# JOURNAL OF MILK TECHNOLOGY

Volume I Number I

## Special Convention Number

## October, 1937

TWENTY-SIXTH ANNUAL MEETING
LOUISVILLE, KY., OCT. 11-13, 1937

*PUBLICATION OF*
*INTERNATIONAL ASSOCIATION OF*
*MILK SANITARIANS*

# *Who knows* Most about Milk?

NOT mother . . . not the milkman . . . not even the baby who drinks it four or five times daily! It's the milk sanitarian who knows most—and who fully realizes the necessity of protection against contamination of this important food. That's why milk sanitarians have been the first to appreciate these features of the Standard Welded Wire Seal:

*1. It's Tamper-Proof*

Drawn tightly around the neck of the bottle, the Welded Wire Seal is a modern safeguard that locks *out* dirt, dust and other contamination —and locks *in* the dairy-purity of the milk.

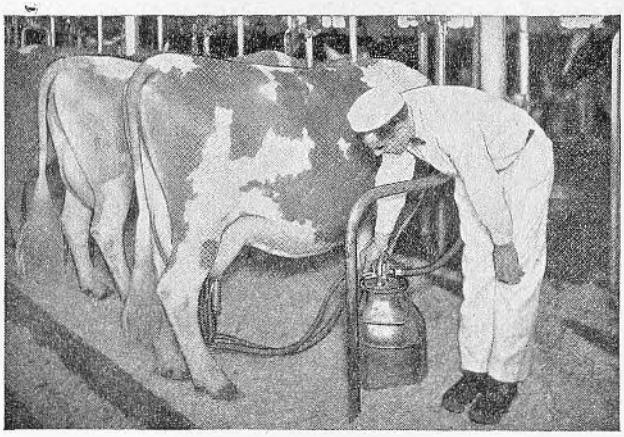
*2. It's Sanitary*

The Welded Wire Hood Seal *completely* covers the entire rim of the bottle. The pouring lip is kept sterile-fresh and the consumer is the very first to break the seal.

Milk sanitarians who are studying hood-capping are invited to write for free leaflets. Address: Standard Cap and Seal Corporation, 1200 Fullerton Avenue, Chicago, Illinois.


**THE STANDARD Welded Wire SEAL**

**THE NATIONAL TRADE MARK OF BETTER MILK AND CREAM**



*The illustration at left shows a De Laval Magnetic Milker of the pail type in use on the famous Cherry Hill Certified Milk farm owned by H. P. Hood & Sons. This milker is giving extremely satisfactory results in every way and is one of several similar De Laval Magnetic Milker installations on other Hood farms. Many other leading Certified Milk producing farms are using De Laval Magnetic Milkers of this type.*

# DE LAVAL MAGNETIC
## WORLD'S BEST MILKERS

TWO TYPES—BOTH MILK IN THE SAME WAY
WITH THE SAME PERFECT ACTION

REGARDLESS of whether you have a standard De Laval Magnetic Milker of the pail type or a De Laval Magnetic Combine Milker for use in a milking parlor, you will get the same milking results ,for both milk with the same uniform and perfect action.

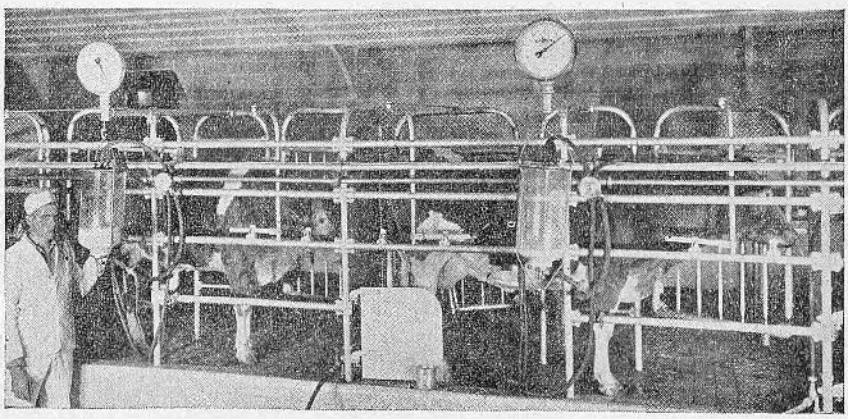
There can no longer be any question regarding the superiority of De Laval Magnetic Milkers. They milk better, faster, cleaner than any other method. They are used and preferred by leading breeders and dairymen. Thousands of individual cows and herds have made outstanding production records with De Laval milking.

Both types of De Laval Magnetic Milkers are used by leading Certified Milk producers and dairymen everywhere for the production of the finest quality of milk.

De Laval Engineers will gladly work out the best system for your particular needs.

## THE DE LAVAL SEPARATOR COMPANY

| New York | Chicago | San Francisco |
|---|---|---|
| 165 Broadway | 427 Randolph St. | 61 Beale St. |



*The illustration above shows interior of milking parlor and De Laval Magnetic Combine Milker at Foxden Farm, near Newark, Del. For the dairyman who is producing and distributing his own milk there is nothing which will help him increase business like a milking parlor and a De Laval Combine Milker.*

JOURNAL OF MILK TECHNOLOGY

Publication of
The International Association of Milk Sanitarians

Volume 1 SPECIAL CONVENTION NUMBER, OCTOBER 1937 Number 1

# CONTENTS



Published by the Special Committee on Association Publication of the International Association of Milk Sanitarians

Office of Publication: 17-19 Day Street, Orange, N. J.

Association Executive Office: State Office Building, Albany, N. Y.

Notice:—Address all correspondence regarding subscription, editorial contents and manuscripts to Publication Committee Chairman, Wm. B. Palmer, 17-19 Day Street, Orange, N. J.

# INTERNATIONAL ASSOCIATION OF MILK SANITARIANS

Secretary's Office: State Department of Health, State Office Building, Albany, N. Y.

## OFFICERS 1936-1937

*President,* John G. Hardenbergh.....Plainsboro, N. J.
*First Vice-President,* Alexander R. Tolland.....Boston, Mass.
*Second Vice-President,* Paul B. Brooks.....Albany, N. Y.
*Third Vice-President,* Victor M. Ehlers.....Austin, Texas
*Secretary-Treasurer,* C. Sidney Leete.....Albany, N. Y.
*Auditors:* J. R. Jennings.....Louisville, Ky.
F. D. Holford.....New York City

## EXECUTIVE BOARD

The Executive Board consists of the Association President, the three Vice-Presidents, and the Secretary-Treasurer.

## COMMITTEES

COMMUNICABLE DISEASES AFFECTING MAN—Their Relation to Public Milk Supplies.
L. A. Merchant, *Chairman*.....Ames, Iowa

MILK PLANT PRACTICE
A. R. Tolland, *Chairman*.....Boston, Mass.

DAIRY AND MILK PLANT EQUIPMENT
Walter D. Tiedeman, *Chairman*.....Albany, N. Y.

DAIRY FARM METHODS
F. D. Holford, *Chairman*.....New York City

SANITARY CONTROL OF ICE CREAM
F. W. Fabian, *Chairman*.....East Lansing, Mich.

FOOD VALUE OF MILK
G. C. Supplee, *Chairman*.....Bainbridge, N. Y.

LABORATORY METHODS
A. H. Robertson, *Chairman*.....Albany, N. Y.

METHODS OF IMPROVING MILK SUPPLIES IN SMALL COMMUNITIES
Leslie C. Frank, *Chairman*.....Washington, D. C.

PUBLICITY AND PUBLIC RELATIONS
Sarah Vance Dugan, *Chairman*.....Louisville, Ky.

RESOLUTIONS
Ernest Kelly, *Chairman*.....Washington, D. C.

SPECIAL COMMITTEE ON ASSOCIATION PUBLICATION
William B. Palmer, *Chairman*.....Orange, N. J.

SPECIAL COMMITTEE ON POLICY
Paul B. Brooks, *Chairman*.....Albany, N. Y.

SPECIAL COMMITTEE TO SECURE NEW MEMBERS
*Sectional Chairmen:*
Canada: C. K. Johns.....Ottawa, Canada
New England: A. R. Tolland.....Boston, Mass.
Middle Atlantic: W. D. Tiedeman.....Albany, N. Y.
Southeast: H. N. Parker.....Jacksonville, Fla.
South: J. R. Jennings.....Louisville, Ky.
Southwest: Victor M. Ehlers.....Austin, Texas
Middle West: Paul F. Krueger.....Chicago, Ill.
Far West: M. A. Heinzman.....Ventura, Cal.

LOCAL COMMITTEE ARRANGEMENTS FOR THE LOUISVILLE MEETING
J. R. Jennings, *Chairman*.....Louisville, Ky.

# JOURNAL of MILK TECHNOLOGY

Volume 1 Number 1

Special Convention Number — October, 1937

## *ANNOUNCEMENT*

*This, the first issue of the Journal of Milk Technology, is published especially for the Twenty-sixth Annual Meeting of the International Association of Milk Sanitarians at Louisville, Kentucky, October 11-13, 1937. The Journal is the official publication of the Association.*

*Beginning in January 1938 the Journal will be inaugurated as a bi-monthly publication and will be issued in lieu of the Year Book heretofore published by the Association.*

*The Report of the Special Committee on Association Publication and the editorial "The Journal of Milk Technology" contained in this issue explain the creation of the journal and its scope. It is anticipated that the Journal of Milk Technology will prove to be a valuable medium to all persons and organizations concerned with any of the various phases of the milk and milk products industry and its many ramifications, whether from the standpoint of its official, industrial, regulatory, quality control, technical or nutritional aspects. The journal will likewise be of interest to the general public and milk consumers.*

## Report of Special Committee on Association Publication

*Presented at the Annual Meeting Louisville, Ky., October* 1937.

AT the Twentieth Annual Meeting of the Association of Milk Sanitarians held in Montreal, Canada, in 1931, the suggestion was made, and renewed at subsequent meetings, that consideration be given to the establishment of an Association journal.

Following the 1933 Annual Meeting, a Special Committee on Association Publication was appointed. After thorough study of the subject it presented comprehensive reports at the 1934 and 1935 Annual Meetings outlining the editorial and managerial requirements involved.

At the 1936 Annual Meeting in Atlantic City, N. J., the subject was referred to the Executive Board with power to act. The original Special Committee on Association Publication, with additions, was requested by the Executive Board to establish a journal, if practicable, subject to the approval of the Board. Several meetings were held during the year, one being a joint session with the Executive Board. After consideration of all phases of the problem including possible affiliation with other publications, it was decided that a journal is essential in the field of milk technology and the Association is able and ought to proceed with such a publication. There are ample indications that with proper management such a journal can be made financially self-sustaining.

Accordingly, and acting with the approval of the Executive Board and with the personal assistance of the Association President, the Special Committee on Association Publication has established and presents herewith the JOURNAL OF MILK TECHNOLOGY. The first issue, published without cost to the Association, is a Special Convention Number for the Association's Twenty-sixth Annual Meeting, Louisville, Kentucky. It is presented as a part of this report.

The Special Committee on Association Publication recommends:

1. That the International Association of Milk Sanitarians formally designate the JOURNAL OF MILK TECHNOLOGY as its official publication to be published in lieu of the Annual Report;

2. That, beginning in January 1938, the Journal be inaugurated as a bi-monthly publication;

3. That the Association take action at the 1937 Annual Meeting on the following:

   (a) Publication policies;
   (b) Management, including editing and business;
   (c) Finances;
   (d) Management be made responsible to the Executive Board of the Association.

Respectfully submitted,

WM. B. PALMER, *Chairman,*
C. SIDNEY LEETE
J. J. REGAN
J. H. SHRADER
J. A. TOBEY

# Editorial Section

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



## The Journal of Milk Technology

WHEN a person sees the formidable list of technical journals that are now abstracted and then notes that in the food field alone there are dozens, he may be excused for looking askance at the appearance of a new journal. However, the JOURNAL OF MILK TECHNOLOGY is a newcomer only in its present form. It is an outgrowth of the Proceedings of the International Association of Milk Sanitarians. This organization came into being in October 1911 and has been known as the International Association of Dairy and Milk Inspectors. In 1935 the name was changed to International Association of Milk Sanitarians. Every year it has published the proceedings of its annual meeting in a report which has grown with the years. Therefore its publication of work in this field of milk inspection has continued uninterruptedly for 25 years.

In the years when life was not geared at its present tempo, the appearance of the Report six months or more after the presentation of the original papers did not greatly inconvenience the membership. Milk inspection was organized entirely on a local basis. The places where really effective work was done were scattered. Each inspector had to solve his problems mostly in the light of his own knowledge and in accordance with the restrictions of his local conditions. He joined the Association to broaden his vision, to increase his information, to exchange views on inspection policies and to secure the encouragement attendant on meetings of kindred minds. There was not great urge to print quickly the papers that had been presented at the annual meeting.

During this time, another movement was developing. The great increase in the public recognition of the necessity for milk inspection had led to the inauguration of this work all over the country and the employment of scores of inspectors. These formed state associations which held annual meetings and published their proceedings, both on the model of the International Association. The kind of information which had previously been annually collected and later published by this organization was being disseminated by the local associations which catered to the immediate interests of the inspectors in their respective areas.

But an even greater factor was at work to change conditions. It used to be that an honest, conscientious, and intelligent practical dairyman, physician, veterinarian, or laboratorian possessed the knowledge that would enable him to become a good inspector—insofar as knowledge itself was concerned. The application of modern science to the dairy industry has changed all this. No longer can a man with a few cows and a horse and wagon conduct a milk business. The present-day milk dealer draws his supply from hundreds of tested cattle on scores of farms. His plant is

equipped with refrigeration and steam, and must have heavy machinery for power production or utilization. His pasteurization equipment is the last word in applied heat engineering. His control of temperatures embody the latest principles of automatic control. His plant equipment is made of materials from the advancing frontier of anti-corrosive performance. His plant operations require all the sanitary knowledge that a trained bacteriological staff can apply. In other words, the application of science to dairying has converted a milkman into a milk industrialist, a dairy into a milk plant. Its operation requires an effective application of the technology of dairying. This technology uses animal husbandry, bacteriology, chemistry, physics, mechanical and electrical engineering, and transportation. It is concerned with advertising, public relations, and regulatory interpretation. The modern milk business is a highly organized industry whose successful operations are predicated on the application of the newest developments of food technology.

The man who must inspect such a business and be responsible for its safe operation must be able to think in terms of all the factors that may be involved. Obviously his knowledge must embrace the benefits of their proper application and also the injury of their improper application. He must keep up with the advances in dairy technology and know when they are correctly applied. Such a man must have a scientific and technical training and a mental outlook of a high order. All of this has led to the designation of such an occupation as that of "sanitarian". The milk sanitarian thinks in terms of technology applied to milk and its products.

It is to this widening field of milk technology that this JOURNAL OF MILK TECHNOLOGY caters. It will publish promptly those papers from the annual meeting which are of immediate interest to the membership. It will accord a publication medium to authors in the field of milk technology. Its policies will be controlled by experienced milk sanitarians. It will be edited by milk sanitarians for milk sanitarians primarily.

This journal is to serve that field of milk technology not now covered by publications of the purely research type on the one hand, nor of the trade journal type on the other. It will be valuable to official sanitarians, to the members of the technical, quality control, and research staffs of commercial organizations, to instructors in educational institutions, to research workers in the experiment stations, and to investigators in all fields of research in milk sanitation and technology. The membership of the Association actually consists of persons in all of these groups.

This publication would not exist if it had not been for the devoted and intelligent work of inspectors in the past. We look back over the years and think of the good men, some dead and gone, who have attended our meetings and who have labored for the growth of the Association and who have contributed to the development of our knowledge of improved milk inspection. Without their work, our present achievements would be impossible. They founded and built. We remodel and extend. Old-timers, we salute you. Our new publication is not a replacement. It is a development. It is not something different. It is all that the old one was, plus the new. It is the expression of the growing edge of our profession—milk sanitation.

## A Broader Vision for Milk Sanitarians

When the first milk inspector in the United States was appointed by the City of Boston in 1859, his functions were merely those of a police officer. Sixty years later, with official milk control and supervisory work established in many areas, the duties of the hundreds of milk inspectors holding office were still those of policemen, although the more progressive inspectors had begun to concern themselves with the important problems of dairy hygiene, as well as with the adulteration of milk.

Today the milk sanitarian, like the modern health officer, is not a policeman primarily, but an educator, an engineer, and a public health statesman. To be sure, his duties still include the reasonable enforcement of proper legislation for the sanitary production, processing, and handling of milk and dairy products, but his functions are now much broader than that.

The modern milk sanitarian is an important cog in the public health machine, a machine that is now concerned mainly with the positive promotion of the public health, and only secondarily with the routine imposition of drastic rules on the conduct of life and liberty, and on the use of property. The goal of modern public health, which is the prevention of disease, the promotion of the general physical welfare, and the prolongation of healthful life, is best attained by education and persuasion rather than by mere coercion.

