FIFTEENTH ANNUAL REPORT

OF THE

International Association of Dairy and Milk Inspectors

INCLUDING PAPERS READ AT THE ANNUAL
CONVENTION IN PHILADELPHIA, PA.
OCTOBER 25, 26 AND 27, 1926

COMPILED BY
IVAN C. WELD, Secretary-Treasurer
PENNSYLVANIA AVENUE AT 26th STREET
WASHINGTON, D. C.

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" Unless health is conserved and protected, there is very little use for other activities for the promotion of public welfare."

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Price Two Dollars

International Association of Dairy and Milk Inspectors

CONSTITUTION AND BY-LAWS

CONSTITUTION

ADOPTED OCTOBER 16, 1911

NAME

This Association shall be known as the International Association of Dairy and Milk Inspectors.

OBJECT

The object of this Association shall be to develop uniform and efficient inspection of dairy farms, milk establishments, milk and milk products, and to place the inspection of the same in the hands of men who have a thorough knowledge of dairy work.

MEMBERSHIP

The membership of this Association shall be composed of men who now are or who have been actively engaged in dairy or milk inspection. Any person who now is or who has been so engaged may make application to the Secretary-Treasurer and if application is accepted by the Membership Committee, said applicant may become a member of the Association upon payment of the annual dues of five dollars ($5.00).

OFFICERS

The officers of this Association shall be a President, three Vice-Presidents, a Secretary-Treasurer, and two Auditors, who shall be elected by a majority ballot at the Annual Meeting of the Association, and shall hold office for one year or until their successors are elected. An Executive Board, which shall direct the affairs of the Association when not in Annual Session, shall consist of the President, the three Vice-Presidents, and the Secretary-Treasurer.

AMENDMENTS

This Constitution may be amended at any Annual Meeting by a two-thirds vote of the entire membership of the Association. Any member proposing amendments must submit the same in writing to the Secretary-Treasurer at least sixty days before the date of the Annual Meeting, and the Secretary-Treasurer shall at once notify all members of such proposed amendments. All members voting on such proposed amendments shall register their vote with the Secretary-Treasurer on blanks provided by the Association before the date of the Annual Meeting.

BY-LAWS

ADOPTED OCTOBER 25, 1913

ORGANIZATION

The Constitution shall be the basis of government of this Association.

ARTICLE 1

MEMBERSHIP

SECTION 1. Any person eligible for membership under the Constitution who shall file an official application, accompanied by the first annual membership dues of five dollars, and whose application for membership shall have the approval of the Membership Committee, may become a member of the Association for one year.

SECTION 2. Any person having once become a member may continue membership in the Association so long as the annual membership dues are paid. Any member who shall fail to pay annual dues within thirty days after having been notified by the Secretary that said dues are due and payable, shall be dropped from membership. Any member so dropped may, within ninety days, be reinstated by the Membership Committee, upon application filed in due form and accompanied by the annual membership dues for that year.

SECTION 3. A member of the Association may be expelled for due cause upon recommendation of the Membership Committee, and a majority vote of the members at any annual meeting. Any member so expelled shall have refunded such *pro rata* part of his membership dues as may not be covered by his term of membership.

HONORARY MEMBERS[1]

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

[1] Adopted October 29, 1915.

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.

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Those who advertise with us are clearly in sympathy with the work of our Association. We are materially benefited by their patronage, and therefore our members and readers should correspond with them FIRST and mention this publication when in need of supplies.

International Association of Dairy and Milk Inspectors

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Pilgrim, Dr. S. L. ..Chief, Division of Food .....Milwaukee, Wis.

Plimpton, Geo. E. .. Chemist ....534 Boston Ave., West Somerville, Mass.

Prentiss, Russell I.. Milk Inspector, Town of Lexington ....Lexington, Mass.

Price, Dr. Wm. H. ..Detroit Creamery Co........Detroit, Mich.

Putnam, Geo. W. ... Chief, Bureau of Dairy Products, Department of Health. Chicago, Ill.

Pyper, Dr. S. T. ....Chief, Bureau of Food Inspection ....Dayton, Ohio

Quigley, J. V. ......Dairy Adviser, Kansas City Consumers' League ....408 E. 11th St., Kansas City, Mo.

Rath, Dr. Floyd C. . Assistant Health Officer, Dairy and Food Inspector. Madison, Wis.

Redfield, Dr. H. W. . Chief, New York Station, U. S. Bureau of Chemistry.. West Main St., Mendham, N. J., R. F. D. 1.

Rice, Dr. John L. ..Health Officer ....City Hall, New Haven, Conn.

Roadhouse, Prof. C. L. Professor of Dairy Industry, University of California ....University Farm, Davis, Cal.

Robinson, Herbert S. Dairy Inspector, Health Department ....Boston, Mass.

Rosenberger,
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Russell, Alfred M. ..Agent, Board of Health, and Inspector of Provisions ...P. O. Box 56, West Newton, Mass.

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Schmeing, J. B. ...Sanitary Inspector of Dairies.Covington, Ky.

Seaman, Carl O. ...Milk Inspector..............14 South Street, Manchester, N. H.

Sheffield, M. H. ....Chief Milk, Meat, and Food Inspector ....Grand Rapids, Mich.

Shoults, Dr. W. A. ..Director of Food Division, Provincial Board of Health. Winnipeg, Manitoba

Shrader, Dr. J. H. ..Director, Bureau of Chemistry and Food, City Health Department ....311 Courtland St., Baltimore, Md.

Shroat, H. E. .....Assistant, Division of Milk Control, State Department of Health ....28 Evergreen St., Harrisburg, Pa.

Shull, Dr. Hubert ..Food and Dairy Inspector ..414 W. Third St., Texarkana, Ark.

Smisek, M. J.......Milk and Dairy Inspector....St. Paul, Minn.

Smith, Dr.
Clarence E........Commissioner of Health.....Greenville, S. C.

Smith, D. R. ....Southern Dairies ....Newport News, Va.

Smith, Edwin J. ....Chief Milk Inspector ....Detroit, Mich.

Smith, Dr. George ..Chief Food and Drug Inspector ....Division of Health, Toledo, Ohio

Smith, Russell S. ...U. S. Public Health Service..519 Dexter Ave., Montgomery, Ala.

Snyder, R. D.................................Bloomsburg, Pa.

States, M. V. ...... Milk Inspector, Department of Health ....Detroit, Mich.

Stevenson, A. D. ...The Borden Company ....350 Madison Ave., New York City

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Strauch, Thomas J..Chief Dairy Inspector, Bureau of Health ....Richmond, Va.

Strickland, Franklin N.......Executive Secretary-Chemist, Board of Food and Drug Commissioners ....Providence, R. I.

Stricklen, Owen E..Dairy Inspector, City Health Department ....Ann Arbor, Mich.

Supplee, Dr. G. C. ..Director of Research Laboratory, The Dry Milk Co....Bainbridge, N. Y.

Taylor, Geo. B. ....Bacteriologist, Chestnut Farms Dairy.....Washington, D. C.

Terrill, R. M. ......Milk Inspector, City of Detroit ....Northville, Mich.

Tingle, John T. ....Municipal Milk and Dairy Inspector ....Meridian, Miss.

Tobin, Michael F....Inspector of Pasteurization..245 Canal St., Providence, R. I.

Tolland, Alexander R......Dairy Inspector, Health Department ....Room 1102, City Hall Annex, Boston, Mass.

Trotter, Dr. A. M. ..Chief Veterinary Inspector, Corporation of Glasgow....60 Hill St. (East), Glasgow, Scotland

Vener, Benjamin ....2738 East 19th Street, Brooklyn, N. Y.

Voorhees, Dr. Louis A. ....Chemist, Department of Health ....New Brunswick, N. J.

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Ward, Dr. A. R. ...Assistant Chief, Dairy Research Division, F. C. Mathews Co. ....Detroit, Mich.

Ward, Willard E. ..Agent, Board of Health, for Milk and Food Inspection..14 Town Hall, Brookline, Mass.

Warner, W. J. .....State Milk Inspector ....Andover, Conn., R. 2.

Washburn, Prof. R. N. ....Director of Laboratories, International Dry Milk Company ....2239 Gordon Ave., St. Paul, Minn.

Way, H. O. ....Director, The Agricultural Laboratory ....508 Blackstone Building, Cleveland, Ohio

Weld, Ivan C. .....Investigator for Chestnut Farms Dairy ....Washington, D. C.

White, G. T. ....Milk Inspector ....1130 Seward Avenue, Detroit, Mich.

White, W. W. ......Assistant, Division of Milk Control, State Department of Health ....Harrisburg, Pa.

Widmayer, Fred J. .Food and Milk Inspector ....Scranton, Pa.

Wilson, Frank C. ..In charge, Milk Laboratory. Food and Drug Department State Board of Health ....152 State House, Indianapolis, Ind.

Wing, Dr. Chas. C. .City Veterinarian and Assistant Health Officer ....Room 613, City Hall, Oakland, Cal.

Winkler, Dr. J. S. ..City Veterinarian and Dairy Inspector ....Newport, Ky.

Yale, Maurice W. ..Chief of Sanitation Department, Pittsburgh District Dairy Council ....451 Century Building, Pittsburgh, Pa.

Yates, J. W. ......General Laboratories ....124 S. Dickenson Street, Madison, Wis.

Young, Dr. Hulbert.Manager, Walker-Gordon Laboratory ....Linden Ave. and Dolphin St., Baltimore, Md.

HONORARY MEMBERS

Evans, Dr. Wm. A. .Health Editor, Chicago *Tribune* ....Chicago, Ill.

Pearson, Dr. R. A. ..President, University of Maryland ....College Park, Md.

Van Norman, Prof. H. E. ....President, American Dry Milk Institute ....160 N. La Salle Street, Chicago, Ill.

Woodward, Dr. Wm. C...........American Medical Association, Bureau of Legal Medicine and Legislation..........535 N. Dearborn Street, Chicago, Ill.

Fifteenth Annual Convention

BELLEVUE-STRATFORD HOTEL

PHILADELPHIA, PENNSYLVANIA

MONDAY, OCTOBER 25, 1926

THIRD SESSION

The Fifteenth Annual Convention of the International Association of Dairy and Milk Inspectors was called to order in the Bellevue-Stratford Hotel, Philadelphia, on Monday, October 25, by its President, Dr. G. C. Supplee, of Bainbridge, N. Y.

Dr. Wilmer Krusen, Director of the Department of Public Health and Vice-President of the Chamber of Commerce of Philadelphia, welcomed the Association to Philadelphia and expressed his approval and appreciation of the work in which the Association is engaged. Vice-President W. A. Shoults, of Winnipeg, Manitoba, in behalf of the Association thanked Doctor Krusen for his cordial welcome.

Doctor Supplee delivered his presidential address, and Prof. T. J. McInerney, Cornell University, Ithaca, N. Y., read a paper on "The Colorimetric Determination of the Hydrogen-Ion Concentration of Milk."

Dr. J. H. Shrader, of Baltimore, briefly discussed the subject "Culture Media and Bacteria Counts in Milk."

SECOND SESSION

The afternoon session was called to order at 2 o'clock, with President Supplee in the chair.

Dr. Samuel Adams Cohen, of New York City, presented a paper entitled "Ice Cream as a Food for Children."

Mr. Ralph E. Irwin, chairman, reported for the Committee on the Sanitary Control of Ice Cream.

Dr. W. G. Hollingworth, of Utica, N. Y., read a paper on "The Dairy Inspector's Ideals."

The final paper of the afternoon session was read by Mr. Geo. W. Putnam of Chicago. Mr. Putnam's subject was "The Elimination of Pasteurization Defects."

THIRD SESSION

The evening session was called to order by President Supplee at 8.15.

Mr. A. F. Stevenson read a paper on "The Future of Dried Milk."

Dr. George W. Grim presented a paper having for its subject "How Municipalities May Cooperate in Milk Control."

"Safe Milk for Small Communities" was the subject of a paper presented by Prof. I. V. Hiscock, Yale University, and Mr. M. A. Maughan read the final paper of the evening on the subject of "Serving Milk in Factories and Offices."

Tuesday, October 26

FOURTH SESSION

The morning session was called to order by President Supplee at 10.10 A.M. Mr. Thos. J. Strauch reported for the Committee on Score Cards.

In the absence of Mrs. Edith Moore, Professor Hiscock presented the report of the Committee on Methods of Obtaining a Satisfactory Quality of Raw Milk for Pasteurization.

Dr. F. D. Holford read a paper on the subject of "Certified Milk."

Dr. H. A. Harding read a paper on "Results from Bonus on Sediment and Reductase Tests," and Dr. Floyd C. Rath discussed "Some Dangers of Raw Milk."

FIFTH SESSION

The afternoon session was called to order at 2.15 by Vice-President W. A. Shoults.

Prof. I. V. Hiscock presented the report of the Committee on Food Value of Milk.

Surgeon Charles Armstrong, U. S. Public Health Service, read a paper on "Milk-Borne Diseases."

Mr. John F. Johnston, Newport, Rhode Island, had for the subject of his paper "Disease Prevention—Modern Aim."

The report of the Committee on Transportation of Milk and Milk Products, with Doctor Frey, of California, as chairman, was in the absence of Doctor Frey read by Doctor Wing, of Oakland, Calif.

SIXTH SESSION

The convention was called to order at 8.10 by President Supplee.

Mr. R. W. Balderston addressed the Association, discussing the work and accomplishments of the Philadelphia Dairy Council.

Mr. T. J. Strauch, of Richmond, read a paper on "The Grading of Milk in Richmond."

Mr. R. R. Graves, of the Bureau of Dairy Industry, United States Department of Agriculture, described some of the work done by the Bureau, especially along the line of breeding experiments.

Mr. W. W. White, of Harrisburg, read a paper describing the work of the Pennsylvania State Association of Dairy and Milk Inspectors.

The paper of Mr. E. B. Johnson, entitled "Some Aspects of Milk Inspection Publicity," was in his absence read by title.

Wednesday, October 27

SEVENTH SESSION

The morning session was called to order by President Supplee at 10 o'clock.

Prof. W. D. Frost, of the University of Wisconsin, read a paper entitled "The Examination of Milk for Streptococci."

Dr. John F. Miller, Supervisor of Milk Pasteurizing Plants in the State of New York, contributed a paper on "The Supervision of Milk Pasteurizing Plants in New York State."

The report of the Committee on Methods of Bacterial Analysis of Milk and Milk Products was made by its chairman, Mr. George E. Bolling.

EIGHTH SESSION

The afternoon session was called to order at 1.45 by President Supplee.

Dr. H. A. Harding presented the report for the Committee on Dairy Methods.

Mr. Wm. B. Palmer reported for the Committee on Milk Ordinances.

Mr. Ralph E. Irwin, Chief, Division of Milk Supply, State Department of Health, Harrisburg, Pa., read a paper on "State and Municipal Milk Regulations."

Dr. C. D. Pearce, chairman, presented the report of the Committee on Bovine Diseases—Their Relation to the Milk Supply and to the Public Health.

The report of the Committee on Communicable Diseases Affecting Man—Their Relation to the Milk Supply and to the Public Health was presented by Mr. John F. Gibbons, of New Haven, Conn., in the absence of the chairman, Dr. John L. Rice. Following this paper, a recess was taken.

BUSINESS SESSION

The business session of the Association was called to order by President Supplee at 4.05. The President and Vice-President not presenting a report, the report of the Secretary-Treasurer was in order. On motion, the Association accepted the report of the Secretary-Treasurer and also the report of the auditors.

Mr. T. J. Strauch, chairman, reported for the Committee on Resolutions, and the following resolutions were adopted:

1. WHEREAS, The International Association of Dairy and Milk Inspectors are assembled at Philadelphia, Pa., October 25-27, 1926, in this, their fifteenth annual meeting; and

WHEREAS, The objects of this Association are to develop uniform and efficient inspection of dairy farms, milk establishments, milk, and milk products; and

WHEREAS, This Association recognizes that milk is the first of the necessities of life and that it must be made safe by inspection, thereby increasing its consumption; be it

Resolved, That this, the International Association of Dairy and Milk Inspectors, go on record as advocating that the various State and local health departments employ only such persons to fill the positions of dairy and milk inspectors as are competent and well qualified to secure the desired results; and be it further

Resolved, That a copy of this resolution be sent to the different State health departments, with the request that the same be published in their bulletin.

2. *Resolved,* That in the passing of Prof. W. A. Stocking, of Cornell University, this Association has sustained a great loss. His contributions to science and to milk control work have been of the highest value, and the International Association of Dairy and Milk Inspectors esteems it a privilege to have been permitted to associate with him in

furtherance of the objects in which we were commonly interested. His cheerful disposition and pleasing personality endeared him to all with whom he came in contact. Be it further

Resolved, That this resolution be spread upon the records of the Association and a copy sent to his family.

3. WHEREAS, This Association has profited and been greatly benefited by the contribution to the program of men not included in its membership; be it

Resolved, That the International Association of Dairy and Milk Inspectors in annual convention assembled express its appreciation and thanks to Mr. R. R. Graves, Prof. W. D. Frost, Dr. Wilmer Krusen, Dr. Samuel A. Cohen, Dr. Charles Armstrong, Mr. R. W. Balderston, Dr. J. A. Kiernan, and other non-members who have contributed to our program.

The resolution on the death of Professor Stocking was adopted by a rising vote.

It was moved and voted that a committee of five be appointed to look into the matter of the removal of competent inspectors as a result of political influence.

The election of officers was next in order and resulted as follows:

President, Dr. W. A. Shoults, Winnipeg, Manitoba.

First Vice-President, Prof. I. V. Hiscock, New Haven, Conn.

Second Vice-President, Mr. Howard R. Estes, Flint, Mich.

Third Vice-President, Mr. Ralph E. Irwin, Harrisburg, Pa.

Secretary-Treasurer, Ivan C. Weld, Washington, D. C.

Auditors, Thomas Holt, Hartford, Conn.; Thomas F. Flanagan, Hartford, Conn.

Following the election each newly elected officer was introduced and spoke briefly regarding the Association and his hopes for its future accomplishments.

Former President Alfred W. Lombard spoke appreciatively of the retiring officers.

President Supplee expressed appreciation of the cooperation of the officers and members of the Association during the past year, after which the business session adjourned.

NINTH SESSION

The meeting was called to order at 8 o'clock. Dr. C. S. Stirrett read a paper on "The Tuberculin Test and Pasteurization."

Dr. J. A. Kiernan, Chief, Tuberculosis Eradication Division, Bureau of Animal Industry, United States Department of Agriculture, discussed the suppression of tuberculosis in live stock.

Dr. Roy F. Leslie, of Cleveland, was unable to be present and his paper was read by Mr. Estes, of Flint, Michigan. Following this, the last paper on the program, President Supplee delivered a brief closing address, and the convention finally adjourned at 9.30.

ADDRESS OF WELCOME

DR. WILMER KRUSEN,
Director of Public Health,
Philadelphia, Pa.

Doctor Krusen said in part:

It is a great pleasure to welcome you here in the City of Brotherly Love. William Penn, sailing up the Delaware River two hundred and forty-four years ago, arrived at the point which has become the city of Philadelphia in a ship named *Welcome,* and we Philadelphians have tried to keep that word prominent in our minds and hearts.

It was in the city of Philadelphia, one hundred and fifty years ago, that the United States of America was created and the Declaration of Independence signed. It was here that freedom from the mother country was established and liberty proclaimed. Among the many places of great historical interest which you should visit while in Philadelphia are the old State House on Chestnut Street, where the events referred to took place and where you will find much that will interest you; and here, too, on exhibition you will find the bell, the ringing of which conveyed the message to the people that the Declaration of Independence was indeed a fact.

We welcome you here on this one hundred and fiftieth anniversary of the birth of American independence, the observance of which is now being commemorated by a great exposition which you will want to visit. In this exposition you will find representative exhibits of the accomplishments of our people and those of many foreign lands in arts, industries, and agriculture.

We are especially happy to welcome you here because you are essentially a health organization, interested and actively at work for the betterment of public health and especially the welfare of the children and babies. As a result of your activities, the milk supplies of many cities and States are improved and safeguarded, so that you make a direct contribution to the welfare of all.

On behalf of the Mayor, whom I have the honor to represent, and the two million people of Philadelphia, including the doctors, the business men, and the babies, I bid you a cordial welcome and hope that you will have a delightful and profitable convention in our city.

"A kindness is never wasted."

RESPONSE TO ADDRESS OF WELCOME

DR. W. A. SHOULTS, *Second Vice-President,*
Winnipeg, Manitoba

I am sure no one regrets more than I the absence of Vice-President Chilson, who was expected to respond to the address of welcome. I do feel some personal satisfaction, however, in having the opportunity to express our appreciation for the hearty welcome from the Director of Public Health, and from one who is also so closely associated with the business and civic development of this city. We have met in many cities but seldom has the formal presentation of "the keys of the city" been so graciously performed as on this occasion. I think it will be readily admitted that the Executive Board did well when it selected this historic city as the meeting place for this annual convention. It is apparent from the remarks of Doctor Krusen that the friendly spirit which has earned for Philadelphia the title of "the City of Brotherly Love" remains a prominent characteristic of the citizens of today. I recall that my father attended the Centennial of '76, and I have no doubt that impressions received at that time were largely responsible for the fact that he later became an American citizen.

In a small town in Manitoba, a monument erected to the memory of the soldiers who fell in the great war bears this striking inscription: "There is no wealth but life." If I may presume to add one word to that philosophy so tersely expressed, it would be to say that there is no wealth but life and health. If there is anything that justifies the existence of this organization, it is that in its own way it may make some contribution to the preservation of health and the prolonging of human life.

I wish to thank you, Doctor Krusen, and to express the appreciation of our Association for your inspiring and kindly welcome.

"Give to the world the best you have
And the best will come back to you."

PRESIDENTIAL ADDRESS

G. C. Supplee, Bainbridge, N. Y.

It is a high privilege to address this Association as its president at this, its fifteenth annual convention. It will not be my purpose to burden you with a retrospect of the motives which prompted the founding of this Association, or of the influence it has exerted in milk and dairy inspection matters. The principles for which we stand are well known. For the past decade and a half the members of this Association have assembled annually for discussion and deliberation of those matters intended to inspire sane judgment and high ideals regarding milk and its relation to the public health. By virtue of the far-reaching responsibilities borne by the members of this Association, it is obvious that the sentiments expressed and sponsored by the Association as a whole are factors for bettering the policies of milk control officials.

