Maryland, College Park, Md.
Van Norman, Dr. H. E., The Borden Co., 350 Madison Ave., New York City.
Woodward, Dr. W. C., American Medical Association, Bureau of Legal Medicine and Legislation, 535 N. Dearborn St., Chicago, Ill.

ASSOCIATE MEMBERS

Bates, H. C., Field Representative, American Guernsey Cattle Club, Atlanta, Ga.
Beardslee, C. E., Gen'l Supt., Dry Milk Div., Borden's, Arcade, N. Y.
Beardslee, C. E., General Superintendent In Charge of Market Cream and Dry Milk Production, Borden's, 350 Madison Ave., New York City.
Breen, W. H., National Supervisor, Dairy Machinery Div., York Ice Machinery Corp., York, Pa.
Burrell, Loomis, Cherry-Burrell Corp., Little Falls, N. Y.
Burrows, O. K., Ass't. Gen'l. Mgr., Cherry-Burrell Corp., 427 W. Randolph St., Chicago, Ill.
Capouch, Frank J., Director of Dairy Inspection, Bowman Dairy Co., 140 W. Ontario St., Chicago, Ill.
Chumlea, L. W., Indiana Condensed Milk Co., Indianapolis, Ind.
Corbin, Dr. C. I., Veterinarian in Charge, Sanitary Control of Milk, 524 W. 57th St., New York City.

Eastwood, H. S., Milker Department, DeLaval Separator Co., 165 Broadway, New York City.
Hall, A. G., Manager, Certified Milk Production, Borden's, 110 Hudson St., New York City.
Hibben, Robert C., Executive Secretary, International Association of Ice Cream Manufacturers, 1105 Barr Building, Washington, D. C.
Hood, Gilbert H., Jr., Dairy Expert, H. P. Hood & Sons, Inc., 500 Rutherford Ave., Boston, Mass.
Huth, H. R., Gen'l Supt., Kraft-Phenix, Cheese Corporation Milk Plants, Beaver Dam, Wis.
Johnson, Dr. H. S., Proprietor of Dairy Products Laboratory, 119 Federal St., N. S., Pittsburgh, Pa.
Johnston, R. A., In Charge Milk Inspection Work for the Abbott Co., Cameron, Wis.
Jones, Vern R., Department Manager, J. B. Ford Sales Co., Wyandotte, Mich.
Kelly, Dr. Thos., Production Mgr. Country Dept., Philadelphia Dairy Products Co., Inc., Upper Darby, Pa.
Keown, W. J., Inspector of Cream Supplies, Breyer Ice Cream Co., Philadelphia, Pa.
Kleffen, E. O., Supervisor, Milk and Farm Inspection for Luick Dairy Co., Milwaukee, Wis.
Larson, Hugh F., Vice-Pres. and Gen'l Mgr., Silver Seal Dairy Products Co., Philadelphia, Pa.
Lemmel, P. F., Borden's, 12 E. Mifflin St., Madison, Wis.
Liverance, Wallace B., Technical Service Representative, Dry Yeast Dept,. Standard Brands Inc., 595 Madison Ave., New York City.
Long, Alvin E., Production Mgr., Newark Milk and Cream Co., and Alderney Dairy Co., Newark, N. J.
McCulloch, Dr. Ernest C., Biological Research, Penn Salt Mfg. Co., and General Laboratories, Widener Bldg., Philadelphia, Pa.
Meyer, Arthur W., Geo. J. Meyer Mfg. Co., 4137 N. Farewell Ave., Milwaukee, Wis.
Meyer, Geo. L. N., Vice-Pres., Geo. J. Meyer Co., Cudahy, Wis.
Mohr, M. R., Farm Inspector, Page Dairy Co., Weston, Mich.
Mojonnier, Timothy, Pres., Mojonnier Bros. Co., 4601 W. Ohio St., Chicago, Ill.
Moyer, Vincent C., Supplee-Wills-Jones Milk Co., Philadelphia, Pa.
Myer, C. Randolph, Superintendent, Whiting Milk Co., 17 Hillside Ave., Cambridge, Mass.
Neuhauser, Maurice D., Supervisor, Dairy Farm Inspection and Improvement Work, Hoosier Condensed Milk Co., Bluffton, Ind.
Nichols, John R., New England General Manager, Walker-Gordon Laboratory Co., Inc., Charles River, Mass.
Parr, J. C., Indiana Condensed Milk Co., Indianapolis, Ind.
Perry, John R., Director and General Manager, Orange Dairy Co., Inc., East Orange, N. J.
Phelan, Joseph F., Chief Analyst in Charge of Laboratories, H. P. Hood & Sons, Inc., 500 Rutherford Ave., Boston, Mass.
Pratt, Harold T., Technologist, Philadelphia Dairy Products Co., Inc., P. O. Box 1588, Philadelphia, Pa.
Schultz, Robert W., Field Manager, Abbott Co., Bruce, Wis.
Scott, Dr. Henry T., Director, Biological Research, Wisconsin Alumni Research Foundation, Madison, Wis.
Uselman, Wm. E., Chemist and Bacteriologist, 325 Tompkins St., Fond du Lac, Wis.
Witham, C. L., Indiana Condensed Milk Co., Indianapolis, Ind.
Ziebold, Dr. A. W., Manager, Foremost Dairies, Inc., Atlanta, Ga.