The milk inspector should, therefore, be a constructive force in his community. While zealous in his attempts to detect fraudulent practices and deliberate violations of laws and regulations, he should nevertheless approach his duties with a spirit of cooperation and helpfulness for the dairyman, the milk plant operator, and the milk company. While displaying firmness and courage, he should also be reasonable and broad-minded. He should practice prevention rather than cure, teaching his clients the rules of the game before he hales them into court for minor or major infractions of these rules.

A valuable creed for the milk sanitarian was that quoted several years ago by Professor I. V. Hiscock, when he was president of the International Association of Dairy and Milk Inspectors. "Dairy inspectors," he said, "should possess tact, perseverance, knowledge, energy, and courage. The bullying dictatorial type may enforce certain rules temporarily; but the greatest good and the more lasting results are secured by the inspector who uses reason as a flame to light the path."(1)

One of the legitimate duties of the milk sanitarian is to aid in the promotion of a greater public appreciation of the nutritive virtues of pure milk and other dairy products. When official supervision and the willing cooperation of the industry have resulted in a supply of clean and safe pasteurized milk, the public should be induced to consume it in liberal amounts, especially since pure milk is conceded by all authorities on nutrition to be our best all-around food.

Because an increase in the consumption of pure milk in this country would be conducive to a better national vitality, milk sanitarians will make a definite contribution to public health progress when they lend their efforts and influence to this cause. By doing so, they will also earn the gratitude and the even more ardent cooperation of the milk industry, the majority of whose members now realize that good milk is fundamental to good business.

The milk sanitarian and the milk industry are today engaged in a common task, that of providing the best possible supply of an indispensable food and of promoting a greater use of pure milk by the general public in the interests both of improved health and their economic welfare.

---

1. Hiscock, I. V.; The goal of dairy and milk inspectors. 17th Ann. Rep. Int. Assoc. Dairy and Milk Insp. 1928. (Quoted from Kelly and Clement.)

# Current Technological Problems in the Dairy and Ice Cream Industries *

**A. C. Fay**

*Director of Laboratories, H. P. Hood & Sons, Inc., Boston, Mass.*

## INTRODUCTION

IT would be both facetious and impossible in the time allotted adequately to discuss or even to list all of the new problems confronting a modern dairy control laboratory. The objective of this paper is merely to call attention to a few of the problems which are occupying the contemporary spot light of scientific attention, and which challenge the efforts of investigators in the various specialized fields of the dairy industry. Neither defense nor apology is offered to support a futile contention regarding the relative importance of the problems selected, because it is highly improbable that any two workers could agree as to just which problem is the most important one confronting any given phase of the industry.

## MILK PRODUCTION

*The use of Lactogenic Hormones.* Of particular interest in the field of milk production is the recent use of pituitary hormone for stimulating the production of milk in animals from 10 to 350 percent. Although the composition of the milk produced is normal, the effect of the lactogenic hormone is most marked in animals that are well-fed for high production levels. Incomplete evidence suggests that variations in the normal production levels of cows may be due in part to the inherent proficiency of their pituitary gland to excrete this lactogenic hormone. This new development in the field of endocrinology is not only of economic importance in increasing the production level of an individual animal or herd, but serves as a challenge to the endocrinologist to provide means of pre-determining the pituitary proficiency of a heifer as an index to her economic value. There also is opened a wide field of accomplishment in the study of animal breeding by making an early evaluation of the ability of a herd sire to elevate the lactogenic hormone content of the blood of his daughters over that of their dams.

*Mastitis.* Although the statement sometimes made that mastitis is of greater economic importance to the dairyman than tuberculosis and infectious abortion combined may be difficult to defend, the inevitable fact remains that mastitis is responsible for serious losses in milk production and for a devastating spread of the disease to a high percentage of the animals in a given herd. The remarkable success in the wholesale eradication of tuberculosis from the dairy cattle in large areas, and, to a lesser extent, the success attained in the control of infectious abortion, has lent encouragement to the attack of the problem of eliminating mastitis. Strangly enough, however, the more one learns about mastitis the more pessimistic he becomes as to the practicality of wholesale elimination of the disease from all dairy herds. The extraordinarily high percentage incidence of the disease coupled with its insidious dormancy in apparently normal animals renders the control comparable in its complexity to that of eliminating the human cold.

Fortunately, only a decimal percentage of the existing mastitis is caused by organisms pathogenic for humans. This fact, however, should not be construed to imply that septic sore throat traceable to milk from certain cows is a rare disease. Statis-

* Read at the Food Technology Conference of the Department of Biology and Public Health, Massachusettes Institute of Technology, Boston, Sept. 14, 1937.

tics from many states rank this disease high among the list of infectious and controllable diseases. Although pasteurization is the most practicable means of preventing the spread of septic sore throat through milk, it is still highly desirable to eliminate cows with infected udders for economic, esthetic, and public health reasons. The spot light of scientific interest has shifted in recent years from tuberculosis to infectious abortion, and still more recently is being focused upon mastitis. It is safe to predict that dairy control laboratories in the future will be devoting an increasingly greater proportion of their efforts to the study, control, and elimination of mastitis.

### MILK PROCUREMENT

*Resazurin Test.* The available methods for testing thousands of samples of raw milk at country receiving stations are beset with many limitations. The direct microscopic examination, and the Methylene blue reduction test are not highly sensitive at the low levels of bacterial population demanded in a well controlled milk supply, whereas the plating technique gives results too long delayed for effective criticism and correction. Considerable interest is now shown in the use of resazurin as an oxidation-reduction indicator which is sensitive at higher levels of potential than methylene blue. Results indicate the possibility of detecting raw milk with a bacterial population in excess of 200,000 per milliliter within one hour. Since this dye reduces at levels of potential only slightly below the normal oxidation-reduction potential of milk, and is sensitive to slight decreases in that potential, further work needs to be done to establish three fundamental points, viz. (1) the extent to which there is uniformity or variation in the oxidation-reduction levels of various samples of milk, (2) the extent to which there is uniformity or variation in the poising properties of milk, and (3) the variation in the reducing intensities of different organisms normally present in milk.

The reduction of a dye in milk depends upon four things (1) the number of organisms, (2) the kind of organisms, (3) the number of leucocytes, and (4) light. Reduction tests are most reliable on very poor milk because such milks usually contain such a preponderance of one type of organism (*S. lactis*) that for practical purposes, the "kind of organisms" may be regarded as uniform, and the reduction intensities inducible by normal numbers of leucocytes and by light shrink to insignificant proportions, thus leaving the number of organisms as the only practicable variable. In milk of good quality, these factors, however, play a more important proportionate part, and hence render the test less reliable as an index to the number of organisms. The high levels of reduction of resazurin make it possible for leucocytes and light to exert an even greater relative influence on reduction time than is the case with methylene blue. Before the resazurin test is widely adopted it is desirable that dairy control laboratories devote considerable study to its possible limitations.

### PROCESSING

*Pasteurization Test.* Few would dispute the statement that among the most impelling unfilled needs of the dairy control laboratory and of the milk regulatory officials, has been a reliable test to determine if milk has been adequately pasteurized. In the past, sole reliance has necessarily been placed upon the inspection of charts from recording thermometers and occasional plant inspections. Such an indirect procedure gives little satisfaction in the examination of a particular bottle of milk submitted for specific examination.

The ideal test for pasteurization would necessarily be dependent upon a normal constituent of milk which would be present in uniform amounts in all milk and whose resistance to heat is just at the threshold of the thermal exposure employed for pasteurization. The nearest approach to satisfying this ideal and this need seems to be the phosphatase test which is receiving considerable attention in dairy control laboratories. Milk which has not been properly pasteurized or milk to which only a small amount (0.1 percent) of raw milk has been added subsequent to pasteurization contains detectable amounts of the active enzyme phosphatase.

On the assumption that the rate of inactivation of the enzyme would be uniform at the fixed thermal exposure of pasteurization, the amount of the enzyme present at the end of the exposure would obviously depend upon the amount present in the raw milk. Recent work has shown that mastitis induces abnormalities in the phosphatase content of milk. Further work needs to be done to establish more convincingly that the quantity of the enzyme in different samples of raw milk is sufficiently constant to avoid misinterpretation of the results of the test.

*Pasteurization of Ice Cream Mix.* Experimental work carried on cooperatively at the Kansas and Iowa Experiment Stations has shown that the sugar present in ice cream mix tends to protect the organisms against the destructive action of heat. If heat induces the physical process of coagulation of cell protoplasm, it is logical to expect the rate and hence the degree of coagulation to be altered by substances such as sugar which exert osmotic effects at the cell surface.

If certain cells are subjected to heat in water, milk, or broth, the original colloidally dispersed protoplasm is at first partially dehydrated, at which stage the degree of coagulation is readily reversible, and, if placed in a suitable medium, it quickly regains its original dispersion. This restoration of the original dispersion is known as peptization and the coagulation is said to be reversible. Continued exposure to heat induces progressively more advanced stages of coagulation which are less and less reversible and the cell can be peptized only in special media, if at all. In the advanced stages, coagulation is irreversible to all media and the cell is definitely dead, but in the intermediate stages the "death" or "life" of the cell will depend upon the ability of the medium employed to peptize the partially coagulated cells.

According to this concept, the presence of sugar in ice cream mix tends to retard the rate and prevent the degree of coagulation of the cell from advancing quite so far in the direction of the irreversible stages. This point of view also affords an explanation for the frequent observation that bacterial counts of ice cream are considerably higher and more uniform when plated on a medium containing some carbohydrate than when plated on plain agar. The carbohydrate medium is more capable of peptizing the partially coagulated cells protected by the sugar in the mix than is the case with plain agar. These experiments suggest caution to the dairy control laboratory in the selection of media for the plating of ice cream and in making thermal resistance studies of organisms suspended in such dairy products as ice cream or sweetened consensed milk.

*Homogenization of Ice Cream.* Studies of the physical chemistry of homogenization and its effect on the dispersion of fat as well as the surface absorption phenomena have been greatly facilitated by the use of photomicrographs. Commercial use of photomicrographs of mixes homogenized under different conditions gives promise of more intelligent control in the direction of standardization of the products made from day to day or maufactured in different plants but sold under one trade name.

## BACTERIAL CONTROL

*Colon Counts.* The determination of the numbers of colon-aerogenes bacteria in dairy products is receiving more attention each year. The plating procedures employed are more readily applicable than the serial dilution methods in the analysis of large numbers of samples, but are not so reliable for samples with colon counts of a low order of magnitude. The large amounts of milk necessarily added to the plates for the detection of small numbers of colon-aerogenes types react with the bacteriostatic agents employed, and hence, destroy the selective properties of the medium. Although the acceptance of colon counts as an index to poorly pasteurized milk has met with considerable objection, it is now rather generally conceded that the presence of colon-aerogenes types in pasteurized dairy products justifies immediate investigation. Contamination from poorly washed equipment subsequent to pasteurization is frequently detected by means of colon counts.

Colon counts are of particular value in the detection of sources of contamination

which contribute relatively small numbers of bacteria. Due to the low order of magnitude at which colon counts are interpreted, the addition of a relatively few colon types by a piece of equipment may increase the colon count several fold, although the actual increase in the total bacterial count may not be detectable.

Colon counts are emphasized in the analysis of certified milk, because they reveal only slight laxness in the extraordinary care demanded for the production of this product. Since the conditions prescribed for the production of certified milk preclude to a large extent the contamination from animal fecal sources, the probability that colon organisms in this milk may be of human origin is correspondingly increased, and is hence given more serious consideration.

The high temperatures now commonly employed in the pasteurization of ice cream mix and of cream for bottling practically preclude the survival of colon-aerogenes types in these products. The presence of these organisms in the finished products which have been pasteurized at such high temperatures is almost certain evidence of contamination subsequent to heating. Dairy control laboratories are finding, and shall continue to find, increasing use for colon counts in the analysis of dairy products.

*Yeast and Mold Counts of Cream and Butter.* Recent studies of the generation times of yeasts and of molds have thrown some doubt on the value of this test as an index to the sanitary quality of cream to be used for butter making and of the finished butter. Due to the slow growth of yeasts and molds, cream may be poorly refrigerated for considerable periods without detection by the yeast and mold count. More direct correlation has been established between the keeping quality of the finished butter and bacterial counts by the microscopic method, than can be found with yeast and mold counts. The evidence at least suggests that dairy control laboratories should reinvestigate the limitations of the yeast and mold count.

*The Use of Tryptone-glucose-skimmilk Agar.* Perhaps the greatest interest of dairy control laboratories is now centered around the proposed adoption of tryptone-glucose-skimmilk agar as a substitute for the present standard beef-extract agar now recognized by the Committee on Standard Methods for Milk Analysis of the American Public Health Association. It is also proposed that plates be incubated 48 hours at 32°C. instead of 37°C. The new medium and method of incubation permits the growth of many organisms incapable of development on plates made from the present standard medium and incubated at 37°C. This is particularly true in the case of milk with high bacterial counts and also with ice cream in which the sugar has exerted a protective effect on the bacterial flora during pasteurization. Comparative counts on ice cream using standard agar incubated at 37°C. and trytone-glucose-skimmilk agar at 32°C. indicate that in about one-third of the samples the counts are more than doubled by use of the new medium. In about three percent of the samples analyzed the increase in count with the new medium was in excess of 1,000 percent. The opposition to the change of procedures for milk analysis may be summarized briefly as follows: (1) Bacterial standards for milk, based upon the present methods of analysis have become so deeply embedded in the minds of producers and consumers, as well as in municipal and state regulations, that chaos would result in the interpretation of the results from the new methods of analysis. (2) No uniform readjustment of standards could be made intelligently since there is no constant relationship between the results of the two methods with various samples of milk. (3) Producers who have learned through years of experience and education by health officials to deliver milk with low bacteria counts will become discouraged when confronted with counts of much higher magnitude. Similarly, consumers who have a fair degree of familiarity with bacterial counts in their milk supply will be frightened by the reports based upon the new methods. (4) Since no method of plating will reveal all of the organisms in milk, the adoption of a new procedure because it reveals a somewhat higher percentage does not offer sufficient advantage to offset the disadvantages. (5) Public health

officials who have successfully improved the milk supply in their communities will encounter many administrative difficulties if the new methods are adopted.

The points presented in favor of the change of procedure for milk analysis may be summarized briefly as follows: (1) The new medium more closely approximates the growth demands of the types of bacteria which normally constitute the bacterial flora of milk. (2) Due to the presence of 0.5 percent of milk as one of the ingredients, the new medium eliminates the discrepancies frequently observed between the plates made from lower and high dilutions of the same sample. (3) the lower incubation temperature is more favorable for the growth of the saprophytic types of bacteria which constitute the majority of the bacterial population of milk. (4) The lower incubation temperature gives more uniform counts on replicate analyses in different laboratories, because the frequent variations of a few degrees in the region of 32°C. do not greatly influence the count, whereas the same variations in the region of 37°C. will greatly affect the count. (5) In the past the programs of milk improvement have consisted of progressively and gradually strengthening the requirements year after year as soon as the producers have learned to meet the previous requirements. Bacterial standards, based upon standard agar counts, have been successively lowered until further reduction would meet with stern opposition. By changing the medium to one which gives higher counts and not altering the standards to compensate for the higher values, a new lever for further restrictions may be provided.

When and if the new procedures for milk analysis are adopted, the dairy control laboratories will necessarily have to meet and solve many new problems not presented by the present standard methods of analysis.

## SUMMARY

By way of summary, it may be said that with the increasing interest in producers problems of production through the use of lactogenic harmones, the curtailment of production by mastitis, the introduction of the resazurin test for raw milk, the phophatase test for pasteurized milk, the newer information on the physical factors involved in the pasteurization and homogenization of ice cream mix, the renewed interest and applications of the colon count, the need for reinvestigating the value of the yeast and mold count for cream and butter, the proposed introduction of a new medium for the plating of milk, and many other new procedures and lines of interest not included in this paper, the modern dairy technological laboratory becomes increasingly important as a vital factor in industrial and public health control.

# Engineering of Pasteurization *

**C. A. Holmquist and W. D. Tiedeman**

*Director, Bureau of Sanitation; Chief, Bureau of Milk Sanitation; State Department of Health, Albany, N. Y.*

The principle of pasteurization was developed by Pasteur to meet a practical need in the beverage industry, namely, to check the growth of organisms causing undersirable fermentation in wines. The commercial application of the theory of heat treatment to wine was fairly simple. With the application of this principle to milk and milk products came new problems.

The bacteriologists soon established points on the thermal death curves of various pathogenic organisms which may be found in milk. The effects of various degrees of heat on the creaming of milk, on albumin, fat, sugar, casein, enzymes, and taste were also determined. It soon appeared that there was a range within which the temperature of pasteurization must fall in order to secure enough heat treatment to destroy any pathogenic bacteria which might chance to be present and yet not enough to damage the physical or chemical properties of milk. This range or zone is shown on North's Curves, with which you are undoubtedly familiar.