Recent years have witnessed a great material expansion in the dairy industry, a circumstance which has accentuated the problems of milk supervision. In spite of these changing conditions in the industry and many cumbersome and unwieldy ordinances, progress has resulted. Time does not permit analyses of the various contributory factors which have brought about the relatively satisfactory status of the country's milk supply at the present time as compared with fifteen or twenty years ago, but the experience of recent years has demonstrated the fact that the cooperative efforts of producers, distributors, and supervising officials, harmoniously or otherwise obtained, are essential for the assurance of a uniformly satisfactory milk supply. Likewise, experience indicates that this mutual cooperation will be more imperative in the future than heretofore, and to substantiate this statement it is only necessary to call attention to the ever-widening territory from which cities are supplied.

The expansion of milk-producing areas for large centers of population complicates, and in many instances may reduce to impotency, the protective features of the control system. This is particularly true unless the integrity and cooperation of the distributor and the producer can be depended upon to a large extent. Therefore, in order to enhance this favorable relationship between the industry and control agencies, it is highly proper that this Association concern itself not only with the various detailed applications of regulatory measures, but also those major problems more or less applicable to all localities. To those principles to which the Association has been committed for the past fifteen years may well be added the moral force and intellectual ability of its members for developing leadership in constructive and broad-visioned policies which will simplify and make more effective the purpose and working details of present and future regulatory systems.

It must not be presumed that milk inspection service and the safeguards resulting therefrom will become entirely ineffective as a result of the expansion of the dairy industry. Regardless of the widening areas from which milk must be drawn to supply our large cities, the fundamental requirements for the production of clean and safe milk are not likely to be disturbed. The future problems of the control agencies, therefore, do not involve in their solution radical departures in policy or the inclusion of any unproved scientific considerations, but rather a revision, simplification, and adaptation of existing regulatory mechanism to prevailing conditions ,whereby a more thorough control is exercised over the fundamental requirements and less effort expended on obsolete and unenforceable nonessentials. It cannot be denied that many of the present regulatory systems are burdened with such an abundance of irrelevant details that the vital considerations are frequently unnoticed.

Not only for efficiency and effective supervision of the milk supply are simple and enforceable ordinances desired, but also from the standpoint of fostering respect for the ordinance on the part of the producers and confidence in its protective features on the part of the consuming public. During the past few years much has been said about a general disrespect for all law because of the existence of unenforceable features of a much-discussed Federal statute. This matter has become more or less of a political issue throughout the country. And in the same category we have today the unique example of the political administration of a great State affected by a heated controversy which had its inception in the question of the enforceable and unenforceable provisions of a city milk ordinance. When the political welfare of eleven million people is involved as a result of a controversy pertaining to milk inspection and supervision, it is time that those responsible for this branch of State and municipal protective service make and execute its provisions in such a clear-cut manner that such matters will forever be immune to the onslaughts of party politics, either municipal, State, or Federal.

It is realized that the clarification of many disputed matters pertaining to milk sanitation and hygiene cannot be accomplished quickly so long as honest differences of opinion exist among those familiar with the subject. The nature of the discussions at such a gathering as this indicates a lack of unanimity of opinion as to the best course to pursue in order to harmonize newly arising contingencies with the highest ideals of milk hygiene in its relation to the public health. However, the fact that such matters can be discussed with frankness and open-mindedness at these annual meetings adds breadth to the sphere of influence which it may exercise not only in maintaining and furthering the principles for which it has long stood, but also in assuring a leading part in formulating and simplifying those policies which shall insure progress, safety, and common sense in all matters pertaining to milk sanitation.

"Our ideals are our better selves."

ICE CREAM AS A FOOD FOR CHILDREN

SAMUEL ADAMS COHEN, M. D.,
New York City

Ice cream is a unique food for children. Ice cream is merely a combination in suitable proportions of cream, milk and milk products, sugars, gelatin, flavors, and sometimes fruits, eggs, and nuts. By special processing, which includes several valuable features, these ingredients are blended to make ice cream a complete, nourishing, palatable, easily digestible, and desirable food for children.

The rigid enforcement of laws by municipal and State inspectors safeguards the quality and cleanliness of the ingredients which enter into the composition of ice cream, making the day not far distant when we shall see the last of the basement ice cream dealer and the hokey-pokey vender, both of whom are now rapidly disappearing. Moreover, the ice cream manufacturers use only wholesome ingredients, in order to make a quality product.

Before discussing ice cream as a food, it may be wise to consider the steps necessary to produce ice cream. After combining the various ingredients which enter into its composition, the first important step is heating, or, as some term it, cooking. With cooking there is naturally agitation, thereby blending and softening the ingredients, resulting in a more uniform mixture. Cooking, with few exceptions, facilitates the digestion of any food. In the processing of ice cream, cooking so alters the physical and chemical properties of its milk proteins that they are hydrolyzed into smaller and less stable compounds; that is, the digestion of the protein is rendered comparatively easy. Clinical observations bear out this fact.

Homogenization or viscolization is the next step in the processing of ice cream. As a result, the fat globules and the protein particles are mechanically reduced. In fact, by this process the fat globules are reduced to from 1/100 to 1/125 of their original sizes. Ice cream contains about five and one-half million fat globules before homogenization, and after homogenization about six hundred million fat globules per c. c.

Our experience in feeding infants with homogenized products demonstrates that the fats are easier to digest. The change produced is purely a physical one, causing much greater surface area to be exposed to the digestive juices. Homogenization also produces a finer suspension of the protein particles, which also results in a greater increase of area to be exposed to the digestive juices; hence peptic digestion is facilitated.

Following homogenization, there is a period of ageing, or the holding of the liquid ice cream mixture, for at least twenty-four hours. This naturally results in a slight increase of acidity, particularly in the form of lactic acid, which causes, when ingested, a lowering of the hydrogen-ion of the gastric contents. It is accepted generally that milk or milk products are rendered more digestible with an increase of lactic acid. The acid salts of fruits and fruit juices which are added to various ice creams likewise assist in peptic digestion.

Before considering freezing, which is the final step in the processing of ice cream, there is one ingredient which demands special consideration. This is gelatin. Until recently, gelatin was used almost empirically as a stabilizer or as a binder to assist, when frozen to a smooth, homogeneous, and velvety mixture, in the blending of all the other ingredients.

The recent scientific investigation of Bogue and also Downing, at the Mellon Institute, demonstrated that gelatin is an excellent colloid. Because of its colloidal qualities, gelatin is an ideal adjuvant in the digestion of milk protein. The otherwise hard, tough, leathery casein curd, which some children find difficult to digest, is changed with the addition of gelatin, combined with the action of cooking, homogenization, and increase of acidity, to soft, flocculent, finely divided curd, which lends itself easily to digestion. Egg yolk, which sometimes enters into the composition of ice cream, also acts as a colloidal agent and accomplishes the same purpose in the digestion of the milk protein. Gelatin receives further consideration because it is known as a protein sparer.

Ice cream is made safe from harmful bacteria by cooking it even more thoroughly than is possible by pasteurization. Thanks are due to the modern ingenious electric refrigeration, which holds the ice cream at such a low temperature, thereby inhibiting the multiplication of bacteria, that ice cream is kept safe in this frozen state. This cannot be said for any of the other milk products in their marketable condition. Ice cream is ice cream only when it is in a frozen state. It is practically impossible for ice cream to melt at the low temperatures obtained by the modern electrical refrigerators, thereby eliminating the practice of rehardening the melted ice cream, which from the point of view of bacterial safeguard formerly brought in an element of risk. It may be added also that once ice cream is reduced from its original frozen state, that is, melted, it is physically impossible for any one except the manufacturers to reharden it. The leading manufacturers of ice cream discourage it, and the laws in some States prohibit this practice.

In the discussion of any food the cost should always be considered. In regard to ice cream, and this includes the richer, and therefore more nutritive grades, the cost compares favorably with the foods commonly used.

So far as I know, there are no harmful ingredients used in ice cream. The only non-nutritive elements used are those of flavoring and coloring, and these are used only in relatively minute quantities.

As a food, ice cream has much to be said in its favor. The caloric value of the 10-per-cent butter-fat ice cream (the average percentage as purchased) is 900 calories per pound, or from 75 to 90 calories to the one-and-one-half-ounce portion which is usually served. Ice cream is a well-proportioned food containing fats, sugars, proteins, salts, and a few of the known vitamins.

The amount of heat applied in cooking, or the intensity of the cold in freezing, detracts very little from the vitamins A and B originally contained in the milk and milk products. Vitamin C is supplied abundantly when fruit juices are added to the ice cream.

The salts, which are so ample in milk and cream mixtures, are contained in ice cream in larger proportions. Although it may be considered unwise to single out any one particular salt as the vital one in nutrition, nevertheless calcium is usually held as being one of the most important of the mineral salts. Ice cream is particularly rich in calcium salts, and the fats present make this calcium readily utilized by the body. An average helping of one and one-half ounces of ice cream contains about 1.3 grains of calcium, or approximately one fourth to one fifth of the total daily calcium requirements for a normal six- to fourteen-year-old boy. (The daily calcium requirement for a normal boy from six to 14 years is six grains.)

The fat content of ice cream ranges from eight to 16 per cent. The total fat percentage in the "average" ice cream is 10 per cent, or about two and one-half times that of milk. The so-called "rich" ice cream has from 14 to 18 per cent butter-fat. The percentage of carbohydrate in ice cream is about 22 to 23 per cent, about 15 to 16 per cent of which is sugar added to the seven per cent lactose contained in the original milk and cream products. There is an average of five to six per cent protein in ice cream, or about one and one-half times that of milk. Comparing ice cream and milk by weight, ice cream has from two and one-half to four times the food value of milk.

Ice cream is a concentrated food. Concentrated foods have a particular advantage in the feeding of children. There are some children who are so constituted that they cannot or will not consume more than a limited quantity of food. This amount usually falls short of their caloric requirements, and their limited quantity of food has to be enriched. This is accomplished by the addition of fats in the form of butter, and of carbohydrates in the form of starches and sugars. But with ice cream, these additional foods are already present. There is the added advantage that the additional foods are held in a complete suspension, thus favoring their digestion. The large amount of sugars—about 23 per cent—which is present in ice cream is hardly noticeable. On the other hand, if this same percentage of sugar were in milk or in many other foods, the taste would be considered too sweet and even unpalatable. As has been pointed out previously, in the feeding of children concentrated food has been used with good results.

The partaking of food which is palatable and at the same time enjoyable is highly desirable. Any influence which increases a desire for food creates a favorable psychic response, thereby acting as a stimulant to the digestive juices. The mere thought of ice cream, together with its attractive appearance, provides the necessary psychic factors. Ice cream is usually associated with a feeling of happiness. Because of its particular value as a food and also because of its singular psychic influence, we have in ice cream a rare combination.

Ice cream has a peculiarly favorable appeal to the taste as well as to the eye and to the mind. It is very palatable. The taste seems to spread over a large part of the tongue. This may be due to the fact that the flavors are so minutely distributed. The flavors, usually vanilla or fruit juices, add a great deal to the palatability of ice cream. The different flavors and also the variety of colors serve to break the monotony which may arise when prescribing ice cream.

The eating of ice cream has one peculiarity which is often overlooked. It is almost a physical impossibility to eat it hurriedly. With children who are in a habit of bolting their food or eating very quickly, ice cream has in several instances served to teach the child how to eat more slowly.

Ice cream is especially suitable as a food for children, and it may be advantageously prescribed as such. It may be utilized in the diet of the well child and can be safely prescribed for malnourished children and also for those who are acutely ill. Good cheer and nutrition are two of the chief therapeutic agents in treating any of the diseases of childhood, and these are amply furnished by ice cream. Because of a pleasant sensation attached to it, many a sick child has been brightened and sustained by utilizing ice cream.

Ice cream is a nutritious food containing from 60 to 80 calories to the ounce, and because it is concentrated and easily digested it serves admirably as a beneficial food for sick children. Ice cream also has some therapeutic value in the treatment of certain pathological conditions. Particular mention should be made of the popular use of ice cream in acute tonsillitis, or in any acute inflammation of the throat. The cold, smooth ice cream slips right down the throat with a minimum of effort. It is soothing. After the removal of the tonsils, ice cream is the one food which is generally prescribed. In acute stomatitis and in many of the other acute infections of the oral cavity, when any food is barely tolerated, ice cream is readily taken. Perhaps the low temperature of the ice cream provides a momentary local anesthesia, or the reason for this food tolerance may be in the fact that ice cream acts as a demulcent.

The soothing emollient effect of syrups or fatty liquid foods in inflammation of the respiratory tract is appreciated by the medical profession generally and by the laity. Such an effect is to be had when ice cream is taken either alone or in combination with cocoa or some such warm liquid. In the treatment of the more common respiratory diseases of childhood, ice cream, either alone or more especially when combined with a warm liquid food, has been very valuable, both as a food and as a therapeutic agent. There seems to be less tendency to vomit with ice cream in whooping cough than with any other food. In fact, I recall many instances of children in the height of whooping cough who have turned away from all foods offered except ice cream, which they took readily and held it down.

I wish to report my observation for eleven weeks during the months of August, September, and October on thirty-five or so malnourished children at the Convalescent Home for Hebrew Children, Long Island. This institution takes care of and treats many of the very badly nourished children sent by the various children's agencies and children's outpatient departments of New York City. The nutrition of most of these children is very poor.

Instead of their usual midafternoon luncheon of milk or cocoa and crackers, these children were given about two ounces of 10-per-cent butter-fat ice cream. This was readily taken by them, with many hints and suggestions to increase the quantity. These observations were interrupted with two periods of five days each, when ice cream with a percentage of butter-fat of 16 per cent was substituted for the usual 10-per-cent grade; that is, a rich ice cream was given instead of the average ice cream. The children were carefully observed for any ill effects, and also if they were reluctant to take the evening meal two and a half hours later, or showed in any other respects that the ice cream interfered in the least with their usual appetite. First, it must be remarked that no child left any of this rich ice cream even for his associates to share. There were no ill effects noted, nor was there any evidence that these children were in any way unfavorably affected by it. As a matter of fact, the children were happier.

The duration of the observation of eleven weeks probably offsets the novelty of having ice cream as a midafternoon luncheon, which after a while was accepted as a routine.

While I do not wish to draw any conclusions from these observations, there is this much that can be said: All the children ate the entire offering of ice cream, containing from 100 to 200 calories of food, the total caloric intake being an increase over that previously taken with the other luncheons. The normal appetite was not interfered with, nor was there any evidence of any ill effects noted. The food was well tolerated and digested, and what is very important, these children thoroughly enjoyed it. More than this cannot be said of any food.

"The experiences of childhood are the memories of future years."

REPORT OF COMMITTEE ON SANITARY CONTROL OF ICE CREAM

RALPH E. IRWIN, *Chairman*

Last year the Committee on the Sanitary Control of Ice Cream indicated that, for the present, attention should be given to the safety and cleanliness of the materials used, the efficiency and condition of equipment in the plant, the personnel of the plant, and the methods and equipment used in the final distribution of the finished product.

During the present year J. H. Shrader and R. S. Craig, Director and Assistant Director, Bureau of Chemistry and Food, Department of Health, Baltimore, published a paper entitled "Cream Quality and Sanitary Control." In this report it is shown that there is no logical reason why milk and cream for the making of ice cream should not meet the sanitary requirements for milk and cream for household purposes.

A. E. Fay and N. E. Olson, Kansas Agriculture Experiment Station, Manhattan, Kansas, published a report in July, 1924, entitled "The Bacterial Content of Ice Cream:" One of the conclusions of this report indicated that it is possible and practicable to consistently produce ice cream containing less than 100,000 bacteria per gram by pasteurizing at 150 ° F. for 30 minutes and by using utensils that have been thoroughly cleansed and steamed.

The committee believes the conclusions in the two reports just cited to be correct and feels that the future growth of the ice cream trade depends upon the use of clean, safe materials.

Many plants making ice cream purchase the materials ready for the mix and are not equipped for the pasteurization of the mix or the proper cleansing of apparatus or containers. This criticism applies largely to small plants. To overcome this criticism, your committee recommends the pasteurization of the mix on the premises. The requirements for pasteurization should not be less than those for the pasteurization of milk and cream for household purposes. Thus, steam or hot water at not less than 180° F. will be available for cleansing equipment. Furthermore, an additional safeguard will be provided by having the manufacturer of the ice cream responsible for the final preparation of the materials used.

The personnel engaged in the preparation of materials and the cleansing of containers should be free from communicable diseases. To this end frequent medical examinations should be made of these employees. While such examinations do not give absolute protection, still the wholesome effect of this precaution is recognized. The committee, therefore, recommends at least semiannual medical examinations of these employees.

Much is being said about the inefficiency of equipment used in the pasteurization of milk and cream for household purposes. This criticism applies equally well to equipment for the pasteurization of ice cream mix. The committee calls attention to the rapid improvement in equipment and the necessity for improvement in existing apparatus and for care in making new installations.

"Caution is the eldest child of wisdom."

THE DAIRY INSPECTOR'S IDEAL

DR. W. G. HOLLINGWORTH, *City Veterinarian,*
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With the increase in production and consumption of milk and its products have developed many problems relating to safety and wholesomeness. In order to satisfy the public as to the purity of milk, reasonable assurance must be given that it comes from healthy cows maintained under sanitary conditions. The responsibility of securing a better milk supply depends upon the activity of the local health departments invested with the authority of selecting milk and dairy inspectors, who ought to be worthy and well qualified. The purpose of milk and dairy inspection is to improve milk supplies and safeguard the public. As rapidly as we can make it known that the milk used in the community is pure and clean, consumption will increase.

The major objectives of a clean, safe milk campaign are: first, to stimulate increased production and consumption; second, to place the responsibility of such production and consumption on the health authorities and dairy inspectors; and third, to assure the public by so doing that they can increase their daily consumption with safety.

To be fitted for the position of dairy and milk inspector, the person must love the work and have a desire to render service honestly and thoroughly, ever remembering that a public office is a public trust. I realize that large milk concerns have done a most laudable work in bettering the milk supply, and a great many cities have done likewise. Today the producers of milk, as a rule, are qualified to furnish a good quality of milk. They are anxious to have the dairy inspector call on them, but they feel that such an official should be an intelligent, honorable citizen, who can give them serviceable advice in regard to their methods and equipment in milk production.

The State sanitary code usually requires at least an annual inspection and physical examination of dairies and herds, and an effort is made to comply with the law. While one examination is of value, the stringency of regulations may be increased at the desire of any local health department in the State. Hence any community may have as efficient dairy inspection as it sees fit. The question is, how much money will a city provide for inspection service?

It is nowadays an easy thing for the producers of a district to know when the dairy inspector is making his rounds, by the use of the rural phones. Inspections should be made at irregular intervals and checked up. Even though milk is to be pasteurized, this process should by no means supersede sanitation.

The great trouble in regard to dairy and milk inspection is too much politics. Laymen are too often selected according to their vote-getting qualities, and in some cases they have no knowledge of the work they are expected to do. The city officials often do not have any conception of the qualifications that a dairy inspector should have; they lack the knowledge that ought to be imparted to them. The public should be shown what efficient dairy inspection means.

A cooperating health officer holds the key to the situation, for as a rule his decision in regard to selecting the inspectors is all that is necessary. Such a person as the head of the health department will act in accordance with an adviser in his department who is proficient along such lines.

A dairy inspector should be thoroughly qualified for such an important position, for judgment means so much to public health. We are living in an age of prevention, and also know that prevention is better than cure. "Public health is purchasable." As clean milk is a necessary food, especially to children, who need it to develop bone, muscle, teeth, etc., we cannot be too careful as to its quality. Care in production is likely to be associated with increased milk consumption.

By education the consumption of milk may be increased. First and foremost, milk must be produced and handled under sanitary measures. Milk is a necessary food and it must be made safe by inspection. If this is done, we may assure the consumers of milk as to its purity and cleanliness.

In dairy inspection good judgment should be first and foremost in the inspector's thoughts. I thoroughly believe in sanitation, and it must be emphasized that there are times when common sense should prevail. We must realize that the producer is the person upon whom the public depends for foods of various kinds, and we must cooperate with him. He is human, as is the inspector. Simply because an unforeseen condition occurs, does not necessarily mean that a milk shipment must stop. Good judgment must be exercised.

My sympathy is with the producer, but I do not allow this to detract from common sense. We must be elastic, so to speak, and we must remember that the producer has many great problems. He must be given reasonable time to comply with suggestions. Our Creator did not accomplish his doings in one day. We must remember that the producer is not the only one to blame for polluted milk, but we naturally look first to the source for trouble. Just because a hurricane happens in a farmer's district and a few milk houses are demolished in a few minutes, to have his milk supply cut off the next morning is ridiculous. To send milk back because it is too warm when it is received at the station, and not his fault, is again unfair, if the producer has lived up to the requirements of his contract. I could go on indefinitely and enumerate many such instances. Getting back at the farmer for anything that goes wrong with milk is too often done. I thoroughly believe in censuring the producer when necessary, but we must remember the basic principle of any business is the golden rule.

The purpose of dairy inspection is to prevent sickness and save human lives, and by its efficiency in accomplishing these ends it must be judged. The sickness of infants is one of the community's accepted standards by which the perfection of dairy inspection service is measured. Our best health departments are constantly checking up the number of infant diseases and deaths that occur. The inspector should be able to render service in case of a milk-borne epidemic.

The operation of local boards of health may include any measures reasonably calculated to promote the health of the community. The department is more likely to keep out of difficulties if it has an efficient personnel. This organization, which is composed of persons who, one would naturally think, are far above the average dairy and milk inspectors, should use its influence throughout our jurisdiction to bring about the selection of well-qualified persons for dairy inspection, and by so doing, put it on a higher plane of efficiency. Educational talks before the public, when possible, may show how public health may be enhanced. A sympathetic public press is very necessary, as by that means many persons may be reached. When you get an intelligent public sentiment aroused, officials are bound to sit up and take notice. A campaign of education should bring results. We must remember that we are not here for ourselves alone, but for others. With that ideal, dairy inspection will be placed in its right category.