The application of the principle of pasteurization to milk and milk products on a commercial scale was first done by operators who apparently did not grasp the fundamental technological principles involved, if such principles were given any thought. After participating in one of the first engineering studies of pasteurizing equipment, Phelps said ". . . . the lack of sound engineering in a distinctly engineering field has been conspicuous and rather deplorably so."

The proper design and construction of pasteurizing equipment requires a knowledge of physics, hydraulics, mechanics, sanitation, electricity, metal processing, strengths and qualities of materials, in addition to an understanding of the effect of heat on bacteria in milk and on the physical and chemical properties of milk.

Perhaps it is to be expected that the first pasteurizers, like the first efforts along other lines, should fall far short of accomplishing what we recognize as proper pasteurization today. There were two general faults: first and most important, faulty design and construction leaving avenues for viable pathogenic bacteria to get through and second, faulty design and construction causing scorching of portions of the milk, damaging cream line, encouraging the development of thermophylic bacteria, and other undesirable effects. The last mentioned faults are of greater health significance than might first appear because when both raw and pasteurized milk are available to the public, consumers have turned to the use of raw milk when the flavor of the pasteurized milk was objectionable for one reason or another. The interesting point is that the application of sound engineering principles to pasteurizing equipment has resulted in replacing the defective equipment so commonly used during the first and second decades of the commercial pasteurization of milk with equipment that will "pasteurize" milk without damaging flavor, creaming or any other important property. By the term "pasteurize" as just used is meant subjecting every particle of milk to a temperature of 143°F. or more for not less than 30 minutes, or to a temperature of 160°F. or more for not less than 15 seconds in pasteurizing equipment of an approved type. The approval

* Delivered at the Food Technology Conference of the Department of Biology & Public Health, Massachusetts Institute of Technology, Boston, September 14, 1937.

of types of pasteurizers has become an important function of health departments.

The first comprehensive engineering tests of commercial pasteurizers were carried on at Endicott, New York, in conjunction with bacteriological tests by Phelps, North, et al, during a period of about a year and a half, beginning in December 1921. The results were reported in Public Health Bulletin No. 147 of the United States Public Health Service entitled "Commercial Pasteurization" with which most of you are familiar. Many serious defects were found in the commercial equipment of that period. This served to awaken the industry as well as the health departments to the need for better engineering in the field of pasteurization. Later Whittaker in Minnesota, Putnam and Frank in Chicago, and our own department did considerable work on engineering tests of commercial pasteurizers using thermocouples to determine temperatures of the milk at significant points throughout the pasteurizing operation.

You will remember that among the serious defects found in these and similar studies were: (1) dead-ends caused by such things as outlet valves located some distance from the holder and in which some milk was either not heated to pasteurizing temperature or was not maintained at that temperature during the holding period, (2) leaky outlet valves which permitted unpasteurized milk to accumulate in the outlet line during pasteurization, (3) leaky inlet valves which permitted unpasteurized milk to drip into the pasteurizer during the holding period, (4) unpasteurized milk held in the inlet line by atmospheric pressure when the inlet was submerged and discharged with the pasteurized milk when the holder was emptied, (5) foam on the surface of pasteurized milk, the temperature of which was likely to be as much as 15 degrees below that of the body of milk in the holder, (6) recording and indicating thermometers with 5° scale divisions closely spaced which could not be read accurately. (7) recording thermometers badly out of adjustment and no means provided for checking them, (8) indicating thermometers on which the metal scale had slipped and no etched mark on the tube for use in resetting the scale, (9) leaks in heat exchangers permitting unpasteurized milk to enter the pasteurized supply, (10) continuous flow pasteurizers designed upon the fallacious theory that actual holding time would equal the theoretical and (11) inaccurate temperature control and lack of protection against low temperature.

The remedies for these defects which engineers have developed are (a) valveless outlets or outlet valves installed flush with the inner wall of the pasteurizer and so built that milk tending to leak past the valve will run to waste instead of entering the outlet line, (b) valveless inlets or inlet valves protected against leakage and with air relief to permit milk which has passed the valve to drain into the pasteurizer, (c) foamless pumps, foamless inlet lines or automatic foam heaters, (d) recording and indicating thermometers with 1/16 inch scale division per degree, (e) indicating thermometers so installed in pasteurizers as to be used for operation and for checking the recording thermometer, (f) indicating thermometers with marks etched in the glass at pasteurizing temperature to aid in detecting and resetting scales which have slipped, (g) safeguards against leakage of unpasteurized milk into pasteurized in enclosed heat exchangers and similar protection of surface type regenerative heat exchangers by the use of leak protector grooves and the extension of the ends of tubes beyond the collecting troughs using diverting fins at the end of each tube, (h) designing continuous flow holders upon actual holding time determined by color or similar test, (i) the development of automatically controlled precision heating for continuous flow pasteurizers, and (j) the provision of automatic devices for flow diversion of underheated milk and automatic low temperature milk pump stops.

Perhaps a few concrete examples of defects in equipment will serve to bring out the engineering features involved in tests better than an abstract discussion of the subject, although it is getting to be an old story. You are familiar with the so-called "flash" type consisting of a

"barrel" heater in which milk flowing through tubes was rapidly heated by surrounding hot water which was in turn heated by direct steam under manual control without recirculation of the water. Milk pumps used in conjunction with these were of variable speed and no attempt was made to determine holding time at pasteurizing temperature. Thermometers used were small, slow to react and difficult to read. The temperatures used ranged from 158°F. to 165°F. and the time of exposure from a few seconds to two minutes. Engineering tests showed a great variation in temperature during operation at any predetermined temperature and similarly great variations in holding time. With the exposure of these defects and the advent of the holding type of pasteurization, "flash" pasteurization was discredited and legislated out of existence. Good engineering might have saved this process as has since been demonstrated, although the equipment then in use was entirely unsuitable.

One of the outstanding examples of inefficient pasteurization was the continuous flow cylindrical holder or so-called "short flow system." When flash pasteurizers were banned this was the next most economical equipment for large plants. Installation usually consisted of two cylindrical tanks, one at a slightly higher elevation than the other and so piped as to introduce milk in a downward stream at the center of the upper one. The overflow from the upper tank was similarly introduced into the lower tank from whence the overflow went to the cooler. Because it took thirty minutes to fill the two tanks it was assumed that it took the same time for all particles of milk to flow through. The Endicott experiments, made on an improved type of short flow holder provided with perforated inlet spreader troughs to break the flow showed that "some milk passed through in from 10 to 12 minutes and that 25 per cent of the flow passed through in about 20 minutes or less." The reasons for this should have been perfectly obvious to the designer and are apparent to the engineer who has studied currents in streams or flow through sewage sedimentation tanks. As a result of these and other tests this type of holder was discredited and was soon taken off the market. Before many years, old installations of this equipment were replaced with so-called "positive holders."

Among the early types of pasteurizers were various ones designed to heat, hold and cool the milk in the bottle in which it was to be delivered to the customer. This intrigued health officials because it eliminated the hazards of recontamination involved in cooling and bottling the milk after pasteurization and insured that the bottles themselves would be at least pasteurized if not sterilized. Bacteriological tests generally showed a good reduction in plate count with an occasional unexplained increase. Engineering tests made by reading temperatures by means of an especially constructed system of thermocouples installed at different levels in bottles of milk at various locations in the pasteurizer while in commercial operation gave a different story. They brought out the fact that milk cannot be heated uniformly in an upright milk bottle without resorting to agitation. The greater heating surface in the narrow neck of the bottle per unit volume of milk to be heated resulted under the most favorable conditions in a differential of about 7°F. in the temperature of the milk in the top and bottom of the same bottle. The results of a typical test of one of these types of pasteurizers as made by our own engineers showed that at the beginning of the 30 minute holding period when every particle of milk was supposed to be at not less than 142°F. (the legal requirement at that time), the temperature of milk at 12 different points in various bottles varied from 85.5°F. to 136°F. while at only one of the points selected was the temperature found to be adequate, that is 147°F. At the end of the holding period the temperatures of milk at three points was still below 143°F., *i.e.* 125.5°, 127°, and 141°. At the other ten points temperatures ranged from 142°F. to 153.5°F. This type has also been taken out of plants and taken off the market. Although with good engineering equipment could be designed to pasteurize milk in the bottle, the operation is not economical and has the com-

mercial disadvantage of leaving a partially filled bottle when the milk contracts on cooling.

More recently pasteurizers have been developed to subject milk effectively to a temperature of not less than 160°F. for 15 seconds or more which tests have shown is equivalent to treatment at not less than 143°F. for 30 minutes or more. This may be called a revival of "flash" pasteurization but has been more correctly called high temperature short time pasteurization to indicate the definite holding period. This is simply another point on the pasteurization curve selected as a matter of convenience and utility. This was first attempted by use of equipment designed to heat milk quickly to 160°F. by electrical resistance during its passage between two energized, water-cooled, flat carbons spaced about 2½ inches apart. The older equipment had a fixed electrical input and the temperature of the milk was automatically regulated by varying the rate of flow through the medium of a variable speed pump. Provision of a pump stop which automatically stopped and reversed the flow of milk was required before the use of the process was permitted by health officials. Dr. Prescott and associates at this institution were among those to subject this equipment to critical tests. Our own department in cooperation with the United States Public Health Service also ran tests on a commercial unit to pasteurize quantities of milk to which human and bovine pathogenic oganisms had been added. The bacteriologists collected continuous flow samples while the engineers subjected the unit to stress conditions such as failure of electric current, interruption of current in certain circuits, reduction in voltage and sudden increase in flow of milk. As a result the use of the equipment was permitted in New York State. Similar action has been taken in some other sections of the country. Many improvements have been made in this equipment since these tests were run.

Other equipment built to similarly heat milk under precise automatic control by hot water has been developed and tested. Of particular interest is the plate type heat exchanger developed for this purpose. Tests have shown that the results are equivalent to that obtained on electrically heated milk. Apparently the degree of heat and the holding time rather than the method of applying the heat are the important factors.

Some of the earlier devices, particularly outlet valves designed to correct defective equipment, were far from being satisfactory. It was necessary to permit the use of some of these that were theoretically sound until defects developed in actual practice. The end result has been equipment that overcame the fault without developing new ones. Notwithstanding all this development it is disconcerting to find that the modern vat pasteurizer so commonly used is not as yet equipped with devices for showing positively the holding time at pasteurizing temperature.

Along with the perfection of the efficiency of heat treatment of milk have gone other important engineering developments. Many metals have been tested and new alloys developed in the effort to secure better milk contact surfaces. Glass surfaces fused on steel are used extensively. Most modern pasteurizers have milk contact surfaces of such material or of stainless steel. Pulleys, shafts and belts have given way to concealed motors for driving agitators. Welded joints have taken the place of soldered joints. Surfaces that need cleaning have been made smoother and more easily accessible. Covers have been constructed so that anything falling or dripping on them will fall on the floor instead of into the milk vats. Methods of applying heat have been so improved as to provide low temperature differentials and to avoid surfaces with hot spots that scorched some of the milk. Milk pumps have been redesigned to minimize foaming, to facilitate cleaning and prevent damage to creaming.

While safety is the primary consideration of public health engineers it has been necessary to accomplish this without destroying flavor or any of the good properties of milk. Early crude attempts at commercial pasteurization resulting in scorching or in producing an oxidized or metallic flavor in milk turned consumers against pasteurization and led them to seek raw milk that tasted better. As you

know, equipment is now available that will pasteurize milk with a full factor of safety without damaging the flavor or materially diminshing any beneficial properties. This has been largely due to the work of engineers in testing, finding faults and redesigning pasteurizers.

Pasteurization of cream and other milk products is of considerable public health importance. Raw cream and ice cream made from raw mix have been found to be responsible for outbreaks of disease on numerous occasions. Most butter manufacturers have adopted pasteurization of the cream in order to prevent foreign organisms from overgrowing added cultures and thus secure butter of uniformly high score. Cheese also has been implicated in disease outbreaks.

Hucker of the New York State Agricultural Experiment Station incorporated hemolytic streptococci from a case of septic sore throat in a cheddar cheese and reports growth of these organisms throughout a three month ripening period. He points out that there is a tendency to place cheese on the market much more quickly than heretofore and sometimes within three months. It is desirable and possible to adapt processes of manufacturing milk products to the use of milk or cream pasteurized in the usual manner. The result is not only a safer but a more uniform product.

The more general consumption of pasteurized milk and milk products has resulted in a definite improvement in the health of the public. One of the factors making this possible has been the improvement in pasteurizing equipment. Our recent use of the phosphatase test for pasteurization indicates that further improvement is necessary and may be expected.

## New Jersey Accredited for Bovine Tuberculosis

ON September 1, 1937, New Jersey became the forty-fifth state to attain a "modified accredited area" status under the Federal-State cooperative program for the eradication of bovine tuberculosis. Tuberculin testing of the cattle in Salem and Middlesex counties completed the list of New Jersey counties in which there remain less than one-half of one percent reactors.

The accomplishment was celebrated at a luncheon, under the auspices of the New Jersey Department of Agriculture, at Trenton on September 9th. Prominent State and Federal officials, past and present members of the State Board of Agriculture, and representatives of the State Veterinary Medical Association, of the State and municipal Departments of Health, of State agricultural organizations and of other interested agencies which have supported the campaign during the past twenty years, were present.

As a part of the program, a portrait of the late Dr. John H. McNeil, first chief of the New Jersey Bureau of Animal Industry and under whose capable and untiring supervision the work of tuberculosis eradication in cattle was carried on for nineteen years, was presented to the Department of Agriculture by the State Veterinary Medical Association.

Only three states—New York, South Dakota and California—now remain to complete accreditation of the entire country, a task started cooperatively in 1917 and the greatest animal disease eradication program ever undertaken. New York State will be accredited within a few weeks and the work in South Dakota and California is progressing quite rapidly.

An important aspect of the bovine tuberculosis eradication program should be emphasized: accreditation of the nation's cattle is a remarkable achievement but constant vigilance and continued effort by continual retesting must be exerted to prevent any spread of re-infection from the small amount of disease that remains. All organizations should continue their interest and support in order to protect the ground gained.

# Report of Committee on the Food Value of Milk and Milk Products

*(International Association of Milk Sanitarians. 26th Annual Meeting, Louisville, Kentucky. October 11-13, 1937)*

THE rapid evolution of knowledge concerning the detailed and intimate principles of nutrition as revealed by improved methods of study and experimentation has mobilized investigators to renewed zeal in the search for the final explanation of the nutritive value of milk and its various products. The food value of milk is as firmly established as time itself and to presume otherwise would seem to transgress the composite judgment and experience of human civilization. Nevertheless, progress demands continued activity in the search for the ultimate explanation of common phenomena. A natural consequence of the rapid progress of the biological sciences is the application of new methods of investigation, the formulation of new concepts, and a more penetrating interpretation of experimental and practical results as applied to milk in order that the lay-man as well as the scientist may better understand the reasons for the intrinsic merits of milk as a food for man and animals. The sources from which such knowledge is derived are manifold; the specialized methods of the bacteriologist and sanitarian, the physicist and engineer, the chemist and biologist, the physician and pathologist, as well as the business executive and regulatory official, all contribute to the task.

Since the technology of milk in its abstract and applied phases involves information of such a diversified character and a variety of scientific and professional viewpoints, it is obviously impossible to present completely in a single report of this character a summation of all of the direct and indirect data relating to the broad subject matter. Milk technology as viewed from the nutritional standpoint embodies an ensemble of interrelated entities and factual relationships which are constantly being revealed in a new light with the emphasis dependent upon the particular object of study and basis of comparison.

In appraising the published data, reviews and editorial comments, the informative items fall into fairly well-defined categories, such as: composition, as revealed by various analytical procedures; biophysical and biochemical considerations, involving physical and chemical methods of study with a biological basis of interpretation; clinical studies involving objective comparison and interpretation predicated upon the response of the human subject to a pre-determined plan of procedure and observation. Since the literature of recent years pertaining directly and indirectly to the food value of milk predominantly falls within or overlaps one or more of these groups, it is essential to further determine, if possible, the broad objectives of this multitude of independent and frequently uncorrelated research, in order that one may examine in perspective the present trend of inquisitive thought and conceptive psychology, therefore determining the practical and ultimate significance of the data as a means for furthering the use of milk for the benefit of mankind.

In pursuing this critical approach for the purpose of presenting a resumé of the current literature concerning the food value of milk, certain generic subjects seem to predominate, for illustration; analytical studies pertaining to composition; biochemical and physical studies relating to physical properties; flavor; and general or specific nutritional response as

determined by animal experimentation; the effects of various physical treatments, including pasteurization, homogenization, irradiation and other processing procedures; and clinical studies involving the response and reaction of the human subject to milk and its derivatives when administered under predetermined conditions.

There has been continued acceleration of studies pertaining to the analytical composition of milk with special reference to the "trace substances", including iron, copper, iodine, manganese, and others which have been or may be proven to be of dietary or therapeutic significance. The vitamins have received particular attention with reference to variations as influenced by the breed of cattle, feed, period of lactation, and the effect of processing procedures. There is also evidence of increasing interest in the specific character of the proteins and lipid and sterol content of milk as related to dietary requirements and physical phenomena manifested in certain manufacturing and processing branches of the industry.

Although it was shown as early as 1922 that pasture feeding versus stall feeding of cattle did not materially influence the copper content of milk, recent data again confirms these early conclusions and cites the copper content of uncontaminated milk to range, throughout the year, between 0.14 and 0.19 mg. per liter. The iron content is reported to vary between 0.34 and 0.43 mg. per liter. No substantial variations in the zinc content of milk due to variations in feed are reported. The manganese content is reported to be increased by feeding certain tuberous crops. Further evidence is presented showing that the iodine content of milk is markedly affected by the amount ingested.

Numerous additional data are presented further confirming the variations in vitamin content, particularly vitamins A, D, and G, as influenced by the character of the feed and the breed of cattle. Lactoflavin is an entity of the vitamin B complex, which is reported to be higher in colostrum than during the later periods of lactation. Milk, or whey and its derivatives contain lactoflavin in quantities reported to vary from 1.5 to 3.5 gamma/cc. or gm. Available data indicates that milk, with the possible exception of liver, is one of the richest known sources of this dietary factor. Of potential significance from the dietary standpoint is the reported data showing that lactoflavin prevents cataract in experimental animals. Complete establishment of the significance of these observations applicable to the human subject remain to be determined.

Milk from animals affected with mastitis shows no significant difference in composition in comparison with normal milk when the milk is of normal appearance.

Seventy-six percent of the soluble protein fraction of milk is reported to consist of an albumin-globulin complex and the remaining twenty-four percent contains proteoses, peptones, certain amino acids, and urea. The amount of cystine and methionine contained in casein and lactalbumin has been reported to be 0.37 and 3.2% respectively, whereas, lactalbumin contains 3.1 and 2.8% respectively. Even though the cystine content of casein is relatively low compared with that of lactalbumin, the relatively high methionine content of casein is reported to be converted by the body to cystine, hence it is concluded that casein and lactalbumin are of equivalent value as a source of this essential amino acid. The merits of casein, lactalbumin and other proteins for attaining nitrogen equilbrium in experimental animals have been rated on the basis of their dietary value as follows: lactalbumin, 100; serum protein, 80; casein, 73; and gliadin, 33.

The comparatively recent development of analytical methods for the direct determination of vitamin C has stimulated numerous investigations concerning this factor in milk. Normal fresh milk as secreted is reported to contain from 20 to 25 mgs. of vitamin C per liter. The evidence is conflicting concerning the degree of influence on the vitamin C content of milk caused by feed, pasteurization, and other processing procedures. Since the knowledge of the chemistry involving vitamin C as contained in milk is still in a confused and labile state, and since quantitative dietary requirements

are still undertermined, and since the practice of employing richer known sources of this factor in the dietary is quite firmly established, the immediate significance of current researches involving the vitamin C content of milk is primarily of an academic character at the present time and the practical value of the more recent data, as a basis for fundamental changes in the usual feeding regimen and established processing methods, must wait further elucidation.

Direct application of physical and biophysical methods of study as applied to milk have resulted in the accumulation of fragmentary data relating directly to the phenomena of varying curd tension of milk, and certain prevalent off-flavors. Although certain factual relationships appear to have been fairly well established, their ultimate significance as a basis for influencing future methods and practices of the industry, are still problematical; this is particularly true in reference to the studies pertaining to soft curd milk.

The term "soft curd milk" empirically defines those milks which yield, under stated conditions of testing, a coagulum relatively soft or less tough and tenacious than other milks yield under similar test conditions. It has been determined that this property of curd character is not a constant property of the milk of the same cow. Nevertheless exhaustive studies have been carried out which show that the general average character of the curd or coagulum of the milk from different breeds show relative and consistent differences. The relative "softness" of the coagulum of average milk from the different breeds is reported to be, in descending order, as follows: Jersey, Guernsey, Ayrshire, and Holstein. Various explanations are offered for the differences in the curd tension observed. The available data appear to involve the following; a specific phospholipid-protein complex or balance; changes or variations in the capacity of the casein of the milk to absorb lecithin; variations in the casein and calcium content and ratio; the existence of varying proportions and effectiveness of the protective colloids of milk, especially the lactalbumin and globulin. Notwithstanding the exhaustive studies already reported and in progress, and their unknown potential value from the standpoint of improving and controlling the nutritive properties of milk, it is to be recalled that many of the established procedures for the modification of milk for infant feeding and special dietary purposes bring about a soft curd equivalent to or greater than that secreted directly by the cow, and many, if not all, of the practices inherent in the production of the established processed milks, such as evaporated, condensed and dried, contribute to a low curd tension of such products.

Off-flavors of milk while not necessarily directly affecting food value, nevertheless have a direct affect upon consumption. A recent survey indicates that twenty-one percent of the samples of fluid milk offered for distribution are at one time or another affected with the characteristic cappy or oxidized flavor. This condition seems to have been more prevalent during recent years, and some authorities have endeavored to correlate this increase in prevalency with the concurrent improvement in bacterial quality, improved refrigeration and transportation facilities. Irrespective of the validity of this deduction, it seems to be well established that the condition is not coincident with high bacteria count milk, in fact, the condition generally appears in milk of low bacteria count. The flavor is developed in the milk of different cows and is largely prevented or eliminated during the period of pasture feeding and accentuated during the period of stall feeding. Processing practices such as homogenization, agitation, low temperature storage, and extended low temperature storage periods accentuate the defect; the presence of minor amounts of copper contamination intensifies its appearance. The natural or synthetic vitamin C fed to cows is reported to have eliminated or reduced the probability of its appearance in the milk of such cows. Contamination of milk by iron accentuates the defect, but iron is reported to be only about 1/50 as effective as copper; ferrous iron is reported to be more objectionable than ferric iron. Pasteurization at 145°F. is without influence, other things being equal, in suppressing

or eliminating the difficulty. It is reported that heating milk to 170°F. inactivates a milk enzyme believed to contribute to the development of the flavor, but it is reported that if copper contamination is present, the 170° temperature accentuates the undesirable effect of the copper. On the whole, no adequate and universally accepted explanation of the cause and remedy of the difficulty has been advanced as yet. Recent data involving a study of the oxidation-reduction potentials is significant, particularly since milk is essentially a physical-chemical system. It has long been apparent to many milk technologists that the many problems at hand in different branches of the industry can not be adequately studied and understood on the basis of the analytical, physical or biological approach only.

During recent years there has been a continuation of studies designed to compare the effect of various physical treatments on the chemical, physical and biological properties of milk. Not many years ago these comparative studies were directed primarily to the processed milks. It is somewhat surprising to now find that many studies are being directed to a clinical comparison of raw milk versus sterilized or pasteurized milk. Those familiar with the technical developments within the industry during the past two to three decades will appreciate the mass of data which accumulated to show differences in the bacteriologic character of raw and pasteurized milk. In view of the present trend toward comparison of nutritive values, it may be that we are on the threshold of a period when the whole question of the merits of pasteurized versus raw milk may be re-opened from the standpoint of technical comparison and clinical study in an effort to prove by such means differences in the two products from a nutritive point of view. Recent reports record the following observations; seven generations of white rats were raised on raw milk, whereas it was impossible to rear the second and third generations on sterilized milk or sterilized milk which had been stored for appreciable periods. More calcium was deposited in the bones of the rats receiving the raw milk. Comparing pasteurized milk with raw milk, no difference was observed in calcium and phosphorus retention or in the red blood cell count. Other investigators report a greater retention of calcium and phosphorus from the use of boiled milk than from raw milk, whereas, still others report no difference in calcium and phosphorus retention between boiled milk and pasteurized milk. When using calves as the experimental subject, a recent report shows no significant difference in nitrogen, phosphorus and calcium retention resulting from the use of pasteurized or raw milk.

The chemistry of vitamin C as contained in milk presents an intriguing problem in both pasteurized and raw milk. Two somewhat different hypotheses have been recently reported. One investigator states that pasteurization at 140°F. destroys the reversibly oxidized vitamin C content of milk but does not affect the reduced vitamin C which is the form of the vitamin contained in fresh milk as it is secreted. The amount of the reversibly oxidized vitamin destroyed by pasteurization in the absence of catalysts is stated to depend upon the previous exposure of the milk to light. It is stated that under the action of light the natural reduced vitamin C of milk undergoes reversible oxidation. Another investigator states that the destruction of vitamin C in pasteurized milk can be entirely prevented and that milk held at 145°F. for one hour may potentially contain more vitamin C at the end of three days than the same raw milk held in the cold for the same length of time. It is also implied that oxidation *per se* plays but a negligible part in the destruction of the vitamin C of pasteurized milk.

Notwithstanding slight or marginal differences in specific matters of a nutritional character applicable to raw or pasteurized milk, which might be shown under particular experimental procedures, it would seem that such differences even though unanimously favoring raw milk, could not and should not outweigh the favorable evidence in support of pasteurized milk. It is of greater moment that the proven nutritive attributes of milk be maintained free from infectious disease

by way of pasteurization, than it is to risk the greater possibility of such infection by the way of raw milk for the meager and questionable gain of marginal and disputed superiority of raw milk.

Probably a greater abundance of clinical literature pertaining directly to milk during recent years is based upon clinical studies of the vitamin D milk than any other subject. Clinical methods cannot be properly classified as an organized science such as chemistry or physics. Nevertheless, clinical methods and reports are accepted by some as the last and necessary recourse for evidence of soundness and validity in support of laboratory findings of an analytical character or the deductions from experimentation with laboratory animals. Lactose is reported to have a favorable effect on calcium and phosphorus retention; beta type lactose has been reported as a very effective hydrating agent for use immediately after birth and in the prevention of loss in birth weight. Milk of low curd tension is being sponsored as a digestive aid; evaporated milk is reported as a valuable dietary adjunct in post-operative cases; alkalized powdered milk tablets are reported to be advantageous in the treatment of peptic ulcer; malted and chocolate milk preparations are advocated as dietary supplements for anorexia and loss of appetite in children. Extended clinical observations by one pediatrician lead to the conclusion that, given a good cow's milk formula under sanitary conditions, the ultimate results may, by all standards, be as satisfactory as those obtained by breast feeding.

Concepts of nutrition appear in the discussions relative to adequate versus optimum diets. It has been customary in many instances to consider an "adequate" diet as the desired end to be attained. Possibly the adequate diet conception has been carried over from the biological laboratory to the layman wherein the criterion for appraising and determining an adequate diet has been a given average growth response of the experimental animals under controlled feeding conditions. The implication of an "optimum" diet is of equal or greater significance particularly from the standpoint of emphasizing the evidence which shows that an adequate diet can readily be converted to an optimum diet by the introduction of a greater proportion of milk. On the basis of extended experimental data, one authority claims the attainment of a ten percent increase in longevity of experimental animals receiving the optimum diet with increased proportions of milk in contradistinction to the adequate diet containing less milk. This nutritional principle as transposed to the human subject would mean an average increase of seven years in length of life and longer retention of the full adult capacities.

Milk as a source of calcium and phosphorus in readily assimilable form has been advocated for many years. The specific and general interest in these dietary components of milk received new impetus with the advent of vitamin D milk and the process of irradiation for imparting greater vitamin D potency to fluid milk. The production and distribution of vitamin D milk now appears to be an established procedure within the industry. Notwithstanding the fact that the principle of irradiation was discovered twelve years ago and the irradiation of milk reduced to practice on a commercial scale was first started over ten years ago, and abundance of clinical literature concerning irradiated milk did not begin to appear in this country until about 1931; similar clinical reports concerning the vitamin D milk prepared by methods other than irradiation soon followed. A review of the existing literature relating to the efficacy of one variety of vitamin D milk in contradistinction to another is not within the scope of this report. Various clinical reports have been contradictory in their respective attempts to show in precise fashion superiority of one variety of vitamin D in contradistinction to another; all such reports however have been unanimous in presenting proof and case histories showing that vitamin D milk of appropriate quality and character is markedly effective in the prevention of rickets in a very great majority of the cases, and that an effective cure of the condition can be brought about in most instances whereas, rickets as manifested in its various forms is highly prevalent

in the absence of vitamin D milk or without the use of antirachitic agents available by way of pharmaceuticals. Even though clinical studies are being continued and detailed reports frequently appear, such evidence will presumably serve primarily as additional confirmation of the inherent nutritive character of vitamin D milk. In the absence of firm conclusions in the support of vitamin D milk of stated and standard potency in contradistinction of other vitamin D milks of different stated potencies, it appears that the industry, the public and regulatory officials will adequately safeguard and assure a proper potency of such milk which will be in conformity with the fundamental available clinical evidence. Numerical potency designation in terms of empirical laboratory units has been confusing to the physician and consuming public.

In concluding this report attention is directed to the character of current literature and technical activities as briefly touched upon in the preceding comments. Without prejudice toward any phase of milk technology, one is impressed with the predominance of technical activities having a direct or indirect bearing upon the food value and nutritive properties of milk and its various constituents. This situation is to be contrasted with the charcater of the technical literature pertaining to milk prevalent about twenty or more years ago when bacteriological and sanitary considerations were uppermost in the minds of the technologists; and further, the present trend of technical activity is to be contrasted with the predominating thoughts of the technologist of some forty years ago when the detection and prevention of adulteration of milk was uppermost in the minds of those concerned with the technical aspect of the industry. Present emphasis upon the nutritive aspects of milk undoubtedly had its beginning with the discovery of the vitamins about 1910. Decline in interest and technical activity pertaining to the nutritive aspects of milk does not appear to be in sight; on the contrary, nutritional problems are constantly increasing in scope and the application and adaptation of biophysical methods, particularly as applied to milk and its various derivatives, promises interesting results particularly from the standpoint of the actual mechanics involved in nourishing the single cell as well as the complex specialized organism. The basic character of milk comprising an ensemble of physically balanced entities will undoubtedly prove to be a valuable base material for the further extension of our knowledge in the direction now indicated.

Chairman: G. C. SUPPLEE
MARIETTA EICHELBERGER
I. V. HISCOCK
J. B. HOLLINGSWORTH
J. H. SHRADER
J. A. TOBEY
A. R. WARD

## Wisconsin Adopts Area Testing for Bang's Disease

A BANG'S disease area-test bill adopted by the Wisconsin legislature was signed by Governor LaFollette at the close of the 1937 session. The bill provides for area testing of all cattle in a county after 75 per cent or more of the herd-owners in such county have petitioned the Department of Agriculture and Markets for such a test. Cattle condemned under the area test will be disposed of and the herd owner will receive both state and federal indemnity, in addition to net meat salvage.

Wisconsin, as one of the principal dairy and cattle-raising and exporting states, has been very active in testing for Bang's disease for several years. Other states which provide a state indemnity in addition to the federal indemnity include, among others, Maine, New Hampshire, New York, Pennsylvania and Virginia.

# The Resazurin Test—Preliminary Studies on Its Practicalities and Possibilities *

**J. A. Keenan, W. D. Barrett and H. Rutan**

*Whiting Milk Company, Boston, Massachusetts*

IN the spring of this year, the resazurin test was adopted as an integral part of our raw milk quality control program. It is the purpose of this paper to discuss data incident to the adoption of this test, as well as primary observations on certain problems suggested as a result of its introduction.

No attempt has been made to repeat or duplicate all of Ramsdell's (1) comparative work, but instead the investigation has been directed toward the determination of whether or not the resazurin test is consistent from a purely practical standpoint. The main theorem was a determination of whether one obtained as much information as to the quality of milk from a one-hour incubation period with resazurin as from a 5-to-7 hour period with methylene blue.