I have just returned from the annual meeting of the American Public Health Association, where very eloquent papers were read in regard to public health activities, especially in the Food and Drugs Section, where the ideals of milk production and consumption were emphasized. It was shown that proper methods of dairy inspection had a great deal to do with the decline of infant mortality. It was also shown that the health department must be a leader in better milk production and in the care of milk from the time it leaves the cow until it is consumed. Milk must be made safe by inspection. Seeds of progress must be planted in soil that has been fertilized and cultivated by medical men, veterinarians, and laymen who can qualify in such a paramount undertaking as the production of clean milk.

As the children are our best future assets—the child of today is the citizen of tomorrow—all energies expended on their development are worth while. And this may be aided by competent, honest, and fearless dairy inspection. The inspector should be instructed to use good judgment and to do the right thing at the right time.

"Blessed are the eyes that find the true ideal."

THE FUTURE OF DRIED MILK

ALBERT F. STEVENSON,

New York City

I think we all agree that man has never improved on milk as it comes from the cow. We have found, however, that conditions in our mode of living and in the industry itself have necessitated changes in handling and safeguarding milk in order to supply our communities with this very necessary food substance. These changes have not been brought about easily. Conservatism regarding so important a food is to be in general commended, but unfortunately in some instances this conservatism has been carried to the point of bigotry, and the introduction of important changes has been seriously delayed.

The most conspicuous example of the difficulty of introducing a necessary change in the handling of milk can be studied in the history of the introduction of compulsory pasteurization. For years pasteurization was not looked on with favor by the medical profession, the health officers, milk dealers, or the public in general. As we look back on this experience it is difficult to understand the controversy that was worked up. We must have learned through this and other similar experiences that we have had in the past that the successful officer in charge of milk control must cultivate a mental attitude which is free from prejudice, for to successfully provide a sufficient safe milk supply for all types of communities our preconceived ideals must often be modified beyond recognition. For example, it is generally agreed that milk should be pasteurized but once before it is consumed. I have in mind, however, a community supplied, with the full knowledge of the health authorities, with milk which was pasteurized three times before it was used. I refer to milk shipped by boat to Panama during the construction of the Canal. This milk came from New York and was pasteurized on three consecutive days before shipment. It arrived in Panama in good condition. No doubt the authorities would have preferred a milk pasteurized but once, but had they not allowed this milk to be sold, the fluid milk supply of Panama would have been entirely lacking.

We appear now to be at a point where more radical changes in the industry are about to take place. Our cities are growing, and the seasonal migration of our population is becoming very large. The milk-producing zones encircling our larger cities are continually being forced back, due to the fact that local dairymen are selling their farms and interesting themselves in less strenuous occupations. These changes in our mode of living and within the industry will within a very few years create serious milk shortages in our larger cities similar to those already in existence in many non-dairying sections. A departure from our regular method of handling milk has developed to meet the demand of these communities. I refer to the great advance in the processes of drying milk. The original drying processes were developed to handle skimmed milk which resulted from the manufacture of cream, and which for many years was wasted in great quantities. These processes have been improved from year to year, until now milk may be dried in such a manner that the finished product varies very little in flavor and chemical composition from the original skimmed milk solids. The drying of milk containing butter-fat has presented much more of a problem. It has only been within a comparatively few years that dried whole milk could be successfully manufactured and packed.

It may be well at this point to refresh your minds as to the principal methods used in the drying of both skimmed and whole milk. A great proportion of the dried milk manufactured in this country is made by the spray process. This process consists of atomizing the milk, either in a fluid state or after concentrating, into a current of hot air, so regulated that the moisture is quickly evaporated from the milk, leaving the solids in a finely divided state. There are several modifications of the spray process in use, the details of which do not need to interest us at this time. Milk is also dried in quantity by the roller or drum process. This method consists in spreading milk on the surface of internally heated drums and allowing the heat from the drums to evaporate the moisture from the milk. The dried product is removed from the drum by knives which shave it off in a thin film. This process may be carried on either under atmospheric conditions or in a vacuum. Skimmed milk is also dried by one company by subjecting a whipped concentrated skimmed milk, which is spread on a moving wire-mesh belt, to blasts of heated air until the moisture is removed. This method produces a flake.

Large quantities of dried milk are made each year by these processes. During 1925 there were over 73,000,000 pounds of dried skimmed milk manufactured in this country and almost 9,000,000 of dried whole milk. It is estimated that during 1926 the production of dried skim milk will reach the 100,000,000 mark, and that the production of dried whole milk will exceed 10,000,000 pounds. These figures represent a lot of milk, and mean that a lot of people are consuming milk in this form. Dried milk is now a fixture among our food substances and those of us who are interested in any form of the dairy industry should recognize its value.

Dried skimmed milk, which constitutes the greater portion of dried products made, is of less importance to the health officer and milk inspector than is dried whole milk. Dried skim is used by our leading bakers largely in the manufacture of bread, rolls, and cakes. It not only increases the food value of these products but has the added value of improving their flavor and appearance. Health officers and health inspectors meet dried skimmed milk in the ice cream industry and where reconstructed fluid milk is manufactured and sold.

The sale and use of dried milk containing butter-fat is of extreme importance to the health worker, for this product is sold largely for direct consumption by the people either as a baby food or as a general household supply. This grade of milk can be divided into two classes, dried whole milk and dried modified milk. The modified dried milk is sold almost exclusively as an infant food, and, as its name implies, is simply a milk prepared to some specific formula whereby skimmed milk and sometimes sugar are added, or cream removed from plain fluid milk and the resulting product dried.

Plain dried whole milk is by far the more popular of the two. It can be used by the householder in place of the regular supply of fluid milk and can also be used in the preparation of infant's milk from a doctor's prescription in a manner very similar to that employed with ordinary milk. It is, therefore, most necessary that we give the subject of dried whole milk, dried modified milk, and dried skim milk serious consideration in this organization. It is not possible for each little community to receive dried milk from a nearby drying plant where the local inspector can make visits and have his own particular ideas carried out. Milk will always be dried in areas where dairying is carried on in a large way and by concerns who can afford to equip in a proper manner. It will, therefore, be necessary to have regulations governing the production of dried milk formulated by some national organization similar to ours and enforced by either the national or State departments of food control.

While this industry is in its early stages, it is extremely important that proper regulations be adopted and improper ones eliminated. Fortunately for the consumer, it is not possible to produce a dried whole milk from an inferior milk supply. The milk has to be fresh and of good quality in order to produce a powder which will keep. It will be necessary, however, to make uniform standards as to the chemical composition of the final product. If, for example, it is left for each community to specify the fat content of the powder sold within its limits, it will be almost impossible for the manufacturers to supply all the demands. A uniform fat content should be adopted which will produce for the consumer a fluid milk of standard richness. It will also be necessary to fix the maximum moisture content, so that water will not be sold at the price of milk solids. This latter point, however, with our present knowledge, is of little importance, for a dried milk of high moisture content will not keep, and no manufacturer can produce such a product and continue in business.

From the health standpoint, a few facts should be carefully borne in mind. The quality of the finished dried milk varies inversely with the temperatures used in the drying. In other words, the higher the temperature used, the poorer the quality of the finished product. This means that all manufacturers will attempt to lower the drying temperatures, and no doubt these temperatures will be brought to such a point that they will not insure the destruction of pathogenic organisms during the drying process. Pasteurization should be carried out previous to the drying of the milk, unless temperatures are used during the drying process which will destroy pathogens. These points can be very clearly and easily established, and there will be little trouble in enforcing them.

After the water is removed from the milk solids, there is little that can happen to the product which will make it dangerous for human consumption, unless it is so obviously bad that the consumer will reject it as unfit for use. If the dried whole milk is properly packed, very little if any change takes place in it during a reasonable storage period at ordinary temperatures. Dried whole milk in the past has received some criticism due to the fact that it did not keep properly. As many of you no doubt know, the method of packing has been so improved during the last few years that it is possible to pack dried whole milk so that the butter-fat, which of course is the most delicate ingredient in the product, does not become altered. One of the most common methods of packing, in order to eliminate this deterioration, is the use of an inert gas, such as nitrogen or carbon dioxid, to replace the air in the can. A container packed with dried whole milk and sealed in this manner will hold the contents without change for many months. If, however, the packing is improperly done, the product changes in composition to such an extent that a very disagreeable odor is produced which would immediately cause the rejection of the product by the consumer.

The problems of control of the product both during its manufacture and sale are much fewer than those connected with the production and sale of fluid milk. The manufacture of such a product is going to be limited to fairly large concerns, for the equipment necessary to produce the product properly is expensive. This will mean that there will be comparatively few manufacturing points where inspection is necessary. The chemical composition, of course, can be checked very closely at any time by laboratory analyses. The temperatures and holding time used in pasteurization and other methods employed in handling the product can be controlled by inspection of the manufacturing points by Federal or State authorities.

I do not wish to give the impression that dried milk is going to take the place of fluid milk where fluid milk is available at a reasonable price. I realize that many of you will not be called on to discuss the merits of dried whole milk for some time to come. Those of you, however, who are interested in the feeding and health of communities remote from dairy districts are already interested in this product. Our Florida associates have met it in large quantities, for it was a big seller in that State during the last few years. Many of our northern summer resorts, where temporary congestion of population exists, depend largely on dried milk for general use. I wish to strongly urge that when dried milk does enter your territory you do not make the mistake of considering it a milk substitute. A well-made dried milk when dissolved in water is exactly as good a product, from the standpoint of flavor and nutritive qualities, as is a pasteurized milk. Its economic advantages should insure it a smooth launching. Let us not repeat the history of pasteurization.

I would suggest that this organization, which is of international scope, give serious consideration to the subject of dried milk, with a view of placing before its members all information available on the subject, formulating neccessary regulations for its production, and attempting to have these regulations enforced by national or State control.

"Man must have some fears, hopes, and cares for the coming morrow."

HOW MUNICIPALITIES MAY COOPERATE IN MILK CONTROL

DR. GEORGE W. GRIM,
Ardmore, Pa.

In almost every State, legislation has been enacted authorizing the establishment of local boards of health. In Pennsylvania, as in other States, the local health board is charged by law with the *duty* of enforcing all of the rules and regulations of the State Department of Health. Aside from the *charged duty,* boards of health are empowered to make, adopt, and enforce such additional rules and regulations, of a reasonable character, as are necessary to protect the health of their people.

Various regulations dealing with the sanitary control of milk have been promulgated by State health departments. It therefore follows that one of the many duties that devolve upon a health board is that of exercising sanitary control over the public milk supply.

The character of organization necessary for the proper exercise of sanitary control over the milk supply of a large city with many thousands of people can differ only slightly from the character of organization necessary for the proper exercise of sanitary control over the milk supply of a suburban borough. In the city, the bureau of milk inspection divides its forces, assigning some of its personnel to dairy farm inspection and to the inspection of pasteurization plants, milk wagons, and stores. In the suburban boroughs, which are in a measure dependent upon the city for a portion of their milk supply, the local health board is confronted with precisely the same problems.

Assuming that ample appropriations were available, it does not seem that a suburban health board would be justified in undertaking, alone, a project of such dimensions, which would impose upon the tax-payers added burdens, unless all efforts to effect a cooperative arrangement for financing the project by all neighboring health boards had failed. When a rapidly growing and forward-looking community has exhausted every means at its disposal in its efforts to arouse its neighbors to a realization of the advantages to be acquired by all through a cooperative plan of milk control, and when these efforts have failed, the forward-looking community does well to step forth with its plan for control alone.

Again, it will be argued by those who oppose any well-organized plan of control that adequate control of the city milk supply is maintained through city milk inspection, and in consequence it is unnecessary and a duplication of effort for suburban health boards to concern themselves with the milk supplied the borough from city sources. We need only consider this argument for a moment. It is obvious that an effective system of city milk inspection will prevent the sale of unsafe milk within the city limits. As a result, a market for the unsafe milk will be sought and found in the suburban boroughs and townships exercising no supervision over the milk supplied from city sources. On the other hand, ineffective milk inspection in the city and effective milk inspection in the suburbs will return the undesirable milk to the city markets.

If both the city and the suburbs maintain effective milk control, unsafe milk will have no place in which to hide itself, and this is the ultimate objective to be reached. May its attainment be accomplished by sending forth into the field many separate armies guided by independent generalship and flying different flags, or would it be better to unite the common forces under single leadership with supreme authority to direct the attack? History has proved the wisdom of the latter course. Too frequently, however, either the suburban municipalities or the city fail to recognize their responsibilities to each other in the matter of milk control.

There are some who urge that full responsibility for the enforcement of an effective State-wide milk program be vested in the State Department of Health, with power to administer uniform milk requirements in cities, boroughs, and townships alike, thereby relieving local health departments from all responsibility in the matter. To accomplish this would be a vast undertaking, necessitating the organization of a huge inspection force. It is entirely possible, however, that such a program, if adopted, would be of benefit to certain communities. On the other hand, wide-awake communities, long in the work of endeavoring to maintain the highest standards for their milk supply, would lose much that has been gained.

While the control of the milk supply of the city and its suburbs presents virtually the same problems, a somewhat different problem confronts the rural district or isolated borough. The difference in itself is sufficient to warrant that each be considered independently.

It would seem that both the city and its neighbors, the suburban municipalities, with their independent forms of government and their geographical boundary lines, which frequently separate what is really one community into different boroughs, townships, and counties, would derive a maximum benefit through the inauguration of a unified program of milk control, participated in by all local governments concerned.

Although the practicability of the cooperative plan of control has been demonstrated in several quarters during recent years, there has not as yet appeared any widespread tendency upon the part of large cities to unite with local suburban governments in the exercise of joint milk control. Suburban municipalities, on the other hand, have accomplished much through combined effort and joint control.

The upbuilding of an effective machine, capable of administering effective control on a cooperative basis, requires careful organization. One of the first things to be considered is a method for financing the project. It is obvious that the burden to be carried by the smallest municipality should not equal the burden of the largest. The total collective population of all the municipalities suggests a basis which may be used in arriving at a fair and equitable division of the expense. From the collective total population, the per cent population of each of the cooperative municipalities is readily computed. The figure obtained will represent the proportion of the total cost of the work which each municipality will be called upon to supply. Should additional municipalities join the cooperative association, the added population would tend to reduce the proportional cost to each. Cost reductions made in this way furnish one of the strongest arguments for extended cooperative control.

Having agreed on a method of financing, it is next necessary to create a representative committee consisting of at least one member from each board. Although the health boards cannot delegate any of their powers to such a committee, the committee serves to coordinate the work and in so doing acts in an advisory capacity to the boards on all matters pertaining to milk control. One of the first duties of the committee will be that of securing a competent official to direct the work. When he has been found, the committee will recommend his appointment by the various boards. If appointed, he will be sworn into office independently by each board. The same procedure may be followed in appointing the laboratory personnel and all other members of the organization.

The committee will next conduct a survey of the entire field and later draft uniform milk regulations, recommending them to the various boards for adoption as ordinances. In the meantime, a budget to cover the probable expenditures for the first year will have been prepared and each board advised of its share of the expense. The committee will appoint a disbursing officer, who will pay all bills from a fund obtained by him through monthly advances made by each of the cooperative boards. It is important that a solicitor be appointed to advise the committee upon legal questions and proposed regulations and to assist in preparing cases where prosecutions are necessary.

As the work gets under way, the committee will hold monthly meetings for the purpose of acting upon the monthly reports of its enforcement officers and formulating general policies to be followed in effecting control. The committee should require from both the laboratory and its administrative officer detailed written reports of the accomplishments for each month. The committee should refer to the health board all questions to be acted upon by them, together with suitable recommendations.

The board will realize fully the extreme difficulty it would encounter in arousing public sentiment sufficient to enable it to carry on effective milk work on an independent basis. Each board will naturally be quick to sense the advantages to be gained by acting together. By dividing the expense, each municipality will secure the services of an official especially trained for the work.

When dealing with a group of municipalities, it is important that the administrative office be organized in a way which will enable it to record the actual conditions of the milk supply for each. Applications for milk licenses should be filed by each municipality, the applicant signing an agreement to comply with all the rules and regulations of the board of health. Milk licenses should be issued by each board independently, following approval of the application by the administrative officer. A separate file should be kept for the records of each dairy. Irregularities noted as a result of dairy inspection will call for a letter to the dairy, requiring either immediate correction or correction within a specified time.

In the field the inspector should enter the results of his inspection in a bound notebook, together with any irregularities observed. It is important that notes concerning irregularities observed at the time of inspection be made during the course of inspection. Such notes will be admitted as evidence, should court action result. The field notebook should be used when dictating notices to the dairy relative to irregularities noted upon inspections at hearings brought before the health boards, and when submitting evidence in municipal court. The book may also be used as a guide in preparing the monthly inspection report. Copies of minutes of milk control committee meetings and monthly reports of the administrative officer should be forwarded to each health board.

Results of physical examinations of dairy employees and copies of health certificates issued should be numbered consecutively and filed in order of next due date. A card file of dairy employees by name and according to dairy should also be kept. The same principle should be followed in filing tuberculin tests.

The laboratory should furnish reports of results of examinations of each sample of milk. If the sample is passed, only the routine findings should appear upon the report. If irregularities have been detected of a character insufficient to condemn the sample, the character of the irregularity should be stated upon the report and a written warning forwarded to the dealer setting forth the nature of such irregularity. Carbon copies of warnings should be made and filed. Samples that are condemned will call for prosecution. The more automatic the procedure, the better the results. It should be remembered that for every bottle sampled by the health board, thousands are consumed by the public, and that the chances are the public suffers a good deal more frequently than it is possible for the health board to detect the dealer in wrongdoing. All samples should be purchased, as sold to the consumer, both from retail stores and from wagons.

A spot chart, to be kept at the milk control office, will furnish a current picture of the conditions of the supply. This chart may set forth the name of all dealers and the grades of milk distributed by each. When a warning concerning an irregularity detected as a result of the laboratory examination of milk is issued, a map tack of a color designated for the particular irregularity noted should be placed upon the chart opposite the dealer's name in a column headed by the name of the month during which the sample was taken. Thus, for example, in the October column we observe, in the space allotted to Brown, tacks of three different colors. The blue tack represents samples from the Brown Dairy with high bacteria count; the yellow, samples low in fat; the black, samples containing visible dirt; and so on, with green, red, white, and other color combinations, each a symbol for some irregularity. A glance at the chart will give the comparative standing of the various dealers.

Laboratory results should be posted in a large, loose-leaf ledger. Separate pages may be provided for each grade of milk sold by each dealer. The ledger will serve to furnish complete detailed information of all laboratory findings on any one grade of milk over a period of several years. From this ledger it would be a simple matter at any time to compute averages for each grade. While the system may appear cumbersome, in actual practice it has proved to be quite satisfactory. One employee has succeeded in keeping all records for a milk control office exercising supervision over the milk supply of six municipalities.

But aside from the routine field inspections and the records to be kept in the office, there are certain additional points to be stressed. The first refers to raw milk. In most suburban districts there is a definite demand for milk to be offered raw as well as pasteurized. The magnitude of this demand is such that health boards are compelled to recognize it and in so doing provide suitable regulations to govern the production and handling of the raw milk.

I have no sympathy for those officials who urge the adoption of regulations which prevent the sale of all raw milk except Certified. If they would permit the sale of a certified raw milk produced under the supervision of a voluntary body, the medical milk commission, there is no reason for them to legislate against the sale of a raw milk produced under the supervision of a legally constituted body, the board of health. The trade mark "Certified Milk" carries with it the moral duty of the milk commission to assure the public that all of the requirements set forth in the Methods and Standards for the Production of Certified Milk have been complied with to the letter of the law. Should the commission fail to exact all these requirements, it is entirely possible that the raw milk produced under the direct supervision of the health board will be a safer product than the Certified Milk. Health boards are not authorized to certify milk. On the other hand, health boards will do well to write into their regulations standards for the production of raw milk. Wherever practicable, these standards should be no less rigid than the present methods and standards for the production of Certified Milk. Legislation should not be directed to exclude all raw milk except that produced under the supervision of a medical milk commission, but rather to exclude all raw milk that has not been produced in accordance with certain specific requirements, regardless of the copyright designation "Certified Milk." The health board should never fail to exercise its authority to inspect *all dairies* producing raw milk, regardless of whether the dairies are under the supervision of a milk commission.

The last point is the matter of pasteurization. From a public health viewpoint it is assumed that all milk shipped to a milk plant for pasteurization may contain living pathogenic organisms capable of producing dangerous communicable disease in man. While it can be stated that no epidemic disease has ever been traced to properly pasteurized milk, numerous outbreaks of epidemic disease with deaths have been caused through the consumption of milk supposed to have been pasteurized. Subsequent investigation of the cause of these epidemics have revealed serious errors at the milk plant, which have been responsible for the milk escaping the heat treatment necessary to effect pasteurization. The Committee on Milk Supply appointed by the Engineering Section of the American Public Health Association in a recent report makes mention of some of the defects encountered in all types of pasteurizing machines in present use. The defects enumerated are dead ends, leaky valves, foam, unsatisfactory thermostatic control, unsatisfactory insulation, unsatisfactory covers, and incomplete recording of time and temperature. In its concluding statements, the Committee expresses the belief that health officials are not now possessed of the proper data to enable them to formulate wisely or enforce fairly a proper definition of pasteurization. In the meantime, the health officer must look elsewhere for a definition of milk pasteurization.

The Joint Committee on Definitions and Standards, composed of representatives of the United States Department of Agriculture, the Association of American Dairy, Food and Drug Officials, and the Association of Official Agricultural Chemists revised and amended definitions and standards for milk and dairy products at its meeting, January 18-29, 1926. Apparently this Committee saw no reason to revise its definition for the pasteurization of milk. Accordingly, Food Inspection Decision Number 200, issued by the United States Secretary of Agriculture, August, 1926, defines pasteurized milk as milk which has been subjected to a temperature of not lower than 145° F. for not less than thirty minutes.