*Results shown in Table I.*

These tests were practiced under spring and summer conditions and on individual producers' milk of various breeds and from different localities. No tests have been conducted on tank car samples. All samples were incubated in an insulated water bath and read as quickly as possible after incubation. The various color shades formed by the resazurin tubes in progressive reduction were differentiated without the aid of standard color tubes. This was due to our inability to simulate the spring color conditions of milk with the standard colors, as well as the inability of the standard colors to remain in stable suspension. Of the samples that did not decolorize resazurin, 94.5% were incapable of reducing methylene blue in seven hours or more, but 1.6% reduced methylene blue in less than 5 hours. The cause of this, as ascertained by microscopic diagnosis of duplicate samples, was the paired diplococci associated with poor cooling. This will be discussed later. Progression

TABLE I

*Comparison of color of resazurin dye at the end of one hour with reduction time of methylene blue*

| *No. of Samples* | *Color of resazurin after on hour* | *Reduction time of methylene blue* | | | |
|---|---|---|---|---|---|
| | | *7 hrs.* | *6 hrs.* | *5 hrs.* | *Less than 4 hrs.* |
| 416 | Blue | 94.5% | 2.5% | 1.6% | 1.6% |
| 112 | Purple Pink | 69.0% | 10.0% | 3.2% | 17.8% |
| 99 | Slight Pink | 83.0% | 9.4% | 3.0% | 4.6% |
| 154 | Pink | 5.0% | 4.0% | 22.0% | 69.0% |
| 163 | Vivid Pink | 13.0% | 19.2% | 21.0% | 46.8% |
| 200 | White | | | 6.0% | 94.0% |

* Read before the International Association of Milk Sanitarians at the 26th Annual Meeting in Louisville, Ky., Oct. 11-13, 1937.

from the purple pink to the white shades, indicating greater reduction of resazurin, is not reflected comparably with decreased reduction time of methylene blue. Samples causing complete reduction of resazurin to white will reduce the methylene blue in five hours or less. The cause of the discrepancy in correlation of resazurin colors intermediate between blue and white may be due to two reasons. First of all, individual operators experience difficulty in clearly differentiating the half-tone colors; second, and by far the most important, is the sensitivity of resazurin to factors other than bacteria count, namely high leucocyte milk, mastitis infected milk and milk from newly freshened cows. The latter is demonstrated by microscopic diagnosis of the same original samples that were incubated with resazurin and methylene blue. *Table II.*

One hundred sixty-three samples were vivid pink at the end of the hour, 21 of which had a bacteria count of less than 25,000 but a leucocyte count of more than 700,000 per cc. These samples did not reduce methylene blue at seven hours incubation. With leucocyte counts of over 2 million, the reduction time of methylene blue was also shortened but not to an equivalent extent. The bacteria counts presented in this table were substantiated through standard plate counts on split samples.

The fact that resazurin is sensitive to leucocytes has been previously demonstrated (1) but is reiterated here to substantiate the contention that the main reason for the inability of this dye to correlate with previously known standards (methylene blue, Breed microscopic, and standard plate) is due to its extreme sensitivity. Resazurin is, then, greatly influenced by the number of organisms in the milk as well as by high leucocytes, as may be found in mastitis milk and in milk from newly freshened cows. Because of this, and until further knowledge is gained, the microscopic diagnosis of all samples demonstrating partial or complete reduction is recommended. Such procedure will help eliminate causes for variation in the test attributable to differences in naming the various colors formed.

In many laboratories, microscopic examination of individual producers' milk constitutes a great portion of the time spent in laboratory control. A preliminary test which would be sensitive enough to segregate those milks which are satisfactory from those which are not would place emphasis on poor quality milks and also save a considerable amount of time. The possibility of resazurin fulfilling this function was therefore, investigated. All producers' samples were incubated with resazurin for one hour. At the end of this period the samples were examined and Breed smears were made directly from those tubes in which the dye was partially or completely reduced. The practical application of this procedure is demonstrated in Table III, a duplicate of a test sheet from one of our country stations.

TABLE II

*Correlation between colors developed after one hour of incubation with resazurin and Breed miscroscopic count.*

| *No. of Samples* | *Color of resazurin after one hour* | *Breed Microscopic Count* | | | | |
|---|---|---|---|---|---|---|
| | | 25,000 | 25,000—50,000 | 50,000—100,000 | 100,000—200,000 | Over 200,000 |
| 416 | Blue | 344 | 31 | 35 | 6 | — |
| 112 | Purple Pink | — | 87 | 18 | 7 | — |
| 99 | Slight Pink | — | 73 | 15 | 6 | 5 |
| 154 | Pink | — | 112 | 16 | 18 | 8 |
| 163 | Vivid Pink | 21(*) | 19 | 99 | 12 | 12 |
| 200 | White | — | — | — | 18 | 182 |

* These samples had a leucocyte count of more than 700,000 per cc.

TABLE III

| *Producer Number* | *Color of resazurin after one hour incubation* | *Microscopic Diagnosis* | *Remarks* |
|---|---|---|---|
| 5 | Slight Pink | 120,000 bact. per cc. | Utensil bacteria |
| 8 | Vivid Pink | 900,000 bact. per cc. | Utensil and lactic bacteria types |
| 14 | White | Uncountable | Spore formers and lactics. Check immediately. |
| 20 | Purple Pink | 25,000 bact. per cc.<br>1,500,000 leuco. per cc. | ——— |
| 21 | Purple Pink | 50,000 bact. per cc. | Utensil and lactics |
| 38 | Pink | 25,000 bact. per cc.<br>4,000,00 leuco. per cc. | Mononuclear types<br>Hold out milk from fresh cows. |
| 59 | Vivid Pink | Mastitis | Reject milk until cleared up. Check herd. |
| 62 | Purple Pink | 250,000 bact. per cc. | Utensil and lactics |
| 70 | Purple Pink | O. K. | ——— |
| 76 | White | Uncountable | External contamination combined with dirty utensils and poor cooling. Check immediately |
| 80 | Purple Pink | 30,000 bact. per cc. | Staphylococci. Check milking machine in particular. Examine herd |
| 87 | Purple Pink | O. K. | ——— |
| 90 | Pink | O. K. | ——— |
| 96 | Vivid Pink | 600,000 bact. per cc.<br>3,000,000 leuco. per cc. | Lactics. Check herd |

This table represents the number of samples examined out of 100 producer samples taken. As will be observed, the time saved through this procedure is equivalent to the time necessary to smear, read and clean up 86 samples.

In most cases where there was a color change, as in the above table, poor quality was verified by the microscope. Occasionally samples will change to a purplish pink and may even turn pink, yet under the microscope no abnormality is observed. The cause of this has not as yet been determined. Previous investigators (1) state that the resazurin dye is sensitive to the catalase and chloride content of milk and these factors may be responsible. Conversely, during the particularly warm weather of this past summer, microscopic examination of all producers' samples indicated that in a few isolated cases paired diplococci, as a result of poor cooling, were not reducing the dye. This may be due to bacterial habitat or some unknown anti-reductase effect, but suffice it to say that if samples harboring such types are kept overnight at chest temperatures, or even 4 to 5 hours, and then incubated they will reduce the dye. Further investigations along this line are in progress.

The combined resazurin-microscopic diagnosis of producer samples is the only procedure on milk under which the dye is now being used by our laboratories. This method has reduced materially the time formerly spent on segregated methylene blue and microscopic examinations. It is not, however, to be implied that the saving in time was of paramount importance, for quality control instruments cannot be measured in this category, but rather that such time saved can be spent in more frequent diagnosis of poor milks.

A comprehensive study on resazurin as an indicator of the quality of incoming pasteurized cream has just been completed by Jenkins (2). Good correlations between reduction time of resazurin and methylene blue are reported, due undoubtedly, to the elimination of the leucocyte sensitivity of resazurin. Through the courtesy of this investigator a typical test sheet is presented.

TABLE IV

*The reduction time of resazurin as compared to methylene blue on pasteurized cream samples.*

| Product | Resazurin Pink | Resazurin White | Methylene Blue | Standard Plate Count | Acid |
|---|---|---|---|---|---|
| 1 | 1 | 2 | 2 | 215,000 | .10 |
| 2 | 4 | 4½ | 4½ | 500 | .105 |
| 3 | 6½ | 7 | 7 | 1,000 | .105 |
| 4 | 6½ | 7 | 7 | 8,000 | .10 |
| 5 | 1 | 3 | 3 | 200,000 | .10 |
| 6 | 2¼ | 4 | 4 | 90,000 | .10 |
| 7 | 2½ | 4 | 4 | 80,000 | .10 |
| 8 | 2 | 3 | 3 | 100,000 | .10 |

Tests on approximately 1,000 samples indicate that if the dye is not changed by the end of two hours, the pasteurized cream will have a plate count of less than 100,000 bacteria per cc. Preliminary investigations on this problem initiated in our laboratories, although approached from a different angle, indicate the validity of this statement.

The resazurin test because of its rapidity appeals to dairymen and has a favorable psychological effect on milk producers. The latter are willing to wait one hour and see for themselves, and are impressed enough by the color changes of their supply or that of their neighbors to be more interested in the quality of the milk and to make the necessary corrections.

## CONCLUSIONS

1. More information as to the sanitary quality of milk is obtained through one hour of incubation with resazurin than is obtained through six hours of incubation with methylene blue.
2. The resazurin test is more sensitive to physiologically abnormal and pathological milks than is methylene blue.
3. The resazurin test is a valuable adjunct to microscopic diagnosis in eliminating the time normally spent in diagnosis of good milks, thereby allowing more time for the detection of the source of the trouble with poor milks.
4. The practicality of this test as an indicator of the quality of incoming cream is indicated.

---

BIBLIOGRAPHY

1. Ramsdell, G. A., Johnson, Jr., W. T., and Evans, F. R.: "Investigation of Resazurin as an Indication of the Sanitary Condition of Milk." Journal of Dairy Science, November, 1935.
2. Jenkins, H.: Unpublished data.

# Progress of the Federal-State Cooperative Program for Controlling Bang's Disease

SUMMARY figures from the U. S. Bureau of Animal Industry records give results of agglutination blood tests made during the 37 months period from July 1, 1934 to July 31, 1937 during which time a program for the control of Bang's disease has been carried on by the Bureau in cooperation with the various states.

The figures given apply to the 48 states and to Porto Rico where a start has also been made. Altogether, agglutination blood tests have been completed in 1,363,182 herds comprising 18,589,151 cattle. Bang infection has been found in 335,157 herds or slightly less than 25 per cent of the total. In these infected herds, comprising 8,699,116 cattle, there have been found 1,262,872 reactors or about 15 per cent.

Under the program, reactors are sent to slaughter and owners are indemnified to the extent of Federal payment of $25.00 for grade animals and $50.00 for pure breds, in addition to the salvage value of the animal. Several states also pay additional indemnity to compensate owners of reacting cattle slaughtered under the program.

# Undulant Fever in Man, and Its Relation to Bang's Disease in Livestock *

**Dr. Gaylord W. Anderson §**

*Boston, Mas.*

MUCH misunderstanding exists as to the attitude of health departments with reference to contagious abortion. This misunderstanding has created a great amount of emotional disturbance about the subject of contagious abortion and its relation to undulant fever. It is well, therefore, to look at the facts. We are all familiar with most of the details as to the spread of these diseases. I would like merely to point out one or two of the most significant facts before going on to the discussion as to the health officer's point of view on this matter.

Without any danger of contradiction, I can say that we are in possession of more evidence of a strictly scientific nature to show the relationship between contagious abortion in cattle and undulant fever of man, than we have as to the relationship of typhoid fever and the drinking of a polluted water supply. We are equally in possession of more scientific data regarding the relationship of undulant fever to infected milk supplies than we are to the relationship of typhoid to either milk or to water.

Specifically, what do we know? In the first place, we know the organism that causes the disease in cattle or in swine. We have means of testing for the presence of infection in those animals. We have been able to demonstrate that this organism can be passed over into the milk of infected cattle. We have been able to demonstrate the existence of the infection in human beings, and have been able to recover the organism from humans, specifically so infected. This is more than has been done for typhoid. One cannot go out and isolate the typhoid germs out of the water or milk supply even if infected. We must rely on indirect evidence as to the existence of this organism in these supplies.

I would not have anyone think that I believe that milk is the sole, or over the country as a whole, the most important medium for the transfer of this infection from animal to man. We recognize other modes of infection. There is overwhelming evidence as to the high number of cases of infection among those employed in slaughter houses or other occupations which bring them in intimate contact with animals that are frequently infected. It is unquestionably true that in certain groups in some localities where the disease has been contracted, both the clinical and sub-clinical types, there have been predominantly occupational cases, owning to the intimate exposure of the persons to infected animals.

We must, nevertheless, recognize the existence of the infection through the medium of raw milk. If there were no other evidence to prove this, we could still point out the almost classic experience in one of the insitutions in New York State. In this particular institution, with a "fancy herd," but infected with contagious abortion, clinically recognizable cases of undulant fever developed in the patients who had been confined to bed in the sanatorium—patients from New York City and from occupations such as could not have brought them into contact with infected animals.

Of course, the mere existence of these cases did not prove their infection through the medium of the raw milk in that in-

§ From the Massachusetts Department of Public Health.

* Read before the Bang's Disease Conference in Springfield, Mass., May 26, 1937.

stitution. There is no way of proving that they might not have been infected with the disease at the time of their admission, unlikely as this possibility may be. The herd was cleaned up and stayed clean for a year or more. During this time all of the new admissions to that particular hospital were tested for infection at the time of their admission, before they were put to bed. Therefore, they were known to be free of infection. Then out of a clear sky, cases of undulant fever developed among these persons who had not been infected on admission, and again the disease was found in the herd. In other words, this was a case of specific infection, contracted by persons spending their lives in bed, with no possibility of direct contact with infected animals, but exposed to infection through a proven infected raw milk supply.

Much of the confusion as to the role of milk as a vector of undulant fever is due to what I believe is a basic misunderstanding as to the epidemology, not only of this, but of other infectious diseases of humans. It has been claimed that milk could not be a vector of this disease because were it so, we would find infinitely more cases. With the large number of persons exposed to the infection, why do we have so few cases? There is nothing singular in this fact. It is true that there are only a few clinical cases, in spite of widespread exposure, but the incidence of a disease depends on many factors other than the chances of exposure. There are all gradations in the infectiousness of these diseases. Practically all susceptibles intimately exposed to measles and chicken pox will come down with it, yet in a disease such as meningococcus meningitis only an occasional person may contract the disease in spite of tremendous exposure. In an outbreak of typhoid fever from a water supply, it is rare that more than one per cent of those who drink the infected water are attacked. In an outbreak of typhoid from milk, ten or twenty-five per cent is usually quite a high rate, yet in an outbreak due to food infected by a typhoid carrier, as many as fifty per cent of those exposed may develop the disease.

There is thus nothing singular in the low attack rate of undulant fever. It probably lies in the fact that of all those exposed, the majority develop, not an acute attack of the disease, but a very mild immunizing infection, too slight to cause any definite symptoms or too slight to cause symptoms which will bring it to the attention of a physician.

We know from studies made of slaughter house groups that a substantial number of those examined show evidences of infection of undulant fever on blood test, but without clinical signs of the disease at any time. It is unquestionably this very capacity of the organism to cause a mild infection which immunizes rather than sickens, that explains in large part the apparently low reported rate. Whether or not different strains of *Brucella abortus* possess different capacities to cause human infection is a matter on which there may be reasonable doubt. There is considerable evidence to suggest that the so-called bovine strain appears to be more "immunizing," whereas the porcine strain is more likely to produce an acute attack of the disease, and yet I do not believe that this evidence is absolutely convincing. It holds out at least a very attractive hypothesis to explain why we have such a high infection rate among certain persons with a relatively low reported attack rate of the clinical forms of the disease.

A few years ago in a hospital in Massachusetts, using raw milk from its own infected herd, there were among its patients a high number of positive blood agglutination reactions, as contrasted with other hospitals which, not using similarly infected raw milk, showed a complete absence of such reactions. The mere pasteurization of that milk supply completely prevented further cases of these subclinical infections in the patients. Yet on blood test of persons not previously showing evidence of clinical infection there was every evidence that there had been a very high attack rate of the mild, unrecognized, symptom-free infection.

It has also been argued that there is a relative immunity of children, who drink

more milk than does any other age group of the population. Of this immunity, I am not so certain. It is true that there are fewer cases recognized and reported among children, but whether or not it is in the capacity of the children to become immunized through sub-clinical infections rather than develop the disease, I do not know. Other diseases show similar peculiarities in age distribution, so that that apparent anomaly in the age distribution cannot be considered as an inconsistency, but rather as one of the peculiarities of the disease that must await elucidation.

In looking at undulant fever from the point of view of the health officer, we can therefore accept the fact that we are dealing with a disease which is not widespread in its clinical manifestations, but which mercifully, immunizes more than it sickens. Its severe forms are, however, severe enough and of sufficient frequence to warrant the attention that is given to it as a public health problem.

The position in which the health officer finds himself is probably very comparable to that in which a steamboat inspector would find himself if he permitted a ship to sail out of port, stripped of the lifeboats, the life preservers, and other safeguards. That ship would probably reach port under these conditions. If a person were to embark on the New York-Boston boat, he would probably reach his destination without recourse to the lifesaving devices. Yet, the experience of a steamboat inspector has been such as to show him that occasionally the ship does not make port without recourse to its lifesaving devices. Each person, as potential passengers on that ship, would wonder as to the faithfulness with which that inspector had performed his duies if he did not do everything reasonable, within the limits of his power, to guarantee to the passengers on that ship that they were protected.

Such is the position of the health officer with respect to the problem presented by undulant fever. The cases of clinically recognized undulant fever may be rare, and yet the health officer knows from his past experience that such cases do occur, and that such cases can be prevented through certain procedures. I would, I think, be open to the most severe sort of criticism if, as a health official of the Commonwealth, I failed to urge and apply those measures which experience shows may bring about such a protection.

Now, what are these measures? Unfortunately, it has sometimes been thought that economics and public health conflicted. I do not believe that they do; I firmly believe that they go hand in hand. The protection of our public water supplies came about basically, not because of public health, but because of economic consideration that made it important to have running water. And, so in the milk industry, public protection and good business are so interrelated that they are inseparable.

We know of several attempts that have been made to solve this problem of undulant fever. I hope it is true that by testing and slaughtering, we can eliminate the disease from cattle, for if we can eliminate it from cattle, the problem as to humans is solved insofar as milk is concerned. Yet every time I hear of a testing and slaughtering program, I am put in mind of the long distance telephone call that came to the Department some five years ago from the western part of the State. The manager of a certified milk dairy called to report that they had an abortion-free herd. "That's fine," we said, "but why did you telephone us?" "Well," he replied, "we thought if we wrote you a letter, by the time it got there, the herd might not still be free."

Can the infection in cattle be controlled through vaccination? I do not know. We all have very profound hopes in that direction. We know of much evidence that is very encouraging, but this much I think we do know. If we are going to control the disease through that means. we must have evidence that, from the point of view of the milk-consuming public, the procedure is absolutely safe.

We have been able, for many years, to prevent certain human diseases but have failed to do so because of the risk of the methods. As long ago as 1920, we could probably have prevented infantile paralysis through an immunizing procedure, but the method was not safe, as an occa-

sional test animal developed the infection. The rest were immunized, but an immunizing agent that gives the disease to some of those whom we are attempting to protect cannot be used on human beings in the prevention of so rare a disease as infantile paralysis.

Whether or not immunization of the cattle against contagious abortion is safe from the point of view of the human may remain to be determined. I believe there is sufficient evidence, both in this country and abroad, to indicate, that the use of these vaccines on the adult animal is attended with certain dangers that the health officer cannot ignore. Experience in America and Europe has shown that the use of these vaccines on lactating animals has in too many instances resulted in passing of these organisms over into the milk and the consequent infection of humans.

The fact that these vaccines are supposedly attenuated for cattle is of no significance so far as concerns their risk to human beings drinking the milk from these cows. We can attenuate an organisms for other animals, without attenuating it for man, and vice versa. In some instances, organisms can actually be increased in virulence by passage through other animals. We have not sufficient evidence to show that the use of the vaccines on the adult animals is sufficiently safe so that it can be recommended, unless we take additional precaution as to the disposal of the milk from the animals. If that milk is so protected through pasteurization as to guarantee the human using the milk against possible infection, I believe as health officers, we can encourage you in the use of these vaccines. But, when it comes to the use of the vaccine in adult animals, knowing full well that the milk from these herds is going to be used raw, I sincerely believe that the health officer cannot, with his eyes open to the facts, approve of this practice but can only say that it is attended with a danger to which the public should not be exposed.

When we come to the Federal experimental program of vaccination of the unbred animal in the first few months of life, we are dealing with a problem that appears to me to be quite different. No one knows whether or not this organism can stay around the body of the animal and be later transmitted through milk. We have no evidence to suggest it. All the evidence we have would point to the contrary, but of course, negative evidence is always harder to interpret than positive evidence. Such as there is would lead us to believe at the present time, that we may be dealing with a means of control that meets both the demands of the dairy industry and the demands of the public. I would agree with you that probably the vaccination of the adult animal meets the demands of the dairy industry, but it does not meet the demands of the public. To insist upon the pasteurization of every single drop of milk in every community might meet the needs of the public, but not the demands of the dairy industry when we are dealing with the extremely small rural community where pasteurization would be impractical.

So, we must be reasonable. We must consider the demands of the dairy industry and the needs of the public, and neither one ought to make itself so noisy or so intolerant as to overlook the problems and demands of the other. When these two objectives can be met satisfactorily through the same procedure, we have at that time the ideal solution to this problem. I profoundly hope that through either the procedure of slaughter or through vaccination of young, unbred cattle, we may have the solution. The method used is not so important from the point of view of the public as is the fact that it works and is not attended with a hazard to the milk-consuming public.

When that is accomplished, then we shall be able to forget the differences that may have existed in the past. Let us as health officers, be tolerant of the point of view of the representatives of the dairy industry, recogniizng that it has problems just as well as the control officials have—and each should be equally tolerant of the point of view of the other. The responsibility of the health officer is to apply those measures which experience teaches him are essential and are practical in protecting the public health.

# Which Test Gives the Most Accurate Fat Determination for Ice Cream?

**Forrest C. Button**
*Professor Dairy Manufactures*
*Rutgers University*

MILK control has come to the ice cream industry. Most states and progressive municipalities have set up standards and regulations to insure the consumer a safe and wholesome ice cream. These standards and regulations are either identical with or closely patterned after those which have successfully improved the qualiy of milk. This conformity to existing policies was to be expected because man has always drawn on satisfactory experience to chart his future course. The various routine and specialized procedures for estimating the bacterial quality of milk can be readily applied to ice cream. When it comes, however, to the testing of ice cream for fat and solids, considerable difficulty has been experienced in using the procedures now commonly employed in testing milk.

Most public health laboratories are adequately equipped for bacteriological analyses and for fat testing with the Babcock or Gerber tests. Few of these laboratories are equipped for chemical, gravimetric determinations of fats in foods. Many technicians who are now called upon to make fat analyses of ice cream samples either labor under a false security in believing that the various modified tests for ice cream are accurate or else they are disturbed by the profusion of such tests and the lack of definite specifications as to procedures in official standards and regulations.

Two phases of ice cream manufacture contribute most to the difficulties arising in using the modified tests for fat determination. The addition of cane sugar, and the homogenization of the basic mix make complete separation of the fat impossible by any simple test. The preparation of tests of fruit and nut ice cream often requires straining of the melted mix to remove seeds and other solid particles or careful pipetting is required so as not to incorporate these particles into the test charge.

Whenever chocolate and cocoa are added to ice cream an accurate fat analysis becomes more difficult to obtain than when any other ice cream is tested. To date those authors who feel they have found accurate modified fat tests for a basic mix usually state that the procedure can not be readily applied to chocolate ice cream.

Considerable study has been given to the testing of ice cream or fat in an effort to overcome these difficulties. Many methods have been devised and published at intervals in scientific journals and experiment station bulletins. In the hands of the authors or trained operators these tests have met with a fair degree of accuracy. They may be classified as (a) Ether extraction tests (b) Modified Babcock or similar tests using acids as reagents and (c) Modified tests using non-acid reagents.

The ether extraction test is used for most accurate analysis of dairy products. It is known as the Roese-Gottlieb procedure and is most commonly found in adapted form as the Mojonnier Test. This test is accurate but requires expensive equipment and is time consuming. Small plants and control laboratories often do not have the equipment or the trained workers for this procedure. Yet it seems this test is the only one that will meet with official sanction or stand in

court, to use the parlance of the sanitary inspector.

The simple acid tests such as the Babcock and Gerber (Fucoma) will not readily recover all the fat in a well homogenized ice cream mix. When sulphuric acid alone is employed the sugar chars and the charred material prevents complete fat separation. Indistinct fat columns result when too much or too little acid is used in any attempt to overcome this charring tendency. Tests have also been proposed employing such acids as acetic, hydrochloric and nitric alone or in combination with sulphuric.

More recently tests making use of concentrated salt solutions and alcohols have been developed in the the non-acid group. In these procedures the fat is aided in its liberation by setting the bottles in a water bath for 10 to 30 minutes at temperatures near the boiling point after the reagents have been added to the weighed samples.

Modifications attracting the most recent attention are those known as the Overman and Garrett or Illinois Test (1), the Crowe or Nebraska Test (2), the Minnesota Test published by Petersen and Herried (3) and recently revised by Thurston and Brown (4), and the Kniaseff test (5).

These tests usually give clear fat columns and this point alone has led many laboratory workers to conclude that these particular methods are absolutely accurate.

The author of each new test or modification feels he has reliably overcome the inaccuracies he has found in other procedures. There is still no agreement on the part of scientific workers as to the reliability of any of the modified fat tests for ice cream. Many committees of scientific associations and commercial dairy organizations have failed to agree upon a single test. In the hands of different workers none of the tests seem to give consistently accurate results. After several years of investigation the Association of Official Agricultural Chemists in 1936 reported (6) "It now appears that none of the numerous modifications of the Babcock fat test is applicable to a determination of fat in ice cream in the hands of different operators. It is therefore recommended that study of such modifications be discontinued." Others feel that standardization of reagents, care in preventing deterioration of solutions and greater familiarity of technicians with specific procedures will tend to narrow existing differences. All will agree that much progress has been made in meeting the difficulties encountered in the past in testing ice cream. Definite agreement should be arrived at by all workers in the fields of dairy research, manufacture, and control as to what methods or correction factors shall be recognized as standard. If the simpler modified tests can not be used, then public health workers in particular want to be informed so they may have their laboratories properly equipped with suitable testing installations to enable them to employ the more elaborate procedures for the determination of fat in ice cream.

## REFERENCES

1. Overman, O. R. and Garret, O. F.
1930 A Non-Acid Babcock Method for Determining Fat in Ice Cream. University of Ill. Agric. Exp. Sta. Bul. 360.

2. Crowe, L. R.
1930 Testing Ice Cream for Butter Fat. Neb. Agric. Exp. Sta. Bul. 246.

3. Petersen, W. E. and Herried, E. O.
1929 Minnesota Agric. Exp. Sta. Tech Bul. 63 Applying to Ice Cream and Minnesota Babcock Butterfat Test.

4. Thurston and Brown
1937 Ice Cream Field 30, 4, p. 8, Feb. 1937.

5. Kniaseff,
1934 Ice Cream Trade Journal, 30, No. 12, p. 29 (1934). See also Ibid, 32, No. 11, p. 19 (1936).

6. Report on the Analysis (Fat) of Ice
1936 Cream. Journal Assoc. of Official Agr. Chemists.

# Raising Calves on Wire Floors

*(Abstract of Circular 372, issued May 1937, by N. J. Agricultural Experiment Station, New Brunswick, N. J.)*

THE authors, J. W. Bartlett and H. H. Tucker, point out that poultrymen have been using wire floors for some time with much success, and it is from the poultry industry that the idea of wire floors has been taken and is now being used in the dairy industry. Wire floors made of sufficiently rigid material may be used at some later time for cow stalls; at present, these have been used only for calf floors.

A dairyman in New Jersey has used wire floors in his calf barn for two years and has obtained good results in health and growth of calves. These wire floors are used over the entire area of the individual calf pens, thereby allowing the same exercise of the calf as when confined in a regulation pen.

The New Jersey Agricultral Experiment Station was not in a position to remodel its calf barn and, realizing that most farmers were in the same position, decided to adapt this principle in a way which could be used in almost any dairy barn. This was accomplished by construction frames on which wire floors were fastened. The wire used was ¾ inch mesh wire cloth made from No. 11 wire, galvanized after weaving. Galvanizing is a great factor in protecting and prolonging the life of the wire.

The frames were constructed of 4" x 4" material to give strength. They were made 4 feet wide to correspond with one of the usual widths of wire cloth, and approximately 5 feet long, so that they would not be too heavy to handle and could be easily removed for cleaning. The frames were mortised at each corner to give a rigid construction and were placed on four legs, 6 inches high and made from the same 4" x 4" material. The wire was stapled securely to the tops of the frames after No. 9 wire had been stretche d over them. This No. 9 wire was used to strengthen the floor and to help carry the load to be put on the wire floors. Heavy woven wire fence 4 feet in height may be used for this purpose, but No. 9 wire stretched individually at distances of 4 or 5 inches over the frame in both directions would be preferable. Calves weighing up to 300 pounds did not sag the wire seriously.

After the wire had been securely fastened a 2" x 4" was placed on edge along each of two sides of the frame to aid in holding the bedding on the frames. These 4" x 4" frames, 6-inch legs, and 2" x 4" side rails were then bolted securely together by ½" x 14" bolts at each corner. A 12" bolt could be used by countersinking the head of the bolt 2 inches into the leg of the frame.

The frames when completed were placed end to end along a panel or wall where the calves were tied. Long straw, swamp hay, or similar bedding was used on the wire to a depth of 3 or 4 inches and made an ideal bed. Water drained through and drained into a gutter so that the bedding was always dry and warm. The fact that these frames were held up 6 inches from the floor permitted ventilation under the frame. This further aided in keeping the beds dry and warm and facilitated in sweeping out any bedding which may have sifted through the wire floors. In this way, drainage was not hindered and water ran readily into the gutters.

Since the bedding did not become wet, it was unnecessary to change it as otherwise. It was necessary to change it only once every 7 to 14 days, depending upon the size of the calf. Calves on this floor lie down almost twice as much as calves on well-bedded, insulated concrete floors in adjoining pens.

Calves were fed milk from calf pails, which were equipped with rubber nipples about the size of a cow teat. Grain and hay were fed in galvanized pails.

Much room was saved by this method of raising calves. Twenty-five calves

may be tied on 90 feet of frames and will not appear crowded.

There was a further saving in bedding and labor costs. Calves raised under this method used only one-third to one-fourth as much bedding as when raised on solid floor. The type of wire used cost 19½c per square foot in rolls. When this was added to the cost of lumber, staples, and bolts, the total cost of materials was about $5.50 per five-foot frame. With baled straw at $14 per ton, the straw saved in six months will pay for the cost of materials, and the labor saved in this same time will more than pay for labor required for construction.

Other materials have been considered for constructing this type of floor, such as metal for frames and expanded sheet iron similar to wire lath or copper-bearing perforated sheet-iron for floors. Further savings and improvements may be made by the use of other materials or by wholesale manufacture.

These savings are very important but are relatively small when compared to the improved health, greater gains, and more rapid growth. The young calves are delicate and most of the troubles encountered in raising them are due directly or indirectly to unsanitary conditions. Cold, damp beds cause colds, pneumonia, and some types of scours. Damp bedding is an ideal place for development of bacteria which spread disease or reduce the calf's resistance to disease. It is particularly important to prevent such conditions, especially during the early part of the calf's life.

Wire floors are therefore a great help in obtaining the best conditions for growth and development.

(Pictures illustrating the construction and use of these calf bedding floors are contained in the circular which can be obtained by writing to the Director of the New Jersey Agricultural Experiment Station, New Brunswick, N. J.)

## Book Review

**The Legal Aspects of Milk Control.** —*By James A. Tobey. Chicago, 1936. International Association of Milk Dealers.* Pp. 102. Price $3.00.

The milk industry in its contacts with producers, health authorities, and the public has long felt the need of a compact and concise reference book outlining its legal responsibilities and its legal rights. Such a need has been filled in the publication of this notable work. It is written in language easily understood and should prove a valuable handbook for executives of the milk industry, health officials, attorneys, and all interested in or concerned with the sanitary control of milk and dairy products.

The author has digested 325 cases ranging from 1860 to the present time, as reported by the courts of forty-two states, the District of Columbia, the Federal Courts, and the United States Supreme Court.

An extremely valuable feature is the arrangement in which the various subjects from Reasons for Public Control of Milk, Sanitary Regulations, Municipal Control, Standards, etc. to Liability in connection with Dairy Products are discussed, and the court decisions applicable cited in or following the text.

The table of contents, the division of court decisions by states, as well as the bibliography and index, are complete and well arranged for easy reference.

In this valuable text the author has added an admirable work to his many other publications on milk, its products, and their relation to the public health.

S. J. S.

**Municipal and Rural Sanitation.**— *By V. M. Ehlers and E. W. Steel, McGraw-Hill Book Co., New York City.* 2nd Ed. 1937—477 pp. Price $3.50.