The Committee on Uniform Standard Milk Ordinances appointed by the Conference of State and Territorial Health Officers to make a careful study of the milk ordinance which has been adopted as standard by eight States, and to submit a report to the 1926 conference as to whether this ordinance, or any modification thereof, is suitable for general adoption by the State health officers of the United States, presented its report to the Conference in Washington, May, 1926. Among the twenty-five modifications adopted was one which deals with the pasteurizing temperature for milk. In this connection the Committee states in substance that health officials seem to be about equally divided in their support of a temperature of 145° F. and 142° F. The Committee expressed the belief that pending the outcome of further research work a temperature of 145° F. should be required, because this temperature gives the public the benefit of all doubt from a public health standpoint. The revised United States Public Health Service Standard Milk Ordinance, published in the Public Health Reports, July 30, 1926, requires pasteurization at not less than 145° F.

The question to be answered in the discussion of this point is: Are health officials justified in permitting the milk industry to operate their present defective pasteurizers at temperatures lower than 145° F.? We believe they are not, and insist on the higher temperature.

"Light is the task when many share the toil."

SAFE MILK FOR SMALL COMMUNITIES*

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The primary purpose of milk supervision is to insure that an adequate supply of safe milk be at all times available for the public. Nutrition workers recognize that milk is a universal food, essential in building the young and in nourishing the aged and invalids. It forms the principal article of diet for a considerable proportion of our population. In fact, there is no adequate substitute for milk. McCollum states that "one quart of milk daily should be the allowance for every growing child, and that adults would be greatly benefited, physically and mentally, by the drinking of one quart of milk daily."

Considerable progress has been made in recent years in safeguarding the public's milk supply and in stimulating increased milk consumption. This has resulted beneficially from the standpoint of the public health administrator as well as from the point of view of the large milk producer. It is questioned, however, if progress in small communities has kept pace with the notable advances in the large cities.

Several different factors, chiefly economic, have prevented the extension of well-organized milk supervision programs in small towns, although the outlook for the future, due to recent developments in State-wide programs, seems promising. In many of the small places, the amount of milk consumed has been considered too small to justify the overhead expense necessary for the employment of the accepted methods of sanitary control on the part of the town or the milk producer. The facilities of the State have

* Presented in part at the first meeting of the Connecticut Association of Dairy and Milk Inspectors, Hartford, May, 1926.

usually been inadequate to meet the situation fully. In the individual large cities, in contrast, many thousands of people have been involved, thereby producing the demand for shipment of large quantities of milk to central points. Complex problems of transportation and delivery necessitating immediate solution have thereby arisen. Immediate and effective control measures have thus been demanded. The fact should not be overlooked, however, that a very large proportion of our population live in small cities and towns.

All States and many cities have fixed standards requiring a certain percentage of butter-fat and a certain percentage of other solids. Until a comparatively recent time, milk inspection was almost exclusively a matter of detecting adulteration, watered milk being a common form. Vigilance is necessary to see that these standards are maintained, but of equal or greater importance is the supervision of sanitary production. Milk is an excellent medium for bacterial growth and must, therefore, be produced and handled under the most favorable conditions of modern sanitation.

Milk-borne outbreaks in large cities have become rare, and bovine infection has largely disappeared since the introduction of pasteurization by the holding process. In small communities, however, this favorable situation is not so general. In countries such as England and Scotland, where pasteurization is less generally effected, bovine infection is still a menace.

In an address at the Cleveland Academy of Medicine in 1925, Dr. E. C. Schroeder, Superintendent of the Experiment Station of the United States Bureau of Animal Industry, stated that "the frequency with which human beings are attacked by bovine tubercle bacilli, especially children, is too great to permit us to characterize this as a negligible cause of disease among human beings." While it is well known that tuberculosis in cattle may be conveyed to children through milk, it is not always easy to trace infections to that source. For example, in an investigation by the

Connecticut State Department of Health *(Connecticut Health Bulletin,* January, 1925), evidence was found pointing toward infection of four children by drinking raw milk from tuberculous cows. In the case in question, the families affected purchased raw milk from a neighbor who kept about twenty cows and sold most of his milk to a large distributor who pasteurized it before delivering it to customers. Examples of this nature are doubtless more common than is ordinarily realized. As pointed out by Dr. W. H. Park, Director of Bureau of Laboratories, New York City,[1] in every country, according to the amount of raw milk consumed, the amount of bovine infection among the cattle would determine the percentage of bovine infection in human beings. After extended and painstaking research, Park and Krumwiede state that of children under five years suffering from tuberculosis, 27 per cent were of the bovine type of infection; that of tuberculosis among children between the ages of five and sixteen years, 25 per cent were of the bovine type; while the type in adults over 16 years of age was only 1.3 per cent. Of course, the most fatal form of tuberculosis, pulmonary tuberculosis, is usually of human origin, although the amount of general tuberculosis in little infants and the deforming infection of the glands in older children make bovine infection a matter of real importance in estimating what we should do to prevent human tuberculosis. Winslow and Gray have estimated[2] that an *excess* of 25 deaths per 100,000 population indicates the approximate danger from bovine tuberculosis between the ages of one and four years of life.

Considerable evidence is accumulating to suggest that the greatest danger of bovine tuberculosis among children exists in the small communities where requirements of tuberculin testing and of pasteurization are not so completely enforced,

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[1] "Control of Bovine Tuberculosis," *N. Y. Tuberculosis Association Bulletin*, vol. 5, No. 5, 1924.

[2] "Tuberculosis Mortality in Relation to the Pasteurization of Municipal Milk Supplies," *American Rev. of Tbc.*, Vol. 10, Oct., 1924.

in general, as in the large cities. This fact is well illustrated by the results of the Children's Tuberculosis Clinic of the New Haven Dispensary, conducted under the supervision of Doctors Dunham, Smythe, and Goldstein, of the Department of Pediatrics of the Yale School of Medicine. The program of this clinic consists in a careful study of children admitted for supervision between the ages of birth and six years. Special consideration is given to children exposed to tuberculosis, especially infants. The Department of Public Health cooperates in the follow-up of cases and dairies where bovine infection is suspected. The report of the clinic for the year ending July 1, 1926, shows that 353 patients visited the clinic during that period. In 284 instances, the source of contact suspected has been one of human origin, as the father, mother, or other relatives in the family. In 51 instances, the source of contact has not yet been determined. In 18 instances, infection of bovine origin has been suspected.

It is very interesting to note in this connection that among the cases from the city of New Haven, where over 90 per cent of the milk is pasteurized and the remainder is from tuberculin-tested herds, infection of bovine origin has not been suspected. In these cases, it has been possible to prove fairly direct exposure in the home. The cases in which tuberculosis of bovine origin has been suspected have come from outlying communities where raw milk was consumed. Investigation of these dairies has shown that tuberculin testing has not been carried out at all, or only at irregular intervals. In the few instances where the tuberculin test has been applied, reactors have been detected and eliminated. As a result of having found seven children with tuberculosis of apparently bovine origin, the tuberculin test was applied by State officials to two dairy herds supplying milk to the families concerned, and all the cows in these two herds were condemned and slaughtered. Autopsy findings indicated that, with the exception of one heifer, all these cattle were affected. Additional examples of this character might be cited if time permitted. The laboratory work associated with isolation and differentiation of organisms in connection with these cases has not been completed to date, but the other findings are sufficiently striking to deserve mention in connection with this problem.

Tuberculosis, however, is only one of the many diseases which may be spread through the milk route. There have occurred a considerable number of other severe milk epidemics which have been reported in medical and public health journals. Dr. S. J. Crumbine, General Executive of the American Child Health Association, in an address on a campaign for clean and safe milk, delivered at Atlantic City, May 26, 1926, made a careful survey of this situation. Only a few typical examples of epidemics which have appeared in small cities will be mentioned here. In the *Journal of the American Medical Association,* Graham and Golaz, of the Food Laboratories of the State Department of Health of Texas, reported a milk-borne diphtheria epidemic occurring in Austin, Texas, in 1922; 71 cases of diphtheria occurred, 57 being among adults. The source of infection was a milker who had a perforating ulcer of the septum of the nose, from which diphtheria bacilli were isolated. This milker infected a cow, from the udder of which diphtheria bacilli were recovered.

About a year ago, there occurred in Chester, Pennsylvania, 600 cases of streptococci infection, the source of infection being traced to a dairy in which a milker was suffering from sore throat. During the month of August, 1926, in Guilford, Connecticut, a town some twenty miles from New Haven, there occurred an epidemic of sore throat. This outbreak presented many of the outstanding features of other epidemics of septic sore throat. The infection was spread through a raw milk supply which provided two fifths of the milk in the town. The majority of the cases began their illnesses on one of two consecutive days. Altogether, there were some 220 cases, with five deaths. The attack rate among children was comparatively low. The clinical throat manifestations in some cases were very severe, while in others they were mild. Peritonitis was a complication that was very striking, but occurred in only a few cases. A hemolytic streptococcus was found in many throats and also in the peritoneum and blood stream of those who died. As soon as the responsible milk supply was shut off, no more primary cases appeared.

The first outbreak of poliomyelitis definitely traced to milk occurred in Cortland, New York (population approximately 15,000), in December, 1925.[3] Nine cases consumed milk obtained from the same dealer. Seven days before the onset of the first case of this apparently milk-borne series, a boy, 16 years old, who was working on the dairy farm, had become sick with the disease. This boy, in addition to milking cows, carried the milk to the cooler and also assisted in filling the cans from the cooler, thus having an opportunity to infect practically all of the milk produced on the farm.

There is even no absolute assurance that a selected or certified milk supply may not become contaminated by an employee who may be in the infectious stage of some disease. Only two years ago, the New York State Department of Health was called on to assist in the investigation and suppression of an outbreak of paratyphoid fever caused by a milker on a certified dairy farm, who was discovered to be an enteric carrier of *Bacillus paratyphosus B.*[4]

Diarrhea and enteritis are diseases of infancy and early childhood which, in 1923, were the cause of the death of 31,444 children under two years of age in the registration area of the United States; or a rate of 32.4 per 100,000 population at all ages. This rate, indicating an enormous loss of life, has been reduced during the past twenty-three

[3] *Health News*, Jan. 18, 1926.
[4] *Jour. A. M. A.*, Jan. 24, 1925, vol. 84, pp. 251-253.

years from a rate of 108.8 in 1900 to 32.4 in 1923. As emphasized by Doctor Crumbine in his address previously mentioned, while milk cannot be held entirely responsible for this phase of infant mortality, it is repeatedly demonstrated that in those cities where the milk supply is carefully guarded by complete and efficient pasteurization, a definite and immediate decrease in infant mortality from this cause is registered.

The ability of proper pasteurization to protect a city from communicable disease is well illustrated in a number of cases.[5] The experience of Berkeley during the Richmond, California, outbreak of typhoid fever will serve as one example. Geiger and Kelly report that from a certain dairy that employed 20 men and kept 300 cows, Richmond received 90 gallons of milk, which was used by 500 people daily, and Berkeley 600 gallons, which was delivered to 6,000 people. In Richmond, where the milk was used raw, 12 cases of typhoid fever developed, which led to its being promptly withdrawn from the public. In Berkeley, where the milk was pasteurized, not a single case appeared. Here is an example of the same milk from the same source being consumed in one city in the raw state and pasteurized in the other, and while typhoid fever was traced to it in the city where it was sold without pasteurization, it was entirely safe in the other. To pasteurize milk is the only reliable way to prevent it from sometimes becoming the vehicle of contagion.

It would seem that there are two essential features to be considered in an adequate control of the public milk supply: (1) The securing of a high-grade raw product; (2) the proper handling of the product to protect the public from the dangers of milk-borne disease. The meeting of either of these requirements alone is not sufficient, for although pasteurization is one safeguard, it is not a panacea, and it cannot make unclean milk, kept in an unhealthful environ-

[5] *Monthly Bulletin*, Indiana State Board of Health, Feb., 1926.

ment, an ideal food for babies; nor yet will the most thoroughgoing inspection of the farms prevent the occasional infection of an entire supply with the germs of one of the communicable diseases. The following elements are considered desirable in adequate milk control programs, and require for satisfactory execution the employment of trained milk inspectors:

1. An ordinance requiring the licensing of milk dealers and distributors. In framing an ordinance, it is necessary to have clearly in mind what is meant by safe milk. As pointed out by L. C. Frank,[6] representative of the United States Public Health Service in charge of State-wide milk sanitation programs, while the safety of raw milk increases as the precautions necessarily surrounding it increase, no milk, however carefully safeguarded, can be sufficiently safe in its raw state. High-grade raw milk, properly pasteurized or boiled, is safe milk. There are, in general, three different types of ordinances in use: (1) An ordinance requiring all milk to be pasteurized, as in Winona, Minnesota, and Tarboro, N. C.; (2) an ordinance dividing milk into two classes, "raw" and "pasteurized," and limiting the conditions under which each may be produced and sold; (3) an ordinance dividing milk into two classes, "'raw" and "pasteurized," and providing for a number of grades in each class. There is a great lack of uniformity among the regulations which have been adopted in different localities and some of them are entirely out of date. Many of them seem to be transcripts of ordinances in force in other cities placed in the municipal series of laws without regard to local conditions. In general, an ordinance should cover three distinct phases, as indicated by Kelly-Leete:[7] (1) Fraud, (2) disease, and (3) cleanliness in the production and handling of milk. One of the most important considerations must be the reasonableness of the law. "A law

[6] *Public Health Reports*, Nov. 7, 1924.

[7] "Inspection of Milk Supplies," Kelly-Leete, U. S. Dept of Agriculture, Circular No. 276, July, 1923.

which works a special hardship on legitimate industry is not reasonable and defeats its own purpose."

2. Regulations defining pasteurization and requiring the pasteurization of all milk not from tuberculosis-free herds are desirable. By properly pasteurized milk, I have in mind the following definition prepared by the Committee on Pasteurization of the International Association of Dairy and Milk Inspectors and adopted by that Association (Twelfth Annual Report, 1923): "Pasteurization is the process of heating milk to a temperature of approximately 145 degrees F., never lower than 142 degrees F., holding every portion of the milk at that temperature for a period of at least thirty minutes, and then promptly cooling below 50 degrees F." It is also understood that pasteurization is not intended as a substitute for clean production and handling.

It has been stated by Miller that if a dairyman or milk concern handles as much as 300 or 400 quarts of milk per day, pasteurization of that milk will probably not add more than two or three cents to the cost.[8] As a result of practical investigation, this author states as a reasonable conclusion that a safe milk supply is possible for any town consuming 400 quarts of milk or more per day.

Methods of municipal milk control requiring a dairy inspector, laboratory equipment, and laboratory technician for the laboratory check of milk samples are ordinarily beyond the economic means of the town or city with less than 10,000 population. These items were impracticable for Tarboro, N. C., and were properly ruled out of consideration. This community is mentioned because of a demonstration carried on since 1918 of a system for sanitary control of the milk supply in a small town of 4,500 people at the time the demonstration started. Here a municipal pasteurization plant has been operated with apparent success for several years under an ordinance which requires that all milk and

[8] *Public Health Reports*, Dec. 13, 1918, and Nov. 6, 1925.

cream sold for human consumption in the town be pasteurized. The standing of the plant with the public is fairly well indicated by the fact that it has not only successfully weathered all storms and continued to operate throughout four changes of municipal administration, but the volume of business handled at the plant continuously increased up to a few months ago, when one of the producers established his own private plant, which has been operated in accordance with the pasteurizing ordinance under the supervision and control of the Health Department.[9]

Since 1922, an ordinance has been effective in Winona, Minnesota, which requires that all milk sold in this city of 20,000 population be pasteurized, and that it be produced from tuberculin-tested herds that are annually tuberculin tested and physically examined quarterly by a licensed veterinarian recommended by the health officer and appointed by the council. This ordinance also requires that all herds be kept, when confined, in clean barns, well lighted and ventilated, that milk utensils be kept clean and sanitary and be of a type approved by the health officer, and that there be a milk house where milk is cooled to a temperature of 50 ° F., or below, immediately after milking, this milk house being separate from the barn and used for no other purpose.[10]

In small communities where pasteurized milk is not obtainable, this form of treatment may be easily carried out in the home by use of a thermometer and double boiler. Incidentally, here is an opportunity for rendering an important service through the education of consumers of raw milk in the simple methods of home pasteurization. The practice of boiling milk to be used in infant feeding is considered by most pediatricians as desirable from the standpoint of rendering milk more digestible as well as safeguarding against communicable disease.

[9] *Public Health Reports*, Nov. 6, 1925.
[10] *Nation's Health*, April 15, 1926, p. 249.

The diet of infants should, however, always be supplemented by the use of fruit juices or other products containing the antiscorbutic vitamin, whether or not milk is boiled or pasteurized.

3. All herds from which milk is to be sold raw should, according to our present knowledge, be systematically tuberculin tested, with prompt elimination of reacting animals. Tuberculosis eradication is making rapid progress, according to the latest report from the Bureau of Animal Industry of the United States Department of Agriculture. Federal activities in eradicating tuberculosis of live stock have been supplemented by various local agencies concerned. States and counties have increased the number of veterinarians engaged in this cooperative work, and combined State appropriations amounted last year to about seven million dollars, or somewhat more than twice the Federal appropriation for the work. The cost of this type of tuberculosis eradication work is, of course, enormous. In this connection we may well consider the possibilities of the use of the Calmette method of producing immunization in young calves, for the results of this pioneer work seem very promising [11] as a means of preventing tuberculosis in cattle.

4. The inspection of milk-producing farms at least twice a year and preferably oftener is, of course, fundamental for a successful milk control program. The recording of findings on a standard score card is helpful both to the inspector and to the dairyman. Dairy farm inspection is of special importance in those small communities where the bulk of the milk is sold in the raw state and where laboratory facilities are frequently not available. Most States are now fortunate in having well-developed laboratory facilities, primarily to meet the needs of small cities and towns. As many of you have repeatedly suggested, dairy farm inspection has a broader meaning than looking into the dairy barn

[11] *Brit. Jour. Tub.*, 15, 103, 1921, and *Ann. de l'Inst. Past.*, 38, 371 and 399, 1924

and reporting on light, ventilation, and the appearance of walls and ceilings. The personal relationship established between the inspector and dairyman is most valuable, and usually results in education instead of prosecution. Kelly and Leete have well outlined some of the results of modern inspection service. "Proper inspection of dairy farms furnishes evidence of disease in dairy cows and milk handlers. It supplies information regarding water supply and sewage disposal, both important public health matters. It enables the official to judge by personal acquaintance with the dairymen the best means of accomplishing hoped-for results. By means of it he is able to bring about permanently by persuasion what might otherwise be accomplished temporarily only by more drastic methods."

5. Control should be exercised over the pasteurization process and the handling and bottling of milk within all plants by at least semimonthly inspection, by laboratory analyses, and by continuous temperature records by recording thermometers. The accuracy of these recording thermometers should be checked at intervals against similar instruments tested by the Bureau of Standards.

6. Temperature standards (as low as 50° F., in most localities) for milk in transit and held for sale should be established and enforced. Further discussion of this factor is not necessary in this group, which is constantly emphasizing its importance, both from the standpoint of the customer and of the dealer, for the prevention of rapid bacterial growth.

7. Where laboratory facilities are available, milk samples should be collected from all distributors—stores, wagons, shipping stations, and plants—at frequent intervals for chemical, physical, and bacteriological analysis. The laboratory is one of the most important aids of the health officer and dairy commissioner, and is of immense value in the supervision and improvement of milk supplies.

8. Provision should be made, if possible, for medical examination of all handlers of milk which is to be sold raw, and of all handlers of milk after its pasteurization for the early detection of disease carriers and the prevention of communicable disease outbreaks. Were it practicable, it would be desirable for the health officer or dairy commissioner to assemble all persons engaged in the handling of milk at least once a year for the purpose of giving graphic practical instruction in the importance of personal habits in the protection of milk. Producers should be systematically instructed in modern methods of milk production through letters, pamphlets, and personal contact with inspectors.

In conclusion, it may be stated that milk inspection is important to the community for the protection of public health. Responsibility for production and distribution rests on dairymen, milk dealers, and State and local health officials. This fact has been recognized by the Association of American Dairy, Food, and Drug Officials; the Conference of State and Provincial Health Authorities; and the American Child Health Association, in their campaign to "secure for every baby, child, and adult, in America, a clean and safe milk supply." As a rule, milk supervision programs have not developed as rapidly and completely in small communities as in the large cities, due largely to economic reasons and lack of adequate personnel. In certain localities, consideration may well be given to municipal or county control of a central pasteurizing plant, if, and when, as stated by Crumbine, "there is general agreement that the health hazard and the dangerous contamination of milk, either from the dairy cow or from human sources, is so great that some form of pasteurization or sterilization is demanded." Another plan worthy of study is the organization and administration of a milk inspection association similar to that of the Oranges, in New Jersey, which has developed an excellent milk supervision program for five municipalities. The need for expansion of present facilities on a local or State-wide basis is apparent. To be adequate, a milk supervision program must reach from the source to the point of delivery.

"Purpose directs energy, and purpose makes energy."

INDUSTRIAL MILK SERVICE

M. O. MAUGHAN, *Secretary*

National Dairy Council, Chicago, Ill.

Industrial milk service is a new development. It is rapidly growing in importance, great progress having been made during the past two years. Factories, offices, department stores, and many other industrial institutions now serve milk to their employees during working hours, midforenoon, or midafternoon, or both, as well as at lunch time. It can be said that practically all industrial institutions now admit that milk for lunch is a good thing. However, it is recommended that continued and even intensive educational work be carried on with the industrial institutions to influence them to emphasize the use of milk at lunch time even more than at present. It is now possible to secure for use in factories considerable literature and also to secure good speakers and demonstrators from time to time to emphasize the value of a greater use of milk.

The big question with a good many managers now is the value of serving milk at times during the day other than at lunch time. Therefore this paper will deal almost entirely with the value of serving milk in midmorning or midafternoon, or both.

ADVANTAGES

Industrial milk service has practically everything in its favor. Men do not become fatigued so easily when they drink milk. Men are more efficient in their work; there are fewer accidents. Men feel better at the end of the day. Men can better enjoy the time with their families in the evenings.