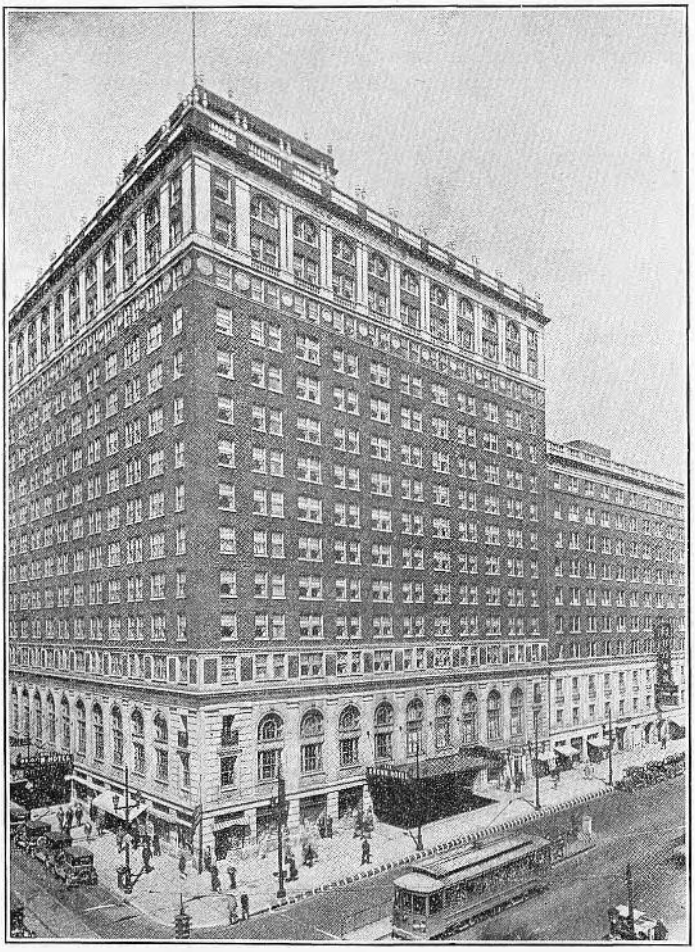
A revised edition of a comprehensive treatment of the various phases of public sanitation activities including, for example, chapters on tourist camps, swimming pools, food sanitation, refuse collection, rodent control, etc.

C. S. L.

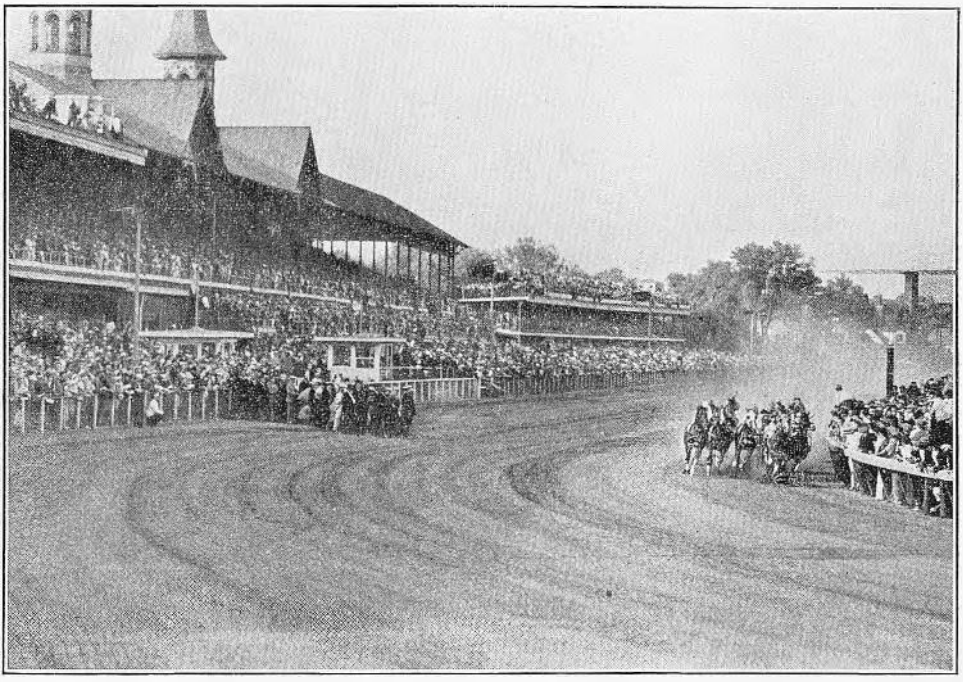
## Louisville, Ky., The Convention City

THE members and guests attending the Twenty-sixth Annual Meeting of the International Association of Milk Sanitarians at Louisville, Ky., October 11-13, 1937, will have opportunity not only to learn of the present-day status of their professions, participate in the meetings, fraternize with others in the same lines of endeavor, but will also have opportunity to visit many places of interest.

Louisville, a metropolis of Kentucky, with a population of approximately 340,000 persons, was chartered as a city in 1799 by the Virginia Legislature, when Kentucky was a part of that state. Romance, adventure, tradition and scenic beauty are some of the qualities which enter into the lure of Kentucky. A loop trip covering approximately a hundred and fifty miles on excellent roads takes the visitor to such places as the birthplace of Abraham Lincoln; "My Old Kentucky Home," where Stephen Collins wrote many of his melodies of the Southland; St. Joseph's Cathedral, where there is housed a million dollar art collection, the gift of King Louis Phillipe of France; the tomb of John Fitch, inventor of the steamboat, and other points of like interest. Mammoth Cave, one of the seven modern wonders of the world, the greatest subterranean spectacle known to man, is situated within one hundred miles of the city and may be visited. The charm of the Ohio River makes an ever-interesting point for visitors to Louisville.



BROWN HOTEL—CONVENTION HEADQUARTERS



CHURCHILL DOWNS—SCENE OF KENTUCKY DERBY RACE



Places of particular interest to the convention delegates are the Kentucky State Department of Health and the Louisville City Health Department headquarters. Here one will be able to visualize first hand the administration of official milk control and supervision. This, combined with the scheduled visits to the modern milk plants serving the city, will make possible the observance of the enforcement and results of the U. S. Public Health Service Milk Ordinance which is in operation with some modifications. The 1937 flood disaster caused many extremely difficult public health problems, one of the major being the matter of properly handling, processing and delivery of a safe, wholesome milk supply to the people of the stricken area. This will be explained and illustrated at a session of the convention by the State and Local Health Officials, and should be not only interesting but most instructive in the application of methods employed to meet emergencies.

Churchill Downs, home of the famous Kentucky Derby, may be visited by the association.

A dinner will be tendered the Association through the courtesy of the Dairy and Ice Cream Machinery Manufacturers Association, Inc., at the Brown Hotel, Louisville.

No one interested in the Association and its aims and activities can afford to miss the meeting and the visit to Louisville, Ky.

# Program

INTERNATIONAL ASSOCIATION
OF
MILK SANITARIANS

26th Annual Convention

Louisville, Ky.

*Monday, October 11*

MORNING

*8:30-10—Registration*

**Greetings:**
J. R. Jennings, Chief,
Division of Milk Control,
City Health Department, Louisville, Ky.

**What Colleges Can Do and Are Doing in Training Milk Inspectors.**
Fordyce Ely, Professor of Dairy Husbandry, Lexington, Ky.

**The Use of Social Security Funds in Training Milk Inspectors.**
L. C. Frank, Sanitary Engineer in Charge,
Office of Milk Investigations,
U. S. Public Health Service, Washington, D. C.

**Plumbing Defects in Pasteurizing Plants.**
W. Scott Johnson, Chief Public Health Engineer,
State Board of Health,
Jefferson City, Missouri.

**Need for Official Supervision of Laboratories.**
F. Lee Mickle, Director,
Bureau of Laboratories,
State Health Department, Hartford, Conn.

AFTERNOON: 2 P. M.

**Studies on Milk Samples from Bang Positive and Bang Negative Cows.**
H. B. Morrison, Jr. and F. E. Hull,
Department of Animal Husbandry,
University of Kentucky, Lexington, Ky.

**A Study of a Milk-borne Scarlet Fever Epidemic in Rockford, Illinois.**
S. V. Layson, Milk Sanitarian,
State Health Department,
Springfield, Ill.
and
C. W. Anderson,
City Health Department,
Rockford, Ill.

**Report of the Committee on Communicable Diseases Affecting Man.**
I. A. Merchant, Chairman,
Associate Professor of Veterinary Hygiene,
Iowa State College, Ames, Iowa.

**What Texas is Doing in Milk Control.**
V. M. Ehlers, Director,
Bureau of Sanitary Engineering,
State Health Department, Austin, Texas.

**Report of Committee on Methods of Improving Milk Supplies in Small Communities.**
L. C. Frank, Chairman, Sanitary Engineer in Charge, Office of Milk Investigations,
U. S. Public Health Service, Washington, D. C.

EVENING: 7 P. M.

**Buffet Supper**—This is an informal "get acquainted" Session.

**Moving pictures:** "The flood of 1937."

**Speakers:**
J. R. Jennings, Chief,
Division of Milk Control,
City Health Department, Louisville, Ky.
Dr. A. T. MacCormack,
State Health Commissioner,
Louisville, Ky.
Dr. H. R. Leavelle, Director of Public Health,
City Health Department, Louisville, Ky.

*Tuesday, October 12*

MORNING: 9:30 A. M.

**Platform Tests.**
W. D. Tiedeman, Chief,
Bureau of Milk Sanitation,
State Health Department, Albany, N. Y.

**The Resazurin Test.**
John A. Keenan, Director of Sanitation,
Whiting Milk Company,
Boston, Mass.

**Business Session.**

AFTERNOON: 2:00 P. M.

**"Seeing Louisville".**
Inspection trip to local milk plants
Transportation furnished.

EVENING: 6:30 P. M.

**Dinner at Brown Hotel.**
Courtesy of Dairy and Ice Cream Machinery Supplies Association, Inc. New York City.

8:30 P. M.

**Standardization of Rulings on Equipment and Supplies.**
Harry S. Calvert, President,
Dairy and Ice Cream Machinery and Supplies Association, New York City, N. Y.

**Report of Committee on Milk Plant Equipment,**
W. D. Tiedeman, Chairman,
Chief, Bureau of Milk Sanitation,
State Health Department, Albany, N. Y.

**Forum: "Local Problems"**
An opportunity for informal discussion by all members of their problems.
Presiding:
C. A. Abele, Director,
Division of Inspection,
State Health Department, Montgomery, Ala.
and
W. D. Dotterrer, Director of Laboratories,
Bowman Dairy Company,
Chicago, Ill.

*Wednesday, October 13*

MORNING 9:30 A. M.

**Sterilization of Dairy Utensils and Equipment.**
A. H. Williamson, Dairy Supervisor,
State Board of Health,
Jacksonville, Fla.

**Symposium on Paper Milk Containers.**

**(a) Consumer Attitude,**
P. H. Tracy, Associate Chief in Dairy Manufactures,
University of Illinois, Urbana, Ill.

**(b) Proposed Standards,**
J. R. Sanborn, Research Bacteriologist,
Agricultural Experiment Station,
Geneva, N. Y.

**(c) Sanitary Aspects,**
M. J. Prucha, Professor of Dairy Bacteriology,
University of Illinois, Urbana, Ill.

**(d) Problems,**
Evan Wheaton, Bacteriologist,
Research Department,
American Can Company, Maywood, Ill.
and

F. W. Tanner, Professor of Bacteriology,
University of Illinois, Urbana, Ill.

**Dyes and Methods as They Affect the Methylene Blue Test.**
J. M. Frayer, Dairy Bacteriologist,
Agricultural Experiment Station,
Burlington, Vt.

**Report of Committee on Laboratory Methods.**
A. H. Robertson, Chairman,
Director, State Food Laboratory,
Department of Agriculture and Markets,
Albany, N. Y.

AFTERNOON: 2:00 P. M.

**Joint Session with Ohio Valley Conference of Food, Drug & Health Officials.**
**The Phosphatase Test.**
L. H. Burgwald, Associate Professor of Dairy Technology, Ohio State University,
Columbus, Ohio.

**Discussion:**
Sol Pincus, Deputy Health Commissioner,
New York City, N. Y.
C. S. Leete, Associate Milk Sanitarian,
State Health Department, Albany, N. Y.
Paul Krueger, Director, Bureau of Dairy Products,
City Health Department, Chicago, Ill.

**Nutritional Aspects of Milk.**
W. E. Krauss, Associate in Dairy Nutrition,
Agricultural Experiment Station,
Wooster, Ohio.

**Symposium on Ice Cream.**

**(a) Problems**
R. C. Hibben, Executive Secretary,
International Association of Ice Cream Manufacturers,
Washington, D. C.

**(b) Sanitation**
J. R. Frandsen, Head,
Department of Dairy Industry,
Amherst, Mass.

**(c) Committee Report**
F. W. Fabian, Chairman,
Associate Professor of Bacteriology & Hygiene,
Michigan State College, East Lansing, Mich.

**The Bottling of Fruit Juices in Milk Plants.**
C. C. Mahannah, Sales Manager,
Bireley's Incorporated,
Chicago, Ill.
V. M. Ehlers, Director,
Bureau of Sanitary Engineering,
State Health Department,
Austin, Texas.

ADJOURNMENT

## Team Work

Local preparations for the Annual meeting this year have been the most extensive experienced by the Association for some time. Much credit is due to the Chairmen of two Committees: Mrs. Sarah Vance Dugan, of the Committee on Publicity and Public Relations, and Mr. J. R. Jennings, of the Local Committee on Arrangements. Together, they have worked hard and effectively to give wide publicity to the 26th Annual Meeting and to insure excellent local facilities and entertainment.

The Association appreciates the work of Mrs. Dugan and Mr. Jennings; they have made a record for future committees to "shoot at."

# Milk Control Exhibit Planned for the New York World's Fair in 1939

INFORMATION from Dr. Louis I. Dublin, Chairman of the Committee on Medicine and Public Health for the World's Fair to be held in New York in 1939 advises of the development of an exhibit on Milk Control and Sanitation. It is believed that an extraordinary opportunity is presented by the Fair to reach several million people with a dramatic, educational message on a subject intimately associated with public health.

Milton J. Rosenau, M.D., has accepted the Chairmanship on the Section on Milk Control. Dr. Rosenau's distinguished career in public health makes his selection a most admirable one for the direction of the work to be undertaken in planning the exhibit on milk control. Other members selected to date to serve with Dr. Rosenau include Mr. Samuel Abraham,* New York City Department of Health; Dr. Paul B. Brooks,* New York State Health Department; Mr. Leslie C. Frank,* U. S. Public Health Service; J. G. Hardenbergh,* V.M.D., Plainsboro, N. J.; Mr. William B. Palmer,* Milk Inspection Association of the Oranges and Maplewood, N. J.; Professor J. M. Sherman, Cornell University; and Dr. Alec N. Thomson, Kings County Medical Milk Commission, Brooklyn, N. Y.

* Members of International Association of Milk Sanitarians.

## Personal Items

Mr. Loomis Burrell of the Cherry- Burrell Corporation, Little Falls, N. Y., was one of the official delegates from the United States, of which there were 24, to the World's Dairy Congress in Berlin, Germany, this summer.

* * *

Mr. C. K. Johns, former President of the International Association of Milk Sanitarians (1934-35), was on leave during the past year from his official duties as Assistant Agricultural Bacteriologist at the Central Experimental Farm, Ottawa, Canada, in order to carry on post-graduate study during the second semester at the University of Wisconsin. There, under Professor E. G. Hastings, Mr. Johns continued his studies on milk from normal udders as reported by him at the Atlantic City meeting last year.

* * *

Mr. Wm. H. Marcussen has been made President of the Farm Products Division of the Borden Company, 110 Hudson Street, New York City. Mr. Marcussen was Vice-President of the organization for a number of years and succeeds Mr. Harry Cronk who now becomes Chairman of the Board.

* * *

Mr. R. C. Fisher, President of the International Association of Milk Dealers, resigned some time ago as vice-president and general-manager of R. J. Worden & Sons, Waterbury, Conn., and has acquired a controlling interest in Wellesley Farms Dairy, Inc., Weston, Mass.

## Dr. Lore A. Rogers—"An American You Should Know"

The Washington (D. C.) "Evening Star" recently contained an article honoring the work of Dr. Lore A. Rogers, under the title "An American You Should Know." Dr. Rogers is chief of the research laboratories of the Bureau of Dairy Industry, U. S. Department of Agriculture, having been associated with the Bureau for 35 years. Several years ago, Dr. Roger's associates dedicated a book, "Fundamentals of Dairy Science," to him in recognition of his quarter-century of service and for his "unselfish devotion and untiring loyalty." Dr. Rogers has made valuable contributions to dairy and general bacteriology. The book, dedicated to him and first published in 1928, was printed in its second edition in 1935.

Dr. Rogers was born "down East" in Maine in 1875 and received his early education at Maine State College (now University of Maine). He did graduate work in bacteriology and botany at the University of Wisconsin and was later assistant in bacteriology at the New York State Agricultural Experiment Station at Geneva. In 1902 he was appointed Bacteriologist in the Dairy Division which was then in the Bureau of Animal Industry.

## Doctor Udall Awarded Prize for Outstanding Work

A prize for the most outstanding and noteworthy work during the year was awarded recently to Dr. Denny Hammond Udal, professor of veterinary medicine at Cornell University, at the annual meeting of the International Veterinary Congress at Omaha, Nebraska. He was selected "for his work in the control of bovine mastitis and achievements in pathology."

On many occasions Doctor Udall has been called on by Health Departments for advice and assistance in his special field and he has long been recognized as an authority on mastitis. He is the author of a practical classification of mastitis which has been accepted as a standard by both the New York State and City Departments of Health.