There are many other advantages in serving milk in factories and other places in industry:

1. Milk helps the employees do their work with *greater ease.*

2. Milk helps the employees do a *greater amount* of work each day, thereby increasing their earning power.

3. Milk helps them work *more regularly,* resulting in larger pay checks throughout the year.

4. Milk helps the employees do their work with *greater accuracy* and *efficiency.*

5. Milk helps build up those who are undernourished, and who should take added nourishment in order to continue their work.

6. Milk *reduces doctor bills* because of improved health.

7. Milk *helps build factory morale,* thereby resulting in the men's developing a better attitude toward their work, with less desire to watch the clock and to slow up and neglect their work when fatigued in midmorning and midafternoon.

8. Milk serves as a *partial protection against poisoning* to those whose work involves handling paints, chemicals, etc.

9. Milk *reduces the number of accidents* because milk steadies the nerves.

10. Milk results in the men's *feeling better* at the end of the day's work, so that they can better enjoy their evenings in recreation with their families.

11. Industrial milk service results in an increased *consumption of milk* in the home, because the message of the goodness of milk is carried home from the factory.

Methods of Serving

There are three principal plans or methods of serving milk in industrial institutions:

Plan 1. Milk Dealer Distribution. This plan consists of the factory giving its consent to a particular milk dealer to go into the factory at a stated period or periods, visiting each worker and offering him a bottle of milk and a straw if desired. Generally the milk dealer collects direct from each worker who takes the milk, but sometimes the management considers it preferable for the milk dealer to keep a record of those taking milk and to hand this report to the manager, who deducts the cost of the milk from the employee's pay check. An example of this type of milk service is found in the Seaman Body Corporation, at Milwaukee, where more than two thousand pints of milk are purchased each day from the milk salesmen as they go throughout the plant.

Plan 2. Factory Employees Distribution. Here the factory buys all milk, paying the milk dealer in one check for the entire amount. The factory then distributes the milk to the employees, using a milk cart or lunch wagon on a definite schedule throughout the plant and serving each man at his post of duty. The money is generally collected for the milk as it is passed out, or by taking a coupon from a coupon book which the employee has previously purchased. Sometimes a punch ticket system is used as a method of payment. In some places the milk service is handled as a part of the plant cafeteria.

An example of this type of distribution is furnished by the International Shoe Company, of St. Louis. This concern operates what they call "tea wagons," which are passed through their factories at ten o'clock each morning by some member of the kitchen cafeteria. Fruit, milk, candies, and cigars are sold. This plan is very popular with the employees. Another example is found in the case of the Imperial Cotton Company, of Hamilton, Ontario. Their house organ makes the following statement:

"The tea wagon, which has become an every-day experience in the mill now, and without which we could not manage, has been taken through every morning and afternoon for about two months. The idea that prompted it was that a five-hour period was a very long one through which to go without a little nutrition. Milk, fruit, tea biscuits, buttermilk, and ice cream are the wares that are sold and anxiously awaited by the folks throughout the plant."

At the General Motors Truck Company at Pontiac, Michigan, they send a cart loaded with milk and fruit throughout the plant shortly after the men begin work in the mornings. This milk and fruit is sold to the men at their machines or benches. This is done because it was found that several of the men were going to work with little or no breakfast, and the management claim they are getting more out of these men since beginning this practice.

Plan 3. The Milk Station Plan. Milk stations are established through the factory and workers are permitted to go to these stations for milk either once or twice a day or even oftener. Generally, straws are furnished so as to eliminate the necessity of using glasses or paper cups, which are objectionable. An example of this type of milk service is found in the Cadillac Motor Car Company, where milk stations are found throughout the plant. Milk, buttermilk, and lemonade are served at cost from nine o'clock to nine fifteen and from three to three fifteen.

Of all methods followed, the one where the milk dealer distributes the milk and collects direct for it seems to me the best.

Only in a few special cases are employees definitely required to drink milk regularly. Some concerns require those who are below par physically to take it regularly while at work. Also, some concerns where the employees work with paints and other chemicals require the employees to consume a certain amount of milk daily. Other than in special cases like these, the drinking of milk during working hours is not compulsory, but is left to the good judgment of the worker.

Before leaving this important topic, it is well to mention the plan followed at the Ford Motor Company. Their plan is unique in that it is somewhat of a combination between lunch service and special service. In this Company, the men work in eight-hour shifts, the lunch period being only fifteen minutes between the fourth and fifth hours. The lunches are brought directly into the factory on several hundred small doubledeck wagons. Each wagon, with a man in charge, is placed at a designated spot just prior to the short fifteen-minute recess period. At a given signal the men drop their work and form a line to get their lunch, which consists of a box with three sandwiches, a piece of pie or cake, and fresh fruit, such as an apple, orange, or banana, with a pint bottle of milk, chocolate milk, or coffee. When the men are through with their lunch, the bottles are returned to the wagon and the waste lunch box and garbage are deposited in a can for that purpose. The men may bring in their lunch if they wish, but they are not allowed to go outside of their particular department at the lunch period. The lunch costs them 23 cents, the milk being eight cents. Over fifty thousand pints of milk are distributed daily.

Time of Serving

The most common time for serving milk in factories seems to be in the midforenoon, possibly around nine thirty or ten o'clock. There are, however, a few factories which prefer serving milk in midafternoon. The afternoon service is the common practice in most of the offices, because workers in offices do not start to work as early in the mornings as do the factory employees, thereby having more time for breakfast. Their fatigue period generally comes about three thirty in the afternoon. A few factories serve milk twice a day, about nine thirty A.M. and again about three thirty.

Survey Conducted

Several months ago we conducted a survey in factories to determine the extent of factory milk service and the general methods followed in handling this service. I sent out a questionnaire, and some of the questions asked were as follows:

1. How much milk is served daily to your employees?
2. What per cent of your employees drink milk?
3. At what hour is the milk served?
4. What is the price to employees?
5. How is the milk served?
6. What is the effect of milk service on efficiency, fatigue, and turnover?
7. What do you consider the ideal way of serving milk to factory workers?
8. Do you think milk service in factories is worth while?
9. Do you think all the employees, or only certain ones, should be encouraged to patronize the milk service?
10. Approximately how long have you had the milk service in your factory?

To these questionnaires I secured a very splendid response. Every factory which reported agreed that the serving of milk was a good thing. A large number of factory managers stated with a decided definiteness that milk service does increase efficiency; that it does reduce fatigue and that it does reduce the turnover. Practically all of them agreed that every employee should be encouraged to take milk because it promoted health, which resulted in the men's earning more money and working to the advantage of all concerned.

All the factory managers stated that the ideal way of serving milk is to serve it in bottles.

Names of Industrial Institutions Now Serving Milk

A partial list of factories, offices, and department stores now serving milk includes the following:

Factories:

The Stanley Works, New Britain, Conn.
The Seaman Body Corporation, Milwaukee, Wis.
The American Foundry and Furnace Company, Bloomington, Ill.
Eli Lilly Company, Indianapolis, Ind.
National Blank Book Company, Holyoke, Mass.
The Viscose Company, Marcus Hook, Pa.
The Chicago & Alton Railroad Company, Bloomington, Ill.
A. G. Spalding & Bros., Chicopee, Mass.
Chase Metal Works, Waterbury, Conn.
The Fiberloid Corporation, Indian Orchard, Mass.
Westinghouse Air Brake Company, Wilmerding, Pa.
Huntington Shoe & Leather Company, Huntington, Ind.
American Woolen Company, Andover, Mass.
H. H. Franklin Manufacturing Company, Syracuse, N. Y.
Milton Bradley Company, Springfield, Mass.
The Imperial Cotton Company, Hamilton, Ontario
A. M. Collins Company, Philadelphia, Pa.
The Winchester Repeating Arms Co., New Haven, Conn.
The Norton Company, Worcester, Mass.
The Cadillac Motor Car Company
The Natonal Cloak and Suit Company
The Eastman Kodak Company, Rochester, N. Y.
Erie R. R. Shops, Huntington, Ind.
Maytag Washing Machine Company, Newton, Iowa

Offices:

The Metropolitan Life Insurance Company, New York City

Goodyear Tire and Rubber Company

The Prudential Insurance Company of America, Newark, N. J.

Department Stores:

Lord & Taylor, New York City

Emporium, San Francisco, Cal.

These are only a few of several thousand industrial concerns that are now serving milk from coast to coast with splendid results. The number of factories starting milk and then discontinuing it is, so far as can be determined, very small.

Testimonials

The following testimonials are rather typical of the attitude shown by practically all the factory managers throughout the country where milk is being served.

The Chicago & Alton Railroad Company, Bloomington, Ill., says:

"With a total force of two thousand employees working at this plant, 70 per cent of these drink their cold milk or milk chocolate each day. We have had this system in effect for a period of two years and during that time the number of employees laying off on account of sickness has gradually reduced to 5 per cent at the present time, as compared with 12 per cent before this system was put in. We are thoroughly convinced that the use of good, wholesome milk by our employees has made it possible to have more men working steadily and has made our employees more healthy and has increased our shop efficiency, and there is no comparison between a steady milk drinker and a nonuser of milk."

The Seaman Body Corporation, of Milwaukee, manufacturers of automobile bodies, employing nearly six thousand men, state:

"We believe in milk in this organization. We have ample evidence that it is the finest thing in the world. It picks up the men during those parts of the day when fatigue wears most heavily upon them. At such times originally the boys would have that droopy feeling, that sinking sensation that would make them eagerly look at the clock and look for soft spots. That is where milk comes in. Along about nine o'clock, midway between breakfast and lunch, the boys get tired, but after a long swig of milk they are ready to fight it out without a let-up until lunch. At four there would be a general let-down period, but milk diverts it. In many cases the boys go to their bottle of milk many times a day."

A statement comes from the Cashwell Runyan Company, of Huntington, Ind.:

"About three years ago," states the manager, "we started serving milk to our employees. We were rather skeptical as to the advisability of the idea, feeling that the employees would not care to purchase, and, further, that it would mean a loss of a great deal of time in distributing it through the factory. Today if we were to attempt to discontinue this plan there would be a general protest throughout the factory. As near as we can figure, 75 per cent of the employees are regular patrons, and we have discovered that in place of losing time it has increased the efficiency of the employees. Milk is served during the morning to the entire plant, including the office, and we cheerfully recommend this plan to any manufacturer."

The Huntington Shoe and Leather Company, Huntington, Ind., through Superintendent Charles Brown, report as follows:

"We are convinced that the efficiency of our men is increased by the use of milk, especially in midmorning. They used to get hungry, to slow up work and to begin watching the clock before the morning or afternoon was half over. Now the minute's respite makes the day seem shorter. The men use less tobacco; they no longer sneak down the fire escapes to buy near beer and soda water, and they have quit seeking out the industrial nurse for such stimulants as hot ginger."

"During the summer of 1921," writes William Dunk, production manager of the H. H. Franklin Manufacturing Company, Syracuse, N. Y., "the factory began an experiment to distribute milk to employees during the working hours. We picked what we considered the best source of supply and contracted for a minimum number of pint bottles of milk to be delivered twice daily, unsold bottles to be returned. Chemical tests of milk from various producers were made at the very start to make sure that the milk to be sold in the Franklin plant was the purest that could be bought. Arrangements were made for refrigerating the milk so that it could be delivered to the employees ice cold.

"Various stations were provided, and from these stations men with small trucks delivered the milk throughout the plant to all employees who wanted it. Incidentally, most of them did want it. The summer of 1921 was a hot one; at times the heat was almost unbearable. We had a heavy production manager of the H. H. Franklin Manufacturing in my mind but that the serving of ice-cold milk to employees during working hours helped to maintain their bodily vigor and render them less liable to fatigue. The milk was on sale also during the noon hours.

"I have noticed that there was actually less absence in the departments where milk sales ran unusually high than in other departments, and the productiveness of these departments seemed to be greater. During the summer of 1921, we had an average of 2,500 employees. Milk sales averaged 2,000 pints daily. On one day over 2,500 pints were sold."

The plan followed by the Milton Bradley Company and the Knox Motors Company, Springfield, Mass., is decribed in Bloomfield's *Labor Digest* as follows:

"These have adopted a plan of serving employees with milk during working hours. At the Bradley Company, the work is under the direction of the service department. The milk is delivered to this department every morning at 9.30 in one-half-pint bottles packed in large tubs with layers of ice over the bottles. At ten, the bottles are placed on a cart and taken to the various departments, where they are delivered with straws to the employees at work. Tickets are collected for bottles delivered. In order to save the daily handling of money by employees and by the boy delivering the milk, strips of tickets (six for 30 cents) are sold to employees every pay day for the following week's service. As many employees take two bottles, keeping one for lunch, no collection of bottles is made until 2 P.M., when the boy goes through the factory again. The plan is reported to be highly successful."

The Imperial Cotton Company, Hamilton, Ontario, whose work along these lines has been mentioned previously, state further:

"All of the food is sold at the lowest possible charge, is of the best quality that we are able to obtain, and is of the nature that contains much nourishment. The receipts have increased considerably since we started out with the wagon, which proves to us that there has been a need for this service, and it is being taken advantage of right freely by those who come without breakfast or with insufficient to tide them over until the noon meal."

A milk clinic is operated by the department store of Lord & Taylor, New York City, so that underweight and poorly nourished employees may be given the benefit of daily supplies of good milk at their expense if they are able to pay, and if not, the company stands the cost.

The work of the Eli Lilly Company, Indianapolis, Ind., is mentioned in *The Nation's Health:*

"An experiment was conducted in cooperation with the Marion County Tuberculosis Association in nutrition classes for underweight workers. Among the other hygienic measures installed to improve the health of the workers was the establishment of milk lunch stations in accessible places throughout the Lilly plant, so that underweight girls might have the opportunity to obtain midmorning and midafternoon lunches conveniently."

The following account of the use of milk by the Eastman Kodak Company, Rochester, N. Y., is taken from the *Kodak Magazine:*

"In our various plant cafeterias and lunch rooms, we consume about 875 quarts of milk daily. A good proportion of this is used for cooking purposes, but the use of milk as a food beverage is decidedly on the increase among the employees. At Kodak Park, just a little less than half the meals served include milk as the beverage. At Hawk Eye and Camera Works, the average is quite a bit higher, running between four fifths and two thirds.

"At Kodak office a small lunch room is maintained, where the office girls are at liberty to prepare lunches for themselves. Also, there are a number of girl employees under medical advice who visit the lunch room daily.

"All milk used in our plants is sold at cost, and everything is done to insure cleanliness and quality."

The Prudential Insurance Company of America, Newark, N. J., requires that "before a person is permitted to return to his desk after an absence for illness, he must pass through the infirmary. Where the illness has been a severe one, he visits the infirmary at regular intervals until he is excused. Should a person be under weight after such an illness or an operation, he receives extra milk and a malt preparation twice a day." [1]

[1] From *The Nation's Health.*

The American Medical Association's magazine, *Hygeia,* states:

"Downtown business houses in Boston are taking up the midsession milk-drinking habit and find that it reduces the time lost through sickness. It started there through suggestions of the heads of departments as a remedy for fatigue and fainting spells of the girls who came breakfastless to work and who lunched on pink drinks and confections. Without any charitable or welfare object, the executives are using it to build up stamina in their workers."

The Emporium, San Francisco, Cal., reports as follows:

"Cold milk and malted milk are served from three to four o'clock every afternoon without charge. The three reasons are: Convalescence after illness, fatigue, and undue loss of weight. Tickets are issued and hundreds of our employees claim they have been benefited."

These testimonials reflect the general attitude of the factory managers regarding milk service.

What the Wisconsin Manufacturers' Association is Doing

Further proof that the factory managers favor milk service and desire a greater consumption of milk on the part of their employees is furnished by the Wisconsin Manufacturers' Association. This organization, in cooperation with the National Dairy Council, is preparing a series of circulars dealing with the advantages of factory milk service and the importance also of a greater use of milk and dairy products in the home. These circulars are placed in the pay envelopes of the employees once each month. Already seven of the twelve have been distributed, with splendid results. Not only the managers, but the employees as well, like the idea. More than one hundred thousand copies of each circular are printed. Many of these are carried home and are read by the entire family, with splendid results. Other State associations are expected to follow.

Should Milk be Given Free or Charged For?

It is the general opinion of factory managers that the ideal way is to charge the employees for the milk. The old statement that nothing is appreciated which is received gratis holds true more or less in the case of giving milk free of charge to the employees. If they pay for it, they appreciate it more, and results prove they stay with the practice better than when the milk is given free. Inasmuch as conditions work out this way with respect to the employees, it is, therefore, a big advantage to charge for the milk because it saves the management a great expense.

Getting Factory Milk Service Started

One of the biggest problems in approaching factory managers is to prove to them that the milk service will be conducted on a strictly business basis, that it will not be handled in a "hit-and-miss" fashion, but that quality, service, and courtesy will be strictly observed, that bottles will be collected promptly and not allowed to accumulate and get broken and become dangerous to the workers as well as detract from the appearance of the factory. Also, it is advisable to assure the management that no high-powered salesmanship methods requiring the time of the factory worker will be used, but that the service will be developed on its own merits. The factory management must be convinced that the plan is simple, that it requires a negligible amount of time, and that it will result in an increased efficiency on the part of the workers.

The factory manager is generally open-minded, and if he can be convinced that the plan is worth trying he will generally try it, but it must be remembered that he wants definite results in the way of increased output and improved health on the part of the workers.

In selling the workmen on the milk service idea, they must be appealed to by letting them know that they can do their work with greater ease if they drink milk, that they will not be so tired at the end of the day, that they will feel better and will be able to work more regularly, thereby increasing their earnings, if they drink milk. The arguments are available and they are absolutely sound and are decidedly convincing when presented properly.

Conclusions

It would seem that industrial milk service undoubtedly has a great future. Past and present experiences indicate that it is an economical measure as well as a health measure. This being the case, it can reasonably be expected that a high percentage of the factories and other industrial institutions in this country will avail themselves of this important service.

"Ability proves itself by deeds."

REPORT OF COMMITTEE ON SCORE CARDS AND THE SCORE CARD SYSTEM OF RATING DAIRIES AND DAIRY PRODUCTS

T. J. STRAUCH, *Chairman*

As this is the first report of the Committee on Score Cards and the Score Card System of Rating Dairies and Dairy Products, the members of the present Committee have deemed it advisable to summarize the views of several of its members.

PROF. A. D. BURKE

"I somewhat doubt the advisability of our dealing directly with and attempting to establish definite standards for dairy products, as I feel this phase largely falls under the jurisdiction of the Dairy Science Association and the different organizations manufacturing those products. While I feel our interest deals chiefly with milk, cream, dairy plants, and the producers' establishments, I grant our right to make investigations and offer suggestions for improvement of score cards wherever we see fit.

"*Dairy Products Score Cards.* It is to be regretted that opinions vary so widely regarding score cards for ice cream. Discussion seems to hinge on the score allowed for bacteria count, one of the chief points on which the interest of our Association should center. A low bacterial content is assumed to indicate care, safety, and sanitation in production and manufacturing; a high count, the opposite. On the other hand, a high bacterial count, if the proper care is used in preparing and processing the mix, may not prove detrimental. We, as inspectors, in our State and city dairy ordinances have established bacterial limits above which we declare ice cream and certain other dairy products to be unsuitable and dangerous as foods. We inspect the plants and guard the product as best we may, yet when an ice cream scoring contest takes place, and I have scored numbers of them, it is interesting to note that the requirement for bacteria is usually much lower than the maximum limit established by law and frequently determines the placing of a higher award for an inferior ice cream than is given one which could be highly desirable from the consumer's standpoint.

"I have known of cases where an exceptionally high temperature had been employed in heating the mix to reduce the count, also extra precautions taken to sterilize equipment. Perhaps from our standpoint this is desirable, as every little bit of "clean up" helps, even though infrequent. On the other hand, one may argue what business it is of ours if the manufacturers of ice cream or scientific authorities wish to set a standard demanding a lower count than our dairy laws provide. I suggest it is our problem; if ice cream to score high must have a much lower count than our standard, then let us raise our standard and require that quality of product all the time. It appears to me that one of several things might be suggested. We might go on record as:

"1. Favoring an increase in the number of bacteria to a figure closely approximating an adopted standard considered reasonable for all commercial ice cream, such as 50,000 or 100,000, and then deducting *heavily* only for those that run above this figure.

"2. Favoring a lowering of the score generally deducted for each increment increase in the bacteria count, so that a high-quality product well within the limits of our dairy law standards would as a rule be placed higher than a product much inferior commercially.

"3. Favoring a lowering of the total score allowed for the item of bacteria.

"Many suggestions present themselves. These are only a few ideas which may stimulate some thought and perhaps argument. Whatever the outcome, we are rightly interested in the bacteria count and health points of all score cards.

"As regards score cards for butter, milk, and cream, I believe these are pretty well established and need no revision. I think they should stand.

"Dairy Barn and Dairy Plant Score Cards. I believe the dairy barn score card established by the Bureau of Dairy Industry to be satisfactory. Criticism of its use all too frequently comes from a lack of common sense in interpreting some of its items. Two years ago I made a rather extensive survey of dairy inspection in the United States. A question was asked: 'Has the score card any value?' The answers indicated the following advantages:

1. Indirectly it assists in classifying and grading milk.
2. It shows the dairyman the chief points to be considered in producing quality milk.
3. 'It puts the office behind the inspector.'
4. It secures uniform results.
5. Milk may be partially paid for on that basis.
6. It has advertising value.
7. It makes neighboring dairymen develop personal pride.
8. It is educational.
9. It furnishes a record of the producer's methods and equipment.

"The disadvantages were not many, although several answers signified it had no value whatever. The chief arguments against the score card were:

1. Different inspectors have different ideas.
2. There is more time put in, in scoring, than the value received.
3. Good milk can be produced in a poor dairy as well as in a good one.

"I hope the use of the dairy farm score card will be continued unchanged. Certainly it has advantages not to be discredited and is a valuable asset to the inspector's records and reports.

"*Buttermilk Score Card.* Good buttermilk possesses the following qualities: It has a mild, clean, acid flavor. It should be viscous and creamy in appearance. After curdling, it should break up readily into a fine, flocculent, smooth, homogeneous mixture which contains no lumps and does not whey off when held in storage at a low temperature for two days or longer. For judging the quality of commercial buttermilk, the writer has prepared the following score card with criticisms of the various items:

Item	*Perfect Score*
Flavor and odor	45
Viscosity	25
Appearance and color	15
Visible dirt	10
Bottle and cap	5
Total	100

"In the first place, the item of flavor and odor has been allowed 45 points because buttermilk is consumed largely for its palatability, medicinal value, and general tasty qualities. Since any undesirable qualities are usually associated with an undesirable flavor and odor, it seemed imperative that this item be given a high rating. Furthermore, bacteria are responsible for the production of the ideal flavor and odor while foreign types of organisms adversely affect this quality. Flavor and odor, therefore, are a partial indication, at least, of the desirable qualities in buttermilk.

"Regarding viscosity, it is readily observed that a lack of this quality is directly associated with wheying off, watery and flat flavor, and a dull color and appearance. A score of 25 was allowed for this item because it was believed that approximately one fourth of the defects appearing in commercial buttermilk are associated with poor viscosity.

"Appearance and color being so closely associated, it was deemed inadvisable to separate the two. As all good buttermilk has a creamy, rich, thick, smooth, soft, velvety appearance, and poor buttermilk a dull, watery, flaky, thin, dead, whitish appearance, it is believed advisable to assign 15 points to this item on the score card.

"The same criticisms for visible dirt and bottle and cap should be considered as are found on the score card for market milk. In the mind of the writer there is no excuse for the sale of buttermilk containing sediment in the bottom of the bottle and much sediment should be considered as indicating carelessness in its preparation."

Dr. J. J. Frey

"I do not believe that inspection can become purely academic, but do regard score cards as a valuable means of recording in a comparative manner the sanitary condition of dairies and dairy products plants and as a means of calling all details to the attention of less experienced inspectors. If, however, the score card is to serve its full purpose and at the same time not be misleading in the meaning it conveys, it must be properly balanced and the relative weights or percentages assigned to the different points on the score card should be in proportion to their importance with respect to some one ideal. This one ideal, I believe, we all agree to be the highest quality in the finished product.

"All points on the score card are therefore to be judged in their relative importance with respect to this one objective of all dairy inspection. This is not the case with the present dairy farm score card. In the first place I believe methods are relatively more important than equipment and to a greater extent than that indicated on the present score card. Also, the present score card appears to give greater weight to the largest or most conspicuous things about the dairy; for instance, the barn and cow. We know, however, as the result of scientific investigation which is gradually permeating among those charged with dairy control functions that the principal source of contamination in milk or its products comes from those articles of equipment with which the milk comes in direct contact, and our own investigations and experiments would cause us to place this source of contamination as constituting in the neighborhood of 90 per cent of all contamination in milk. Therefore, the means by which this contamination is to be prevented, so far as dairy farm and plant score cards are concerned, should receive by far the greater emphasis on any score card.

"So much for the *dairy farm* score card, the requirements of which I feel are very important, and I therefore urge that the foregoing recommendations be given much earnest consideration. I feel that every one of the suggestions is sound.

"For our purposes in California we prefer one type of score card which may be adapted to any class of *dairy products plants*, and we are just now trying out such a score card. This we believe will simplify somewhat and greatly facilitate our work and will serve well the purpose for which it is intended.

"In considering the milk plant score card and creamery score card, there are many indefinite points which arose in the detailed consideration which was given to them at the time a revised score card was designed and there were some points which we believe to be inconsistent, aside from the major objection that the distribution of the relative weights was not in proportion to the relative importance of the various items on the score card. We are now trying out this new score card for plants which has not yet been definitely and finally adopted.

"As to the system of scoring dairy products, there must of course be a separate score card for each class of product. We have used the milk score card recommended by the United States Bureau of Dairy Industry in our surprise scoring contests, of which we hold over one hundred annually and in which products of several thousand dairies are rated. There are some objections, but in the main we have not been able to make any improvement which would not be open to equally serious objections.

"We have been considering application of the five points normally allotted to acidity to other points on the score card, since there has never been a case in the history of milk scoring in this State in which it was necessary to deduct for acidity. We also considered placing samples of each milk in an incubator in a sterile tube and noting the time required to sour, if it eventually sours at all, or if it does not sour, and whether actual curdling takes place by reason of development of acidity, noting the character of fermentation, presence or absence of gas or activities of peptonizing bacteria.

"There has also been some dissatisfaction with the bacteria count scale as applied to raw and pasteurized milk, but on more mature consideration we have come to the conclusion that the present scale is about as good as can be used.

"We have found the system of surprise scoring contests to be of very great and immediate effect in elevating the supply of market milk in communities where the general quality is deficient, and we have also found it the means by which milk may be raised to the highest degree of quality in communities where there is adequate supervision. It is by far more effective and less disagreeable and expensive than ordinary police methods. In publishing the results of our surprise milk scoring contests, we have now adopted the policy of publishing all dairies rating above 95 per cent as a group. The result of this system has been to bring the score, by weighted average of all market milk distributed in the State of California which is now graded, to above 95 per cent.

"The use of score cards on milk and other dairy products at fairs, shows, etc., where prepared samples are invariably submitted, is valuable in educating persons who participate in methods for producing finest quality, but it is open to the serious objection that scores given on these prepared samples do not reflect the usual quality of the milk or products of milk which are so rated. As a matter of fact, some of those who are in the habit of distributing very poor butter in this State have won first place in our contests. The use of the results of these contests in the subsequent advertisements has therefore become a source of misinformation to the consuming public, and I would suggest that this work could be materially reformed if required samples were to be taken by a disinterested agent from those who desire to participate in such fairs, shows, etc."

DR. ROY F. LESLIE

"We use the standard Government score card in Cleveland and find it satisfactory. We, however, made one change, or addition, the adoption of which works out well in practice. This addition to the present score card is known as the 'follow-up system,' which is checked as follows:

"At the time the dairy is scored a note is made on the score card under 'Remarks' of the improvements that are to be made at the dairy. The same notation is also made on the so-called 'follow-up card.' This 'follow-up card' is then left with the dairyman with instructions to sign the same and mail it to the office when the instructions have been complied with.

"The dairy scores as they come in are separated and the ones having a notation on them of needed improvements are filed separately in a 'follow-up' file. From time to time this file is gone through, and scores showing the improvements to be overdue and the card not in yet are removed from the file and a letter written to the dairyman. If a reply is not had in a few days, a second letter is sent out, and if it fails to bring in a reply the dairyman is excluded. These cards save many revisits and put the responsibility definitely on the dairyman, whereas in the old system of writing notices due in so many days, the burden of the enforcement was mostly on the Health Department.

"When the cards come in, a 'R. C.' notation is made, which means 'received card' on a certain date. These cards are then turned over to the inspector in the district where the dairy is located and he visits the dairy at his convenience, at the time of his visit marking the card 'Complied' and mailing it in with his reports, or shutting out the dairy at once if the card has not been complied with."

T. J. Strauch

"We have been using the score card in connection with our dairy farm inspections in Richmond, Virginia, since 1907, and we consider it has been a great factor in improving the milk supply of our city. In fact, after an experience of over twenty years in milk improvement work, I am thoroughly convinced that frequent farm inspections (we inspect our dairies at least once a month) and the intelligent use of the dairy farm score card is the best way of obtaining a good milk supply.

"We have found from experience that milk showing a low bacteria count does not always mean that this milk has been produced and handled under the best conditions at the farm, for in checking up places with low counts we have found in a number of cases that the milk had not been produced and handled under the best sanitary conditions, the low counts being due entirely to the efficient cooling and storage system at the farm. On the other hand, we have had a number of cases where milk was handled at the farm under almost perfect conditions, but when samples of this milk were taken on its arrival in the city, these samples showed upon bacteriological examination very high counts. Investigation showed that these high counts were due entirely to lack of an efficient cooling and storage system at the source of production and not to any lack of cleanliness.

"It has always been our opinion that a liberal provision should be made on the score card for construction of dairy buildings and their equipment, for we have considered the dairy barn a factory in which the most delicate of foods, as well as one of the most valuable and most easily contaminated, was being produced and handled. It should, therefore, be a building so constructed as to be easily cleaned, well lighted and well ventilated. In fact, we think the dairy barn should be so constructed and equipped that we would not be ashamed to take the consumer out in the country and let him see under what conditions the milk he is drinking is being produced and handled. Owners of fine, up-to-date distributing plants in the cities beg the public to visit their establishments, which they consider the last word in sanitation and efficiency; but these firms, as a rule, are not so eager to have the public visit the farms and see the existing conditions under which the milk being sold by them is produced. I know there are a number who think that a very few points should be allowed on the score card for equipment and construction, their contention being based on the fact that trained men have produced high-quality milk by exercising extreme care even amid poor surroundings. In dairy inspection, we are not dealing with the exceptional man but with the average man.

"The present score card allows five points for the tuberculin testing of cattle. As this is a requirement in a number of cities before milk can be sold from the herd, there is a question whether this is not too liberal an allowance for something that is compulsory."

You have heard the opinion of four members of the Committee. The consensus of opinion of the entire Committee is that as this is a very important subject, they are desirous of hearing it thoroughly discussed by members of the Association.

"Read, mark, learn, and inwardly digest."

REPORT OF COMMITTEE ON METHODS OF OBTAINING A SATISFACTORY QUALITY OF RAW MILK FOR PASTEURIZATION

EDITH MOORE, *Chairman*

The questionnaire used last year by the chairman of this Committee covered only the fundamentals of the dairy industry, which are incorporated in most of the laws of our cities, as a working base. This year, with Dr. Harding's suggestions, a questionnaire somewhat broader in scope was prepared, but it has thus far been possible to secure replies from committee members only. As time permits, each State should be surveyed. These members are widely separated, however, and should be considered representatives of their communities.

Answers to the first question, as to the number of pasteurizing plants buying on a quality basis, revealed the fact that in over 95 per cent of the communities represented, milk is purchased on a quality basis. The majority were buying on the percentage of butter-fat.

The practice of grading seemed equally divided between bacteriological and chemical methods, some using sediment testing.

Butter-fat of milk coming into plants varies on the average from 3.4 to 3.8 per cent in most instances, but a few reported an average of 4 per cent. In answer to the question concerning methods used to increase butter-fat content, some of the replies state that a bonus is paid for butter-fat over 3.5 per cent. In a few communities the low-test cows are reported to be eliminated, but in the majority no effort of this kind was reported except to enforce the butter-fat standard. (This seems to be a good place to comment on the desirability of raising our butter-fat standards. In some cities it is difficult to buy milk with more than a minimum butter-fat content.) We know that butter-fat is such an important food that we should endeavor to secure enforcement of our butter-fat standard.

Cleanliness is determined in most part by sediment tests. Reductase tests are next in frequency. These tests coupled with close inspection are reported to have been helpful in increasing the cleanliness of the dairies supplying milk to the pasteurizing plants. It is somewhat surprising to find that in a few instances colon counts are still used.

Keeping quality in many instances is determined by bacteria count and reductase tests, while acidity and temperature tests are also used. (One answer recorded the fact that after the quantity of milk desired for examination was withdrawn, the sample was placed in the laboratory ice-box and held until the sample was acidified or peptonized. The longest time required for this test in one instance was 29 days, the shortest was 11, but the average was between 13 and 20 days.) Methods used to increase the keeping quality in nearly all answers were to maintain inspection and laboratory control.

Tuberculin tests of cows supplying milk to pasteurizing plants are used extensively as additional safeguards. In a number of the localities the tuberculin testing is required only for herds supplying raw milk.

Medical inspection does not seem to be widely practiced and is used only where required by law. That plants should have their own medical inspection to constantly safeguard their employees and milk supply seems to be very desirable and should be more widely adopted.

The employment of inspectors by pasteurizing plants to work in harmony with Health Department inspectors seems to be an excellent means of aiding in the wholesale dairy inspection work. Constant supervision of milk handlers, cows, and the milk itself by systematic inspection and laboratory control is essential.

"Reading maketh a full man."

CERTIFIED MILK

Dr. F. D. Holford, *New York City*

Certified, as applied to milk, signifies that it has the food value of normal four per cent milk, the healthfulness resulting from a careful medical supervision of all animals and men connected with the production and handling of the milk, the cleanliness following careful attention to the condition of the animals and the utensils, and the keeping quality to be expected of fresh milk with a low bacterial content and kept at a low temperature.

The term was first conceived and used by Dr. Henry L. Coit, in connection with a plan brought to the attention of physicians and finally put in operation in Essex County, New Jersey, in 1893.

Certified milk is the product of dairies operated under the direction of a medical milk commission, which body is appointed by a medical society for voluntary service. The milk is designed to fulfil standards of quality, purity, and safety, to insure its adaptability for infants and sick-room purposes. The requirements for the production of certified milk are based on the most advanced clinical requirements, prophylactic science, and dairy husbandry.

The principles involved are cleanliness, caution, and control—cleanliness as applied to everything and everybody, caution as applied by every step in the collection, handling, and transportation of the milk, and control in the contract supervision of the methods of production from the first step until it is delivered to the consumer.

Doctor Coit, being desirous of furnishing the very best milk possible for his patients, originated the plan of medical supervision for milk production. Accordingly, he formed a Medical Milk Commission in Essex County, N. J., and on May 19, 1893, the Commission drew up a lengthy and minutely detailed agreement with Stephen Francisco, of Caldwell, N. J., for the production of milk under the supervision of this Medical Commission. In the year 1906, as there had been several commissions formed in different parts of the United States and certifying to this special milk, they became federated into a national association known as the American Association of Medical Milk Commissions. The American Association made it a fundamental object to bring about uniformity of standards and their perfection. This result has been approximated by the adoption at different times of definite standards relating to the veterinary inspection of herds, the sanitary inspection of employees handling the milk, and the bacteriological and chemical examinations as to quality and purity.

Most of the certified milk produced in this country today is produced according to the uniform standards and methods of this Association. A medical milk commission is appointed by a representative official county medical societ and acts under its auspices and for it, to encourage the production of milk and the highest possible standard of security.

The motives of the commission are disinterested and its members forbid themselves any pecuniary rewards. This Doctor Coit provided for, because, should any member of a commission receive financial remuneration for his services, a weakness might result and destroy the principles underlying the cause of certification of milk. At the beginning, Mr. Stephen Francisco, who was a very close friend of Doctor Coit, was very desirous that the term "certified milk" should not be used by any dairyman who was not producing milk under medical supervision, so he had the term "Certified Milk" trade-marked. Today, any dairyman producing milk under the supervision of a medical milk commission, by the payment of a small fee to the Certified Milk Producers' Association of America, may use the term free of charge.

Before a medical milk commission will certify to the product produced on a dairy, the owner must first meet the requirements as set forth by the commission certifying, which are the same as those adopted by the American Association of Medical Milk Commissions.

Certified Milk, as you all realize, is a raw milk produced under the most rigid methods, and every precaution is thrown around it to protect it from contaminating influences. It is not my object in this paper to discuss the merits of Certified Milk as against those of pasteurized, for I believe that both have their place in the general supply. It is evident that many officials believe that all milk should be pasteurized, and then again there are many of our best authorities and pediatricians who claim that certain cases respond more favorably to raw milk than to pasteurized. Therefore, as long as there is a demand for a raw milk, it behooves us as sanitarians not to discourage or condemn its production, but to encourage and make sure that the methods under which it should be produced are properly and honestly carried out.

The quality of Certified Milk is uniform, due to the fact that the environments which surround the animals are constant day in and day out. Not only this, but the food which the animals receive is of the best quality and no radical or sudden changes are ever made which tend to affect the quality of the milk; in other words, a child fed upon Certified Milk not only receives its milk from the same dairy each day, but also receives the same quality of product. The animals in the herd are tuberculin tested at least every six months, and in most cases the ophthalmic test is applied in conjunction with either the subcutaneous or intradermic. The herds are also physically examined monthly by veterinarians representing the medical milk commissions certifying to the farms, and all cows which are not in a perfectly healthy condition are immediately removed from the herds. As a rule, and I believe that you will concur with me in this thought, men who own or operate certified farms are much more interested in their operation than the average dairymen on market milk farms. They therefore realize the dangers of keeping unhealthy animals in their herds and such animals are immediately removed upon the first appearance of trouble.

The cows in certified herds are kept thoroughly clean and in most cases the hair on the entire surface of the body is clipped from two to four times a year, while the hair on the udders, hips, flanks, and tails is clipped at least once a month. Before each milking the udders and flanks of the cows are thoroughly washed with clean water and then each udder is wiped dry with an individual sterile towel, and the cow, by the aid of throat latch, is compelled to remain in a standing position until after she has been milked. Constant supervision is employed over the health of the employees, and not only must the physical condition of the individual be in a healthy state but at intervals the feces, urine, and blood are examined. Before a new employee is allowed to work on the dairy it is necessary that all of these examinations be made. It is also essential that thorough weekly physical examinations be made of all employees. The reports of the physicians making these examinations should be kept on file at the dairy, so that representatives of health departments and others interested in the production of Certified Milk may have access to the same when making surveys.

It is necessary that the stables be so equipped that the walls and ceilings are tight and smooth and the floors constructed of concrete or some nonabsorbent material. The windows, as well as the interior of the stables, must be kept scrupulously clean at all times and free from any objectionable odors. Only milking cows are allowed in the stables and all other animals are excluded. Only cows with perfect udders are allowed to be kept in the milking herds.

It is necessary that all employees wear clean white suits and caps when milking and bottling and that these be properly laundered. The men doing the milking are required to thoroughly wash and clean their hands after milking each cow. The utensils used in the dairy must be in the best of condition and thoroughly washed and sterilized after each use. After the milk is drawn, it must be immediately cooled to a temperature not in excess of 45° F. and must be kept at this temperature or less until it is delivered to the consumer. It is advisable to use a storage vat at the bottling plant so that the entire milking from the herd can be mixed in the vat before it is bottled. This tends to produce an even butter-fat content. Certified Milk is bottled on the farm where it is produced and no milk from any other source can be handled on this farm. The apparatus used in the handling of the milk must be of the best quality and in perfect condition. The building in which the milk is handled must be of such construction that it can be easily kept clean and free from odors and other contaminating influences. It must be kept thoroughly painted and in the best of sanitary condition. Facilities for the proper cleansing and sterilizing of the apparatus must be provided.

The entire water supply shall be absolutely free from contamination, and shall be sufficient for all dairy purposes. It shall be protected from flood or surface drainage and shall be conveniently located in relation to the milk house. The pastures or paddocks to which the cattle have access shall be free from marshes or stagnant pools, crossed by no stream which might easily become dangerously contaminated. The surroundings of all buildings shall be kept clean and free from accumulation of dirt, rubbish, or animal matter, and the stable yards shall be well drained.

The standards under which this milk is produced require that the top of the bottle in which Certified Milk is placed must be protected by a proper hood which will prevent any contamination of the top and lip of the bottle. After the milk is bottled it is packed in crushed ice and kept in covered boxes until it is delivered to the consumer.

I have merely touched on some of the most essential features in the production of Certified Milk in order to point out the necessity of great care in its production. One can readily see that it is much easier to obtain a uniform quality product from a dairy of this kind than it would be from mass production—so to speak—from many farms. It goes without saying that the rigid methods which have been formulated for the production of Certified Milk have had their influence on market milk dairies. Not only have some of these requirements been placed in milk ordinances for market milk, but some dairymen who themselves have been interested in their operations have also adopted some of the methods used in the production of Certified Milk. The consensus of opinion among many pediatricians and child specialists has been that milk for infant feeding should test as near four per cent butter-fat as it is possible to obtain; therefore, the Committee on Standards of the American Association of Medical Milk Commissions placed in their requirements a four per cent butter-fat, and Certified Milk should be produced as near this test as it is possible to obtain it.

Certified Milk must not contain more than 10,000 bacteria per c. c., and these bacterial counts are made at least once a week. The samples to be examined are obtained from milk which is offered for sale and are taken by a representative of the milk commission. These examinations are made as soon after collection of the samples as possible. Some pediatricians claim that it is just as essential to have milk which is uniformly low in bacterial content for infant feeding as to have it uniform in butter-fat content and total solids.

In July, 1926, there was printed in the *Archives of Pediatrics* an article by Maynard Ladd, M. D., Helen W. Evarts, M. D., and Lucile Williamson Franks, M. D., of Boston, in which these investigators worked out some very interesting experiments on the weight of children who were fed milk, with and without cod liver oil and orange juice.

In these experiments it was shown that the gain in percentage development of young children under observation was greater where Certified raw milk was fed without either orange juice or cod liver oil than it was where pasteurized milk and Certified Milk did have these additions.

In the general conclusions of these investigators, it was stated that the protective properties in Certified Milk against rachitic changes, as shown by radiograph, were clearly demonstrated and dentition developed normally. It is quite possible that the greater efficiency of Certified Milk is due to the more exact and scientific feeding of the cows. It was also stated that in their opinion the highest grades of Certified Milk are sufficiently protective, and a larger use of it in infant feeding should be encouraged by the medical profession.

We all realize that pasteurization is essential in protecting the public health, especially for milk from dairies which do not use the precautions prescribed for dairies producing Certified Milk. The greater percentage of Certified Milk is sold under advice of physicians, and it might be classified as a "medical milk." In addition to the infant consumption of Certified Milk, many physicians prescribe it for invalids and convalescents. There is an unquestionable demand for this grade of milk and statistics show that this demand is constantly increasing.

There must be some merit in Certified Milk, due to the fact that there has been a steady increase in the demand for the past thirty-three years. At the present time, approximately two per cent of the milk sold in the larger cities is Certified Milk. We must also admit that due to the uniform methods under which the milk is produced, to the uniform butter-fat content, to the uniform quality from a bacterial standpoint, and to the uniform quality of the food for the animals, it must have some effect upon the infant which is fed on this product. There is no one who is better qualified to judge the effect of foods on infants than the physicians and pediatricians.