## Professor Dotl. Constantine Gorini

*Professor Dotl. Constantine Gorini,* whose studies of the physiology and biochemistry of the bacterial flora of dairy products are well known, recently retired from active service at the School of Agriculture of Milan, Italy. The march issue of "Le Lait" contained an article in his honor. He has also been elected an Effective Member of the Imperial German Academy of Nature Study, and an Honorary Member of the British Dairy Farmers Association. In addition to his contributions to dairy bacteriology, Dr. Gorini also made notable applications of his studies to agriculture, industry and human and veterinary medicine.

## Abstract

## Milk an Important Factor in Improving Human Nutrition in Chile

Following a study by a commission of the Health Committee of the League of Nations, supported by investigations of the Chilean Minister of Health, the government of Chile has planned a far-reaching program to correct the nutritional deficiencies of its people. These deficiencies are related principally to insufficient production in Chile of the protective foods (milk, meat, eggs, green vegetables and fruit), inadequate phosphorus and calcium in foods in some parts of the country, lack of meat and proteins and little variety in the habitual diet which is fundamentally obtained from wheat and potatoes.

In order to correct the present deficiencies and avoid their evident dangers to the future of the Chilean race, government agencies will be utilized as outlined by Dr. Eduardo Cruz Coke, Chilean Minister of Health in the August 20 number of Public Health Reports. Dr. Coke states that the most serious problem for immediate solution is the decreased production of milk which is far below what is needed, averaging only one-fifth to one-tenth as much per capita as in other countries. Dr. Coke states:

"If it is remembered that milk is the principal material for the building of a race, irreplaceable by any other food in nearly all cases, that it is the most important of the protective foods, and that according to our own studies and those of our co-workers it has, furthermore, an inhibitory action on precocious sexual development, the primary interest of the Department of Public Health in its maximum consumption will be understood.

"All attempts at decreasing infant mortality are useless if the child and the nursing mother do not have sufficient milk, and all moral education of children becomes purposeless if through lack of milk puberty is advanced and, with this, precocious differentiations resulting in an organic and psychological unbalance.

"The Government has already suggested measures to stimulate consumption and production of milk, which the Council will carry on; these include the school lunch, the contribution being almost entirely in milk, and perfecting of the relations between production and distribution, involving pasteurization plants.

"Investigation of the causes of decreased production of milk has shown that it is due to the fact that the economic return from milk production has not increased in proportion to that from other farm products which, furthermore, are easier to produce and do not necessitate control and regulation. Means are being studied of increasing production not only through increasing consumption, the state itself being a large purchaser for the school lunch, but also through lending at low interest the extra capital needed by the milk industry. The installation of milk drying or condensing plants in the grazing regions of the South, permitting utilization of it in periods of great abundance, is another measure which may be established."

# Abstracts

**Pasteurization in England and America.**—*Edit. Am. J. Pub. Health.* 27,920 (1937).

Pasteurization of *all* market milk, says this editorial, is now generally recognized by health and medical authorities, by most of the dairy industry, and by a substantial proportion of the people of this country as an *essential* public health measure. Today, about 88 per cent of the milk supplies in all cities over 10,000 population in this country is pasteurized, although the amount varies in different parts of the country, and the average is brought up by many larger cities where nearly 100 per cent pasteurization has been attained. In our communities in the 1,000 to 10,000 population group, on the other hand, only about 39 per cent of the milk is now pasteurized. These figures indicate that market milk in our large cities is much safer than in the rural sections of the country.

This editorial also expresses the opinion that more certified milk should be pasteurized.

In England, pasteurization has not received as wide recognition as in the United States, although the British public health and medical professions are strongly advocating this desirable process, which they believe should precede much-needed attempts to increase milk consumption in Great Britain. Recent investigations have shown that pasteurization does not appreciably affect the excellent nutritive properties of milk.

"Raw milk, whether in England or America," concludes this editorial, "should no longer be permitted to impede public health progress."

**Standardization of Tablets for Determining Methylene Blue Reduction in Milk**—*H. J. Conn—Am. Jour. Public Health,* 27,793 (1937).

The first attempt to prepare standardized tablets for the methylene blue reduction test was made in Denmark prior to 1920. The first American tablets prepared in 1923 were intended to duplicate the Danish tablets, overlooking the fact that in America the test is commonly made with only 10 cc. of milk whereas in Denmark 40 cc. are used. Decision to reduce the amount of dye in the American tablets to one-quarter of that in the Danish in order to insure the same dilution in milk at first resulted in some discrepancies in dye content of the tablets prepared on a commercial scale. More recently, much better results have been obtained. Following the recommendations of Thornton and Sandin, it is proposed that the tablets shall now be made, employing methylene blue thiocyanate instead of the chloride, to contain 7.5 mg. each of the dye, giving a dilution of 1:300,000 in milk. Following satisfactory test results on a trial batch of tablets so prepared, it is expected that the standardization work, begun some 15 years ago, is nearly completed.

**Modified Methylene Blue Reduction Technic**—*H. R. Thornton—Am. Jour. Public Health,* 27,791 (1937).

The proposed modification of the standard test which would require the shaking of the tubes of milk during incubation is not recommended by the author as a requirement in the technic used on this continent. The shaking does give more uniform reduction and probably greater accuracy. However, there is a high correlation between the results of the standard and modified methylene blue reduction tests which does not seem to justify a change in the technic now recommended.

**Bovine Mastitis I.**—*The Significance of the Dose Factor in the Production of Experimental Mastitis. ..Ralph B. Little, Cornell Vet.* 27,297 (1937).

Finely drawn glass rods, dipped in

broth cultures of typical, identified strains of hemolytic mastitis streptococci were used to introduce small numbers of the organisms into the teats of first-calf heifers and older cows, this technique resulting in no injury to the teat sphincter. Careful examinations of the milk from each quarter of the udders of the experiment animals were made daily both before and after the inoculations in order first to determine the normality of the udders, and, second, to follow closely the results of the infective procedures. Twelve quarters of 5 first-calf heifers became infected on a single inoculation of a small amount of undiluted 6½ hour broth culture. When a $10^{-2}$ dilution of a similar culture was used it required 16 inoculations to produce mastitis in 10 quarters. With a $10^{-3}$ dilution, 37 inoculations were necessary to induce infection in 7 to 9 quarters, while 2 remained uninfected after 8 and 9 inoculations, respectively. The production of experimental mastitis is evidently correlated with the dilution of culture employed; that is, the number of organisms introduced beyond the meatus of the teat apparently determines whether a single or repeated inoculations are necessary in order to establish infection in the udder.

**Bovine Mastitis—II.**—*The Production of Mastitis by the Suction of Streptococci into the Duct of the Teat. Ralph B. Little. Cornell Vet.,* 27,309 (1937).

To determine whether infection of the udder could be produced in a manner more nearly approaching natural exposure than obtained in the previous study, methods of exposure were employed including the rubbing of cultures of hemolytic mastitis streptococci over the meatus of the teat, the introduction of broth or milk culture or infected milk into the teat by suction, and the application to the teats of rubber bags containing culture. It was found that the first and last of these methods failed to introduce the streptococci into the teat. When the teats were inserted in broth or milk cultures and pressure was applied to the teats and then released, resulting in suction, mastitis was manifested in 5 quarters. It was easier to induce infection by this method in older cows than in heifers, suggesting that the intact duct and sphincter of the teat may act as a natural barrier to the passage of pathogens into the udder.

**Mastitis: VI**— THE EFFECT OF FEEDING IRRADIATED YEAST ON THE RESISTANCE OF THE UDDER TO BOVINE MASTITIS. *G. J. Hucker and Marion Synder Reed. Tech. Bul. No.* 243, *New York Agricultural Experiment Station, Geneva, New York.*

The feeding of irradiated yeast was found to have no significant effect upon the resistance of the udder to the invasion of mastitis streptococci in tests carried on with 116 cows in 4 herds over a 2-year period. Depending upon the index of infection used, from 10 to 13% more of the infected yeast-fed cows showed an improvement than was found in the case of the infected cows not fed yeast. No prophylactic effect was found by the addition of irradiated yeast to the diet of mastitis-free cows. (Author's abstract).

**Mastitis: VIII**—THE USE OF A SPECIALLY PREPARED VACCINE IN AN ATTEMPT TO CONTROL BOVINE MASTITIS. *G. J. Hucker and Poul Arne Hansen, Tech. Bul. No.* 245 *New York Agricultural Experiment Station, Geneva, New York.*

Vaccines prepared from stock and from freshly isolated strains of *Streptococcus agalactiae* and used on 45 cows over a 2-year period with 57 controls gave no evidence of increasing the resistance of dairy cattle to mastitis. Similar vaccines had little or no therapeutic action in the treatment of latent and chronic mastitis; nor was the prophylactic or therapeutic action of the vaccines stimulated by the use of simultaneous intra-muscular injections of milk. (Authors' abstract).

**The Inspection of Dairy Farms and Its Meaning.**—*Hyatt Kisselbrack. Cornell Vet.,* 27,317 (1937).

A brief review of the origin and development of the milk inspection activities of the New York City Department of Health and the present concept of the inspection methods most likely to produce the best results in controlling the quality of raw milk delivered to pasteurizing plants.

**Education Relative to Public Health Service.**—*O. V. Brumley, North American Vet.,* 18,32 (1937).

This able and thoughtful analysis by the Dean of the College of Veterinary Medicine, Ohio State University, deals with the veterinary aspects of public health; the educational requirements, both regular and post-graduate, essential to the proper training of veterinary personnel for public health work; the necessity for education of the public regarding veterinary phases of public health; and the desirability of close cooperation and affiliation between all professional groups engaged in public health service.

**The Need of Uniformity of Conditions for Counting Plates**—*(with a suggestion for a Standard Colony Counter) Jacques Archambault, J. Curot and Mac. H. McCrady—Am. Jour. Public Health,* 27,809 (1937).

Recognizing that even well-designed counting devices with different methods of lighting may yield discordant results in making plate counts, the authors undertook a study of the essentials involved for the purpose of developing a simple but properly and satisfactorily illuminated counting device at a reasonable price. The "Quebec Colony Counter" is the result. It consists essentially of a small box or frame on which is mounted an adjustable 1½ times magnifier, a constant lighting source so arranged as to combine transmitted and reflected light, and a ruled plate, interchangeable as to type. A hinged support allows adjustment of the apparatus to any angle to suit the comfort and convenience of the operator. The device, available from the manufacturer (Spencer Lens Co.), is believed to afford very definite advantages for the accurate counting of plates used in bacteriological examinations of milk and water.

**Methods of Making Cheddar Cheese from Milk with a Low Curd Tension Due to Latent Mastitis**—*J. C. Marquardt and G. J. Hucker, Tech. Bul, No. 242, New York Agricultural Experiment Station, Geneva, N. Y.*

Investigation has shown that even when milk contains demonstrable numbers of mastities streptococci and more than 500,000 leucocytes per cc. it can be made into satisfactory cheddar cheese though it may lack in normal curd-formation properties. This was accomplished by adding 1½ to 3% of starter or 30% HCI at the rate of 100 cc. per 1,000 pounds of milk. The need of using a test like the Marschall cup test in making cheese from milk whose curd tension varies from normal was shown. It was found that after 9 months of curing, *Strpetococcus agalactiae* were present in cheeses made from milk with a low curd tension. Milk of abnormal composition produced by cows with acute mastitis (garget) should not be used for cheese making. (authors' abstract).

## The Association Membership

Secretary Leete advises that the Association should be pleased with the healthy condition of membership enrollment which will be reported upon at Louisville. The Asociation has lost a few of its valued members by death during the past year but, otherwise, seperations have been few. On the other hand, new applications have been received in considerable numbers, both with and without solicitation.

This is a good sign of the Association's growth and prestige. A future issue of the Journal will list the new members accepted since the last Annual Meeting.

## Application for Membership

I wish to apply for membership in the International Association of Milk Sanitarians.

.....19.....

Name .....
(Print name in full and degree)

Address .....
(Street and City)

Present occupation .....

.....

Previous positions .....

.....

.....

Application is for:

.....Active membership

.....Associate membership

Person may qualify for

MEMBER is officially engaged in dairy or milk inspection, or laboratory control, or administration of such function for any country or subdivision thereof; or officially engaged in research or educational work related to dairy or milk inspection for any country or subdivision thereof.

ASSOCIATE MEMBER if interested in the promotion of dairy sanitation.

DUES: $5.00 per year payable in advance, and includes the Association JOURNAL OF MILK TECHNOLOGY.

Application endorsed by:

.....
.....
Active or Associate Members

Mail with remittance to:

C. SIDNEY LEETE, *Secretary*,
Int. Assn. of Milk Sanitarians,
N. Y. State Dept. of Health,
Albany, N. Y.

# INTERNATIONAL ASSOCIATION OF MILK SANITARIANS

## Constitution and By-Laws

## CONSTITUTION

### Adopted October 16, 1911*

NAME

This Association shall be known as the International Association of Milk Sanitarians.

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 my be, upon pyment 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 a once notify all members that the proposed amendments will be open for discussion at the Annual Meetig 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 Secrtary-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.

* Amended Oct. 20, 1932 and Oct. 15, 1936.

# 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.

## Milk-Borne Disease Outbreaks in 1936

RAW milk was responsible for all of the outbreaks of milk-borne disease in the United States in 1936 according to statistics tabulated by the Office of Milk Investigations, U. S. Public Health Service and recently made available.

There were 42 outbreaks of disease attributed to milk-borne infections and reported by health authorities throughout the nation. The number of cases associated with these outbreaks totaled 1892 and the deaths 27. The deaths were from typhoid fever (15 epidemics, 114 cases, 5 deaths), scarlet fever (12 epidemics, 1282 cases, 15 deaths) and septic sore throat (6 epidemics, 271 cases, 7 deaths). The other disease outbreaks reported as milk-borne comprised paratyphoid fever (1 outbreak, 21 cases), enteritis and gastro-enteritis (3 outbreaks, 88 cases), food poisoning (1 outbreak, 100 cases) and undulant fever (4 outbreaks, 15 cases).

In addition, the Office of Milk Investigations tabulated by states, 2044 cases of undulant fever that were reported as occurring in 1936, the number of these that were actually milk-borne being undetermined.

## Coming Meetings

Association of Dairy, Food and Drug Officials of the United States. Raleigh Hotel, Washington, D. C. Oct. 26-29.

International Association of Milk Dealers. Dallas, Texas, Oct. 21.23.

National Association of Retail Ice Cream Manufacturers, Dallas, Texas. October 21-22.

Certified Milk Producers' Association of America, Dallas, Texas, Oct. 22-23.

Michigan Public Health Association, Lansing, Michigan, November 10-12.

New England Milk Producers' Association, Boston, Mass., October, 26-27.

West Virginia State Health Conference, Charleston, West Virginia, November 8-10.

Dairy Industries Exposition. New Orleans, Louisiana, October 21-27.

Society of American Bacteriologists. Mayflower Hotel, Washington, D. C., December 28-30.

U. S. Livestock Sanitary Association, Hotel LaSalle, Chicago, Dec. 1-2-3.

New Jersey Health and Sanitary Association, Princeton, N. J., Dec. 10-11.

New Jersey Health Officers' Association. Princeton, N. J., Dec. 10-11.

Conference of Health Officials of the Metropolitan (New York) Area, Princeton, N. J., Dec. 10-11.

Conference of New Jersey State and Local Health Departments, Trenton, N. J., Feb. 1938.

Colorado Association of Dairy Products Manufacturers, Denver, Colorado, January, 1938.

Ohio Association of Ice Cream Manufacturers. Columbus, Ohio, January 17-19, 1938.

Iowa Public Health Association, Des Moines, Iowa, May, 1938.

# ADVERTISERS

## INDEX TO ADVERTISERS

DIFCO

# CULTURE MEDIA FOR MILK EXAMINATION

## Bacto-Nutrient Agar

Bacto - Nutrient Agar is approved for determining the routine plate count of bacteria in milk in "Standard Methods of Milk Analysis." The dehydrated product is readily prepared for use in the laboratory and yields uniform lots of medium upon which reliable and comparable results are secured.

## Bacto-Violet Red Bile Agar

Bacto-Violet Red Bile Agar has been found satisfactory by the Committee on Methods and Standards of the American Association of Medical Milk Commissions for the direct plate count of coliform organisms in Certified Milk. After 18 to 24 hours incubation these organisms form reddish subsurface colonies which are surrounded by a characteristic zone of precipitated bile. Organisms other than those of the coliform group are largely inhibited.

## Bacto-Malt Agar

Bacto-Malt Agar is recommended for the enumeration of molds and yeasts in dairy products, and is widely used for detecting sources of contamination by these organisms at various stages of manufacture. The dehydrated medium is readily made up for use in the laboratory by dissolving the powder in water and sterilizing the resultant solution.

---

*Specify "DIFCO"*

THE TRADE NAME OF THE PIONEERS

In the Research and Development of Bacto-Peptone and Dehydrated Culture Media

---

DIFCO LABORATORIES

INCORPORATED

DETROIT, MICHIGAN