In a recent issue of the *Journal of the American Medical Association,* there appeared a report of an outbreak of paratyphoid fever, alleged to have been caused through the use of Certified Milk. There were fifty cases reported having the disease. The report further states: "Epidemics of infectious disease spread by Certified Milk are extremely rare." Apart from the one here described, I have been able to find only one authentic outbreak caused by Certified Milk since 1893, when the production and sale of Certified Milk had its inception. This excellent record is a great tribute to the medical milk commissions and producers of Certified Milk and is witness to their unremitting efforts to put on sale as safe a raw milk as is possible.

On the other hand, it can be stated without fear of contradiction that no epidemic has ever been traced to Certified Milk where the methods and standards of the American Association of Medical Milk Commissions for the production of Certified Milk have been rigidly enforced. The producers of Certified Milk throughout the United States are more than willing to have every possible safeguard thrown around their product and look to the medical profession, through the medical commissions, to so safeguard their product that it may be as safe as any product handled by human beings.

Occasionally, a milk commission fails to see that the methods and standards are carried out to the letter. Occasionally, a pasteurizing plant fails to properly pasteurize its product. These are not sufficient reasons to condemn either the certified or pasteurized product.

Why should it not be the duty of health officers to assist and help medical milk commissions which are weak to enforce the methods and standards for Certified Milk? They should, and some are doing so.

What the Certified Milk industry needs today is to have the methods and standards of the American Association of Medical Milk Commissions for the production of Certified Milk incorporated in the sanitary code of every State, thereby insuring the enforcement of such regulation by properly constituted health authorities when and where milk commissions fail in their duty. This would make it possible and desirable for health authorities to assist weak commissions or those who are not properly enforcing standards, as well as do away with the friction which sometimes arises between health officers and medical milk commissions.

The most important single problem in the field of medicine at the present time is the combating of malnutrition, which is admitted to afflict one third of all the children in the country. E. V. McCollum says in his book, "The Newer Knowledge of Nutrition," that the vitality of the young depends upon the diet of the pregnant mother. Again: "There can be no doubt that there is great lack of knowledge by the people generally as to the importance of milk and other dairy products in the diet. There is no substitute for milk and its use should be distinctly increased instead of diminished, regardless of cost. If we accept the importance of milk in nutrition, then we should see to it those who need it most shall get that which gives the best result."

While Certified Milk represents only about two per cent of the milk sold on the market in any city where used, yet it behooves us all, as officials, to use our influence for the protection of Certified Milk when laws are being enacted for the betterment of the public milk supply in general.

In conclusion, I believe that every ounce of milk going into the larger cities and many of the smaller cities, except Certified Milk, should be efficiently pasteurized; and that no raw milk unless safeguarded by a medical milk commission should be sold for human consumption. If it is good enough not to be pasteurized, then it should be Certified. I believe, therefore, that Certified Milk is the highest achievement in the dairy industry, since it represents the ideal product which is used to the greatest service of humanity—"the feeding of its future generations."

"How far that little candle throws his beams!
So shines a good deed in a naughty world."

SOME ASPECTS OF MILK INSPECTION PUBLICITY

E. B. Johnson, *Executive Officer,* Board of Health
Framingham, Massachusetts.

It has been tritely said that "advances in health work can be made no faster than we as health officers can lead the people to demand advances." The same statement applies to milk control. Stringent laws passed in advance of public opinion usually lead to an increase in price, a lessened consumption of milk, the enmity and opposition of dairymen, and not only a public lack of support on that one point but a decided public feeling that the board of health is becoming autocratic and has forfeited public confidence in all its work.

When we wish to improve our milk control we must (1) determine what reasonable regulations we must pass, and (2) educate both dairymen and public so that they favor those regulations *before* they take effect. Such regulations must be reasonable; that is, they must be such that both dairymen and public can be convinced that they are both necessary and advantageous and that sufficient time for compliance is allowed. Too often we overlook this fundamental basis by passing laws that are unnecessary or that bring too great a financial burden on the dairymen. No amount of publicity or education will lead to support of such a law, and it will generally be found that reasonable enforcement is impossible. We must build our publicity on the foundation of a reasonable regulation.

Having such a reasonable regulation promulgated, the next step is to educate dairymen and public to favor such a regulation, and this step should be taken before the regulation is formally adopted. The average man (and many dairymen) has accumulated a vast amount of misinformation about milk; that misinformation must be corrected. It does little good to shoot broadside, hit-or-miss, at the subject as in the old shotgun method, or to hit at one particular point.

The true story of the dangers in milk, whence those dangers come, and the relative value of different methods of safeguarding against those dangers must be impressed on the minds of dairymen and public. The average dairyman, the average man of influence in any community, is usually reasonable; when the subject is presented to him properly, he usually takes the proper attitude. But it must be presented to him properly.

There are a number of specific points on which misunderstanding is rife, not only among the public but among dairymen themselves. To most people a "bug" is a "bug"; the bacterial count of milk is a precise, accurate measure of that which is harmful or dangerous in a particular milk. To say that milk A has 7,000 bacteria while milk B has 9,000 shows them at once that milk A is far superior from the safety standpoint to milk B *regardless of all else*. Somewhat allied to this is another misunderstanding: that we can take routine samples of milk, reach down into them, and quickly and accurately identify each individual "bug."

Even in these enlightened days, there are many people (and among them quite a few dairymen) who do not believe in the tuberculin test or any test similar to it. These people believe that by just looking at a cow you can tell whether the animal has tuberculosis, or any other disease for that matter. We talk about the tuberculin test and advocate it strongly, but do we satisfy the public of the *necessity* of it? Do we convince them that the average tuberculous cow cannot be identified by her looks, that we must use a test like the tuberculin test to detect her, or that a few billions of tuberculosis bacilli may be distributed *to them* (the public) before any one knows the cow is tuberculous?

There is probably more misunderstanding about pasteurization than about any other modern industrial process. Somehow or other, almost everyone believes he knows all about pasteurization, about the kind of milk that is pasteurized and its sources, about the process, about the effect on the milk, and about every other point in connection with the process one could imagine. The only trouble is this: about ninety per cent of this information is misinformation, but is thoroughly believed by the public. How many of us try, on a public scale, to correct this information and to drive home to the public the truth about pasteurization?

It is not an indictment of our health agencies that we cannot make the milk industry conform to all this misinformation. It may be an indictment that we have so long allowed such misinformation to spread without strenuous efforts to correct it. It certainly is an indictment if we allow the public to thus miseducate themselves any longer about such an important subject as the milk supply.

It is not necessary to go into the different channels through which the public can be reached. The milk inspector on his inspection trips; personal conferences; addresses to local organizations and to meetings of dairymen; the public press; all these have their own effect and sphere of usefulness and all should be used. The material that is given to the people is more important than the channel through which it is distributed. This is the day of innovations, and the people are beginning to be suspicious of innovations. We need to get down to sound, basic principles that are uncontrovertible, and to instill them into the public mind. When the public knows the basic dangers in milk, and what is necessary to prevent those dangers from becoming catastrophes, the public will demand and get good milk.

On January 1, 1925, the milk supply of Framingham, Massachusetts, was fair. With a population of 21,000, the daily consumption was 7,025 quarts, of which 3,500 was pasteurized, 725 raw from tuberculin-tested cows, and 2,800 raw from nontested animals. The median bacterial count of all milk samples taken during the previous year was 31,000, with the median of five dealers over 50,000. Framingham had for some years had many deaths from nonpulmonary tuberculosis among minors; and from the experience of dealers who had employed the tuberculin test, it was obvious that tuberculosis in cows was a very common occurrence.

It was believed that the consideration of prime importance in connection with the milk supply was the wiping out of this 2,800 quarts of raw milk a day, from untested cows. A regulation covering the subject was prepared, requiring all milk to be pasteurized or produced from cows tuberculin tested under the accredited herd plan. Before it was formally adopted the dairymen were called to a meeting of the Board of Health in a body and the question talked over in detail. The dairymen themselves were asked to set the date when the regulation would become effective and selected January 1, 1926.

Immediately following this meeting, general publicity work was started. Several local organizations were addressed and a series of half-column articles, along the line suggested above, were printed in the local newspaper. These articles were run one a week for two or three weeks, at intervals of about a month. As public opinion became stronger in support of the regulation, they were made to bear on the excellency of milk as a food, with the end in view of increasing milk consumption.

Many of the dairymen were heartily opposed to the regulation at the start, but were convinced of the honesty and fair-mindedness of the Board of Health because of the meeting held prior to enactment and because they themselves were allowed to select the date when the regulation was to become effective. Visits to these dissenting dairymen found them favorable to the Board, although opposed to the particular regulation. With this attitude there was little trouble convincing them of the value of the regulation *to them,* especially as public opinion (and the dairymen respect public opinion) began to be outspoken in favor of the regulation.

Months before the date when the regulation was to become effective, dairymen began to comply with it; in fact, some eighty per cent of those required to make changes had made those changes before October 1, 1925, more than three months before it was necessary! Coincident with this, we began to notice a general improvement in quality, in bacterial count, and in sediment; and at the same time the consumption of milk began to increase rapidly. The following tables and chart will show the changes taking place at this time:

TABLE I

Quarts Sold Daily

Date	Total	Pasteurized	Raw T. B. Tested	Raw Nontested
Jan. 1, 1925..........	7,025	3,500	725	2,800
Jan. 1, 1926..........	8,175	6,260	1915	None
June 1, 1926.........	9,360	7,451	1909	None

TABLE II

Median Bacterial Count

Year	All Milk	Number Dairies over 50,000	Median of Highest Single Supply
1924	31,000	5.	91,000
1925	18,000	0.	46,000
1926 (7 mos.)............	11,000	0.	*32,000

* A new man; one sample only.

TABLE III

Sediment
No. of Samples

Year	Fine	Good	Fair	Unsatisfactory
1925	52	136	37	8.
1926 (7 mos.)..........	79	53	5	0.

The dairymen themselves have become intensely interested in the quality of their product. If we get a sample low in fat, high in bacteria, or only fair in sediment, the dairyman is after us immediately and insists that we go all over his plant with him to find out what is wrong. When the trouble is found, it is removed without any question or delay. The increased sale of milk following the enactment and enforcement of the regulation has convinced the dairymen that production of a high quality product means money to them.

The public also is interested in milk. Almost every day we are called on for information as to some particular dealer's product, or to tell some housewife how to keep her milk. An interesting occurrence was the complaint of a lady that a jar of cream she bought had soured too quickly. It was discovered that she had bought the cream early Monday morning (obviously Sunday's cream), that she had used it for cereal Thursday morning, but that it was sour Thursday noon, and so she called up the Board of Health to know what was the matter with the cream.

This improvement in our milk supply has been brought about with practically no increase in price. Dairymen supplying some ten per cent of the milk raised the price a cent a quart, while 90 per cent of the milk is still sold at the same old price.

We believe that the improvement in our milk supply, backed by both the public and the dairymen and accomplished without friction, has been due to the publicity used. It was not the channels used; it was the material, the avoidance of innovations, the sticking to basic principles which could not be controverted, the presentation of these principles in such a way that the public learned and believed the true story of milk, and the fair, open-handed method of dealing with both the dairymen and the public.

"Self interest, be it enlightened, works indirectly for the public good."

WHAT THE PENNSYLVANIA ASSOCIATION OF DAIRY AND MILK INSPECTORS IS DOING

W. W. WHITE, *Assistant, Division of Milk Control, Pennsylvania Department of Health*

The idea of the Pennsylvania Association of Dairy and Milk Inspectors was first conceived at Washington, D. C., when the International Association of Dairy and Milk Inspectors met with the World's Dairy Congress in October, 1923.

A number of milk inspectors and educational workers from Pennsylvania attending the twelfth annual meeting of the International Association of Dairy and Milk Inspectors met in a hotel room after one of the sessions to discuss some of the addresses that were given. During the conversation, some one suggested that Pennsylvania could have a live milk inspectors' association.

Our State Secretary of Health, Charles H. Miner, was asked to issue a call to all State and municipal employees, educators, research workers, students, employees of any individual corporation, or any other persons interested in the sanitary inspection or supervision of sanitary inspection of dairy farms, milk distributing stations and milk treatment plants, or whose duties included the direction or operation of a laboratory for the analysis of milk or dairy products. Invitations were sent out, and 82 persons attended our first meeting, held January 23-24, 1924, in Harrisburg, when the Pennsylvania Association of Dairy and Milk Inspectors was formed, the constitution and by-laws adopted, and officers elected for the ensuing year. Dr. George W. Grim, a member of this Association, was elected the first President and was very active in making the Association a success.

Five committees of three members each were appointed by the President and made a report at the first annual meeting in 1925. These committees were: Membership, Nomination, Resolution, Pasteurization, and Hygiene and Dairy Methods. At the first annual meeting two additional committees were added, to study "Methods for the Bacterial Analyses of Milk and Milk Products" and "Communicable Diseases Transmitted through Milk." The reports given by the committees have been excellent, showing that much time and thoughtful effort has been given in their preparation. I believe one of the reasons the committees of our Association have been giving such excellent reports is because our Presidents have been very careful in the selection of the chairmen heading the committees and also that the committees are small, usually three to five members. This past year the Association has been able to pay the expenses of the more important committees, which enables them to hold a meeting some time in advance of the annual convention and arrange the material for the report.

The Association has engaged in a large field of cooperation with health officials, milk producers, milk distributors, manufacturers of dairy equipment, etc., and in a score of ways is steadily building to a better understanding of individual responsibility in the production, manufacturing, and distribution of milk and milk products.

At our annual meetings, which have been held in conjunction with the Pennsylvania Farm Products Show in January, we have had in attendance inspectors, health officers, milk producers, distributors, manufacturers of equipment, and others interested in the improvement of the milk supply. Our next meeting will be held in Pittsburgh in January with the Pennsylvania Public Health Association.

Annual reports are published, in which are given the membership, addresses given at the annual meetings, reports of the committees, and instructions in the use of recording thermometers. Each company selling recorders is given two pages free of charge on which to publish the instructions for the use and care of their particular type of thermometer. Milk inspectors and distributors use the annual report as a handbook and many doubtful questions are often settled by reading the addresses.

Fifteen hundred copies were sent out last year to all the members, larger milk distributors, and health officials interested in milk control. Copies were also sent to all the State vocational schools, college libraries, public libraries, and to many foreign countries.

Last year a banquet was held the first evening of the meeting and practically every member attending the convention was present at the banquet. An illustrated lecture on the production of milk in foreign countries was given by a member of the Association.

The results of the work done by the Association are very encouraging. Many municipal boards of health which have been doing no milk supervision work have sent representatives to our meeting and through knowledge gained and associations made have returned and done very creditable work. The municipalities pay the expenses of a representative to our meetings. This enables many to come who could not afford to go to the International Association meetings because of the great distance and expenses which it would entail. However, since the International meeting is held this year in Philadelphia, as Secretary I sent out letters asking our members to attend these meetings. Some of our active members are present.

Our Association has also been the medium through which many milk producers and distributors have been encouraged to produce a cleaner and safer milk. Some of our milk men have been the greatest supporters of our Association and have taken an active part in the program as outlined. Representatives of milk companies are members of our committees and give many helpful suggestions. I believe a State Association which enlists the active support of the smaller milk distributors in the State will do more to promote a better milk supply than any other agency. Our ultimate goal is to have at least one milk distributor present from each municipality at our annual meetings, who will be a pioneer in the production and distribution of a clean, safe milk, and by example show the remainder of the distributors in his community how it can be done.

In this brief statement it has been possible to mention only a few of the most important activities of the Pennsylvania Association of Dairy and Milk Inspectors, but it will be understood that close cooperation between inspectors, producers, distributors, and manufacturers of equipment is the foundation on which the Association is built, and that we are all working together in order to obtain the best possible results.

"Nothing is denied to well-directed labor."

MILK GRADING IN RICHMOND, VIRGINIA

T. J. Strauch, *Chief Dairy Inspector,*
Bureau of Health, Richmond, Virginia

The first steps toward bettering the milk supply of Richmond, Virginia, were taken in May, 1907, when stringent regulations regarding the production and handling of milk were adopted by the Board of Health. An inspector was also appointed at that time to make regular inspections of the farms supplying the city with milk.

After seven years of dairy inspection, our milk supply was in very good condition, and in 1914 we attempted to have all the cows from which the milk supply was drawn tested for tuberculosis and reacting animals removed from the herds. We found that this was not practicable at that time, for if we enforced general compulsory tuberculin testing, we would have a great shortage in our milk supply. In 1915, the situation was this: We had a number of herds that were tuberculin tested and a number of these herds were owned by dairymen who had tested their cows at our solicitation, so in order to reward the dairymen who had rid their herds of tuberculosis, we decided, in 1915, to grade the milk supply of the city and make the tuberculin testing of cows one of the principal requirements for the highest grade of milk.

We required that Grade A milk, whether sold raw or pasteurized, be produced by cows that had successfully passed the tuberculin test. Of course, tuberculin testing constituted only one of several requirements for the production of Grade A milk. As this grade of milk has sold for two cents a quart more than Grade B milk, the dairyman who tested his cows received his reward in increased compensation.

The grades established in 1915 were as follows:

GRADE A MILK

Grade A Raw Milk shall come from cows free from disease as determined by the tuberculin test and physical examinations by a qualified veterinarian, approved by the Health Officer. It shall be produced and handled by employees free from disease, as determined by medical inspection by a qualified physician. It shall be produced under sanitary conditions such that the bacteria count at the time of delivery to the consumer shall not exceed 25,000 per cubic centimeter in the cooler months (that is, from November first to March thirty-first, inclusive) or 50,000 during the rest of the year (that is, from April first to October thirty-first, inclusive). Dairy farms producing this grade of milk shall score at least 80 points on the score card of the United States Bureau of Animal Industry, of which not less than 45 points shall be for "methods."

Grade A Pasteurized Milk shall conform in every respect to the requirements for Grade A Raw Milk. The bacteria count shall at no time prior to pasteurization exceed the limits allowed for Grade A Raw Milk, and the bacteria count when delivered to the consumer shall not exceed 5,000 per cubic centimeter.

GRADE B MILK

Grade B Milk shall come from cows free from disease as determined by physical examinations, of which at least one each year shall be by a qualified veterinarian approved by the Health Officer. It shall be produced and handled under sanitary conditions such that the bacteria count at no time exceeds 250,000 per cubic centimeter. All milk of this class shall be pasteurized under the official supervision of the Richmond Health Bureau, and the bacteria count at the time of delivery to the consumer shall not exceed 25,000 per cubic centimeter. Dairy farms producing this class of milk shall score at least 70 on the score card of the United States Bureau of Animal Industry.

This system of grading our milk supply worked very well until 1925, when the entire milk supply of the city was being produced by tuberculin-tested cows. With the cows in the herds producing Grade B milk free of tuberculosis, the Grade A and Grade B milk was being produced and handled under conditions so nearly the same that we did not think the difference in price being charged was warranted. The only solution we could find was to regrade the milk supply of the city. As the milk sold as Grade B was produced and handled under conditions that compared favorably with, or were even higher than, the Grade A milk of other places, the situation was indeed a difficult one, but the remedy was found in regrading our milk supply.

In our regrading plan, in order to give the milk we had been grading as Grade B the grade we thought it was entitled to, and with the one change of reducing the bacteria requirement from 250,000 bacteria per cubic centimeter to 200,000 bacteria per cubic centimeter before pasteurization, we allowed all the milk that was formerly sold as Grade B pasteurized milk to be labeled Grade A pasteurized milk.

The milk formerly sold as Grade A, with the one change of requiring a butter-fat content of not less than four per cent at time of delivery to the consumer, we called Grade AA. This milk could be sold either raw or pasteurized.

There is also sold in Richmond a special milk known as Guernsey Milk. We required that this milk be produced and handled to conform to all of the requirements for Grade AA pasteurized milk, and in addition must contain not less than 4.5 per cent butter-fat at time of delivery to the consumer and be produced by Guernsey cows as defined hereinafter. This milk is labeled Guernsey AA pasteurized.

The present requirements are as follows:

Grade AA Raw Milk shall come from cows free from disease as determined by the tuberculin test and physical examinations by a qualified veterinarian, approved by the Health Officer. It shall be produced and handled by employees free from disease, as determined by medical inspection by a qualified physician. It shall be produced under sanitary conditions such that the bacteria count at the time of delivery to the consumer shall not exceed 25,000 per cubic centimeter in the cooler months (that is, from November first to March thirty-first, inclusive) or 50,000 during the rest of the year (that is, from April first to October thirty-first, inclusive). It shall contain not less than four per cent butter-fat at the time of delivery to the consumer. Dairy farms producing this grade of milk shall score at least 80 points on the score card of the United States Bureau of Animal Industry, of which not less than 45 points shall be for "methods."

Grade AA Pasteurized Milk shall conform in every respect to the requirements for Grade AA Raw Milk. The bacteria count shall at no time prior to pasteurization exceed the limits allowed for Grade AA Raw Milk, and the bacteria count when delivered to the consumer shall not exceed 5,000 per cubic centimeter.

Grade AA Pasteurized Guernsey Milk shall conform in every respect to the requirements for Grade AA Pasteurized Milk, and shall contain not less than four and five-tenths per cent butter-fat at time of delivery to the consumer, and shall be produced by Guernsey cows as defined hereinafter.

Grade A Milk shall come from cows free from disease as determined by the tuberculin test and physical examinations by a qualified veterinarian approved by the Health Officer. It shall be produced and handled under sanitary conditions such that the bacteria count at no time exceeds 200,000 bacteria per cubic centimeter. All milk of this class shall be pasteurized under the official supervision of the Richmond Health Bureau, and the bacteria count at the time of delivery to the consumer shall not exceed 25,000 per cubic centimeter. Dairy farms producing this grade of milk shall score at least 70 on the score card of the United States Bureau of Animal Industry.

All cattle on dairy farms holding permits to sell Guernsey milk in the City of Richmond, Virginia, must be registered as purebreds in the Herd Book of the American Guernsey Cattle Club; or, if unregistered, must have the general breed characteristics of Guernsey purebreds. No unregistered cow will be passed as a Guernsey cow unless yellow, orange, or fawn is the predominating color of the animal, with patches of white on the body and legs. The nose must be light or flesh colored, and the skin all over the body, particularly inside the ears, must be yellow.

After an experience of eleven years with the grading of our milk supply, we have found it very satisfactory, especially when the different grades are well defined and sufficient funds are available for enforcing the grading system.

In some cities in which the milk ordinance does not provide for different grades of milk, you find the dealers doing their own grading or selling milk under such names as "baby milk," "nursery milk," etc., and charging a higher price for these special milks. This system works a hardship on the honest producer or distributor who actually delivers to his patrons a better quality of milk, for he has no protection from the unscrupulous producer or dealer who may label the milk he is selling as he pleases, where the city has no control over how the milk shall be labeled.

Where a milk supply is graded by city ordinance and the conditions under which the different grades must be produced and handled are definitely defined and the designation of the grade plainly marked on each bottle cap, then the different grades of milk have some definite meaning to the public, as well as being a protection to the producer and dealer.

"Society is built upon trust."

REPORT OF COMMITTEE ON BOVINE DISEASES—THEIR RELATION TO THE MILK SUPPLY AND TO THE PUBLIC HEALTH

DR. C. D. PEARCE, *Chairman*

Since our latest meeting no great outbreaks of disease among cattle, which would have affected our milk supplies, have been reported. However, we should give consideration to a few bovine diseases that, from time to time, may be transmitted through milk from animal to man.

The most widespread of these diseases is tuberculosis. In the control of the spread of tuberculosis through milk there are two methods in vogue, namely, tuberculin testing and pasteurization. Tuberculin testing is aimed at the eradication of the disease among cattle themselves, while pasteurization renders milk safe by destroying all disease organisms that may have found their way into it.

The tuberculin test, however, cannot be substituted for pasteurization. It does aid the Federal and State authorities, who are fighting to eradicate, or at least to control tuberculosis, and it helps to lessen the danger of tubercular infection through milk.

However, most public health workers and sanitarians are of the opinion that all milk should be pasteurized, with the exception of farms producing certified milk, where extreme precaution is taken to prevent the spread of disease through milk.

Where there is a small percentage of tubercular infection in cattle, it is comparatively easy to control this disease with good initial testing and proper quarantine regulations if the necessary funds are available, and thus prevent its spread from infected to healthy herds. Cities located in an area of this kind do not have the same problem as those located in areas where there is a greater infection, and compulsory tuberculin testing does not impose much of an economic hardship on the herd owners. This relatively light infection exists in a great many districts of the United States and Canada.

The problem of controlling tuberculosis in an area where the cattle show a heavy tubercular infection is more complex. Many of these sections are adjacent to large centers of population and the dairymen who are producers of market milk have bought and sold cattle for years, thus spreading the infection until nearly every herd is affected.

A rigid enforcement of the tuberculin test in these heavily infected areas means considerable economic loss to herd owners, and also, unless a sufficient supply of milk is available to take the place of the milk produced by condemned cows, there may be an actual shortage in those communities which draw their supplies from these sections if all of the cattle are tested before the community is prepared. In these areas one test does not free the herd from tuberculosis, and the community, relying on this test alone, has not necessarily safeguarded the public from the disease.

Efficient pasteurization, however, does safeguard the public from tuberculosis as well as other infections that may be spread through milk.

Many small communities have passed ordinances demanding the tuberculin test, while most of the larger cities call for pasteurization. A few demand both. One State, California, as noted last year, rules that all market milk sold in the State must be pasteurized or be produced by tuberculin-tested cows. Since our last meeting two of our larger cities, Baltimore and Chicago, have passed ordinances requiring all herds supplying these cities with milk to be tuberculin tested. In cities of this size this is a considerable undertaking.

A great deal of criticism that is heard from time to time regarding tuberculin testing is caused by a lack of understanding on the part of the dairyman. The dairyman is the man who stands the initial hardship through the loss of condemned cattle. It is, therefore, essential that his cooperation be obtained if the best results are to be forthcoming. This can best be done through education rather than by compulsion.

With the cooperative tuberculin testing being done by Federal, State, and city governments, the future looks bright, and within a comparatively few years we may hope to see the control, if not the eradication, of tuberculosis from our herds.

Every year likewise sees more communities demanding pasteurization. Thus tuberculosis is gradually being eliminated as one of the diseases that may be spread from animal to man through milk.

There is nothing new to report regarding foot-and-mouth disease, except that quarantine placed on those areas in California and Texas where our last outbreaks occurred has been removed. This disease has been reported in Mexico and South America, and, as you all know, is prevalent in some countries of the eastern hemisphere. There is thus a constant danger of its again finding its way to our shores. Our Federal quarantine regulations are very rigid, and it is the hope of all that this disease has been banished from our herds forever.

It may be of interest to the members to know that at the present time there is reported in Sussex County, New Jersey, a disease diagnosed as vesicular stomatitis. This disease is of an infectious nature and the symptoms are somewhat similar to that of foot-and-mouth disease. As far as it is known, this disease is not communicable to man. State and Federal authorities have placed a rigid quarantine over the affected area and it is hoped that the disease will not spread to other sections.

Another malady met with year after year is septic sore throat, caused by hemolytic streptococci. The bovine type of streptococcus is not known to cause this disease, so that when it is spread through milk, contamination undoubtedly takes place from a human carrier. Carriers of this disease, from time to time, do infect the udders of cows, thus spreading the disease through the milk. Such an outbreak was reported from Madison, Wisconsin, last March. The source of the infection was traced to one of the milk handlers on a dairy farm. The milk was found to be the carrying agent. The organism causing this outbreak was recovered from the throat of the carrier as well as from the milk of three cows in the herd. Another outbreak occurred this past summer at Guilford, Connecticut, and although the milk was supposed to be the carrying agent, the records do not show that any of the cows were affected. This emphasizes the fact that milk should be pasteurized and that milk handlers should be healthy.

Trembles, or milk sickness, has been reported in Illinois and adjoining States since the pioneer days of agricultural development. It is now well established that poisoning of cattle through eating a poisonous variety of white snakeroot accounts for at least one form of this disease. It receives its name from the fact that trembling in cattle is one of the prominent symptoms. It is transmitted to man by drinking the milk or eating the milk products from affected cattle. In man the disease is called "milk-sick" or "milk sickness." Milk-sick in man sometimes proves fatal and in case of recovery there is usually a long period of convalescence. In Illinois a few cases in man have been reported during the past year. The cure is prevention, and prevention is through keeping the cattle away from woodland pastures containing the poisonous variety of white snakeroot, especially during the late summer and fall, and not using milk from affected cows. This weed can also be exterminated from the pastures by systematic weeding, and this should be done in August or September, when the flowers are in bloom, and again in October. After the plants have been dried they should be burned.

Our report would not be complete without mentioning the disease known as Bang's bovine abortion. This disease is widespread. It has been thought by some workers that the organism causing this disease was more or less pathogenic to man. Investigations of this disease are now being made, but as there is so little known regarding its transmission to man, a discussion of the subject may well await the results of future study.

The evidence before us today points very decidedly to the fact that our efforts and ambition should be to see that

1. All our dairy herds are free from disease. In this connection emphasis should be placed on the necessity of frequent physical examinations of dairy herds furnishing market milk.

2. To produce and handle our milk supplies in a clean, wholesome manner.

3. To pasteurize our market milk as an added safeguard to public health.

"He who has health has hope, and he who has hope has everything."

DISEASE PREVENTION—MODERN AIM

JOHN F. JOHNSTON, *Inspector of Milk*,
Health Department, Newport, R. I.

It is perhaps no exaggeration to say that in no period of history has the prevention of disease occupied so large a place in the thoughts of every progressive community as at this present day. Functionally considered, this modern aim, which is the greatest outstanding tendency in this time and age, belongs to the activities that care for the public welfare. Public health protection has, however, become so highly specialized and technical that it is almost universally treated in American cities as a separate branch of the municipal administration, with its own organizations and problems. National, State, and municipal bodies cooperate in all cases demanding emergency measures, but the general idea is to depend upon a local body or health department to assume responsibility in the enforcement of all rules formulated for the protection of its citizens against the invasion of contagion.

Disease prevention is the guiding spirit in every branch of an efficient health department, and no bureau of that organization assumes more responsibility in this direction than that having to do with the supervision of milk and milk products. Safe milk is the objective desired by every well-informed health official, and careful observations will prove beyond the question of any reasonable doubt that no disbursement of public funds brings greater return to the people of any community than the money expended for the promotion of health in guarding against possible contamination of the milk supply. The public has always expressed a desire for civic improvements such as good roads, a well-groomed and efficient police force, a splendid fire department, and ornamental buildings, all of which may be important, but it is not easily moved or excited over so prosaic a subject as health.

It is therefore most gratifying to note that in recent years there has been an awakening of public interest in municipal milk supplies because it has been abundantly demonstrated that it is to the advantage of the consumer that he understand the importance of milk as a food and that sanitary safeguards are necessary to the health of all people.

For many years, much important work has been done in improving the character of milk by rigid but impartial inspection. Laws have been enacted by far-sighted health officials, and trained persons laboring diligently in this field have been instrumental in bringing the industry to its present important place in the minds of producer and distributor. There is also an ever-increasing number of consumers who appreciate changed conditions, most of which have been created to the consumer's benefit, not to make life more miserable for him.

In the old days, men equipped with some but not definite knowledge of the requirements for pure milk were sent out to work what were then considered real hardships upon producer and dealer. Conditions found during these early inspections showed very little understanding of sanitary milk production. Stables were small, ill-ventilated, and poorly lighted. Very little milk was properly cooled, and instances are recorded where consumers demanded warm milk because they believed it freshly drawn from the cow. Raw milk was dispensed from unsterilized cans and dumped into uncovered receptacles found on door steps. Dust and dirt raised by passing vehicles added to the sediment already contained in this usually contaminated product.

Pasteurization and tuberculin testing were said to be the fantasies of ultrascientific minds, and it was claimed that they would add greatly to the cost per quart. Little or no examination of the milk was made, as the tax-payer did not sufficiently believe in milk control to provide money and equipment for farm inspection or laboratory analysis. Infants often died from intestinal disorders and the cause was not then known and therefore not guarded against. Adults contracted certain preventable diseases which modern progress has practically eliminated. The afflictions were attributed to miasmas from the soil if not to the will of Divine Providence. Lack of knowledge, ignorance, and apathy were impediments in the way of progress, and the early inspector, blazing the trail for our present highly trained and experienced force was looked upon as an unnecessary evil and therefore despised—despised because he was correcting insanitary conditions and because he was bringing order out of chaos by the establishment of new ideas. The people of that day, and unfortunately some of the people of our day, detest new ideas for two reasons; first, because the new idea compels the ossified brain to try to think—and that is painful—and second, because the new idea threatens established ways and perhaps established incomes.

That the health of any community is dependent, to a far greater degree than is realized, upon the proper safeguarding of its milk supply is evidenced by the remarkably low infant mortality and reduced number of cases of contagious disease obtained in cities where inspection, tuberculin testing, and pasteurization have been adopted by the health authorities. Cooperating with these public agencies will be found progressive milk dealers who have installed at no little expense plant equipment, the object of which is to destroy pathogenic organisms and to render milk safe and satisfactory for the most exacting consumer. These are noticeable points of progress which in the old days seemed impossible of accomplishment. The present time, however, finds the intelligent dealer ready and willing to adopt every preventive measure that will bring health and happiness into the home.

The producer has also observed the trend of progress, and the modern barn, the clean, well lighted and ventilated stable, the prompt cooling of milk, the application of the tuberculin test, and a decided improvement in sanitary methods of production have been the farmers' contribution to the program instituted by the health department for safe, pure milk.

There may be sections where these outlined conditions do not exist, but the time is not far distant when the obstinate, unprogressive producer will find himself standing alone and will be forced to come shamefaced into the fold.

To the pioneers in pasteurization, the world can never be sufficiently grateful. Introduced as it was in the face of marked opposition, ignorance, and prejudice even indulged in by some supposedly well-informed medical men, we find this preventive measure fast becoming universally adopted. Education of those opposed to the system and publication of facts concerning its merits have removed the veil of misunderstanding, resulting in an almost united support from men and women engaged in the medical profession. Pasteurization has long passed the experimental stage, and when preceded by inspection of the product to be processed and accompanied by strict supervision given with a view to prevent subsequent contamination, the system may be regarded as one of the most important sanitary safeguards ever introduced by man for his own protection.

The recognition that much tuberculosis in human beings is of bovine origin laid the foundation for the present widespread application of the tuberculin test as a public health measure. The test, while greatly to be desired, should not be looked upon as a full protection against pathogenic organisms that sometimes inhabit milk. To apply the test to all cattle is a step in the right direction and should be encouraged because of the improvement in herd condition which it brings about, together with the elimination of unhealthy cows. To emphasize the test to the exclusion of pasteurization is a procedure that should be promptly condemned.

In the southeastern portion of the little State of Rhode Island is located the city of Newport, better known to most of you as the "Capital of Vacationland." In 1917, the city was visited by an epidemic of diphtheria, and the source of the infection was definitely traced to several adjoining dairy farms where members of the family suffering from mild cases of the disease were found to be engaged in milking and preparing the supply for market. Only raw milk was sold in the city at that time, and the delivery system was carried out by producing farmers who sold the product from their own and neighboring farms.

Realizing that no system of inspection could guarantee that milk might not become infected at the farm by unrecognized or unreported cases of contagion, the Newport Board of Health took a great step forward in its war for the prevention of disease by making mandatory the delivery of only certified and pasteurized milks. For nearly nine years, these regulations have weathered the storm of adverse State legislation suggested by persons who did not understand the supreme importance of health protection. If successful, this opposition would do a great deal of harm and would negative an established policy that has demonstrated that the prevention of disease is an outstanding modern aim. Several investigations were also ordered by the City Council, but the fearless stand of the Board of Health in insisting that the rulings must prevail, even if disturbing to influential but misguided people, has gradually brought about public recognition that compulsory pasteurization is the desirable treatment for all market milk. Although we have found it necessary to contest frequently but successfully for intelligent milk control, and Newport was the first city in Rhode Island to require pasteurization, it is a pleasure to see that the position maintained and the arguments presented by representatives of our Board of Health have paved the way for other cities in the State to require this process. So successfully has the Newport system been maintained that Statewide laws for the grading and pasteurization of milk and the tuberculin testing of cattle were passed at the last session of the Legislature.

The situation as it exists in Newport today is the result of close cooperation between the producer, distributor, and health official, all working toward a definite goal and united in the belief that the safety of human life takes precedence over every other consideration. Because of the establishment of the new regulations, certain drastic changes were found to be necessary and the suggestions given by the Milk Inspection Bureau have been of considerable value to the producer and dealer.

Ninety-six producers were supplying the city, involving the expense of drivers' salaries, care of equipment, and a duplication of service. Many men dispensing but a few quarts of milk were covering nearly every street in various sections of the city. This antiquated system of delivery has been replaced by one requiring but seventeen wagons or motors having capacity loads and serving the entire wholesale and retail trade.

The milk is collected at the farms by huge motor trucks. The process of pasteurization is started immediately upon their arrival at the plants and within a comparatively short time after the milk has been produced in the country. Only positive systems of holding are permitted to be used and each holder is equipped with a recording thermometer. A spare thermometer is required at each plant for emergency purposes, as it has been found that if broken, considerable time is consumed in repairing and the charts are not filed as required each week. All milk during the process of pasteurization is held for a 30-minute period at 145° F. and immediately cooled to a temperature below 50° F. Surface coolers are protected by tight-fitting shields unless contained within a dust-tight room especially provided for this purpose. After the cooling process has been completed, the milk flows into rotary fillers and the bottles are filled and capped by machine. The filled bottles run on conveyors into a cold room where a temperature of 40° F. is maintained at all times. Semiannually, every person handling milk is required to visit the office of the Health Department, where a thorough physical examination is given by the physician to the Board of Health. Samples are collected from sterile bottles, cans, and the raw and finished products. For 1925, the average butter-fat content of 3,600 samples was 3.89 per cent and the average number of bacterial colonies found was 15,550.

Among the five pasteurization plants which have been constructed and equipped under the supervision of the Milk Inspection Bureau may be found one that is owned and operated by milk-producing farmers. This organization is mentioned because it is one of the few successfully conducted cooperative milk plants in the United States. Three dairies serve the city with certified milk and cream.

We believe that the problem of a safe milk supply has been solved to the satisfaction of the men interested in the milk industry, and above all to the practicing physician. The producers enjoy more comfort, the distributors have more confidence, and the consumers are receiving in sterile, mechanically sealed bottles, a perfect food at a very reasonable cost.

By their strict application, our regulations in force since 1918 have been the prime factor in a marked reduction of contagion and infant mortality. So striking are the results that they are outstanding when compared with the reports from other cities in the United States. During the eight years before pasteurization, 68 infants died from gastroenteric disorders as compared with only 18 for the eight-year period of its enforcement. For the past four years, there have been no infant deaths from this cause. In addition to this amazing achievement, which has had the effect of stimulating the public mind to the need of pasteurization, our local physicians take great pleasure in announcing an almost entire elimination of glandular diseases which in the past had been produced by tuberculous infections. These facts have conveyed to our citizens a message worthy of the widest attention. Confidence in the milk supply is expressed by an increase of 1,350 quarts in the average daily consumption for 1925, and so far this year an additional increase in the use of dairy products has been observed.

What has been accomplished in Newport can be realized by any city of corresponding population. Just as the human race discovered, one at a time, the implements wherewith it was enabled to cope with the marauding animals of the forest, so it now develops, one at a time, weapons against all disease to which the flesh is unfortunately heir. Wherever we find municipal authorities with sufficient courage to insist upon tuberculin testing, health certificates for milk handlers, rigid inspection of raw and finished products, exacting sterilization of equipment, and supervised pasteurization, health conservation is particularly noticeable. These are highly desirable prevention measures. The application of preventive principles must obtain in the milk industry as fully as in modern medicine. Control of communicable diseases was historically the first activity of organized health agencies. It is still the important function of the department of health and the predominating or sole activity of any milk inspection bureau. It cannot be denied, therefore, that the greatest outstanding aim in the practice of our profession as guardians of market milk supplies should be the elimination of communicable diseases which are transmissible through the medium of infected milk.

"The greatest results of life are obtained by common sense and perseverance."

THE SUPPRESSION OF TUBERCULOSIS OF LIVE-STOCK

DR. J. A. KIERNAN

Chief, Tuberculosis Eradication Division,
Bureau of Animal Industry,
Washington, D. C.

The live-stock owners of the United States, in cooperation with the live-stock sanitary officials of the various States and the Federal Bureau of Animal Industry, have been engaged for a period of eight years in an effort to control and eradicate tuberculosis of live-stock.

For many years prior to 1917 the leading veterinary authorities of our country watched with much apprehension the spread of infection from herd to herd, from county to county, and from State to State. They were eager to attack the problem many years ago, but could not obtain the necessary support and funds. They did not sit idly by, however, for they expressed their knowledge of the conditions which threatened our live-stock industry on platform and in bulletins, advocating the necessity for taking up arms against such a formidable foe as tuberculosis, lest the time should come when it would have gone beyond the possibility of control and eradication. State and Federal authorities pointed out many years ago the necessity for inaugurating such a campaign as was launched in 1917. Progress has marked the steps of the work from year to year, and in a later paragraph the speaker will endeavor to show that substantial progress has been made and is now being made. In this brief paper it will be my purpose to omit many of the phases of the work that are so well known to you, and that have been so often repeated, in order to afford time to bring up some of the present phases, and the problems that are being encountered. It is unnecessary to explain to an audience of this class the meaning of an accredited herd, area work, or modified accredited area. Others will speak of the combination test and of the many problems encountered daily by the veterinarians who come in actual contact with the live-stock owners in the field, and upon whom the great responsibility of the work rests. It will be my endeavor to point out the importance of the work from a national standpoint.

The National Problem

In all live-stock disease control work in the United States that has been performed since 1884, the Federal Government has assisted the various States in conquering outbreaks of an infectious or contagious nature. It is well and proper that the Federal Government should assist the States, for, should any infectious or contagious disease become so widespread in any State that it would go beyond the possibility of control, it would be as great a menace to the sister States as to the one particularly involved. While each State is sovereign in itself, there is that freedom of movement of man and animal interstate that virtually ignores interstate lines to all intents and purposes; therefore, a live-stock infection in any State is a menace to the whole nation and the general public is interested in it and has always supported measures and provided funds to permit the Federal Government to assist the States. There have been various outbreaks of foot-and-mouth disease during which the State and Federal governments have always worked as a unit, fighting side by side in conquering the common foe; likewise in other diseases. At no time, however, in the history of the country have the forces worked more closely together than in this campaign. The live-stock owners of the country have watched this team-work and the success that has been obtained up to the present time, and are encouraging the continuance of the amalgamation through the consummation of the work.

Economic Importance

It was estimated in 1917 that tuberculosis was causing a loss of approximately forty million dollars per annum, and that each year the disease was neglected the losses were increasing. Suppose no steps had been taken to check the progress of the disease. What do you suppose would be the condition in 25 years? There is no doubt that the disease would spread into every community in the nation, and would involve a high percentage of the herds in each State. This thought was gleaned from the spread of the disease in some of the older States, where it is known to exist in at least fifty per cent of the cattle. No one can calculate what such a condition would mean economically to the United States. It could not be figured in hundreds of millions of dollars; therefore, the effort put forth and the funds expended, even admitting that they are great at this time, are infinitesimal compared with the tremendous losses that would have followed had the disease been neglected. It will probably require one hundred millions of dollars or more to eradicate tuberculosis in the United States or to reduce it to less than one half of one per cent, but in our judgment no better investment could be made, because it would be an assurance of better live-stock, more food, beef and milk, for our ever-increasing population. And it means more than this; it means a pure, wholesome, untainted food supply free from the infection that has made the whole world weep—the infection of tuberculosis—the "great white plague."

Public Health Aspect

As live-stock workers, desirous of rendering service to the great industry in our particular capacity—disease control, our aspirations have been, are now, and ever will be in these United States to keep our live-stock free from the infections that cause death, debilitation, lack of production, and loss to the owner. We have ample grounds upon which to predicate our work from the economic importance of controlling diseases of live-stock, and it was on that program that the tuberculosis campaign was inaugurated. However, there is another aspect to the subject that is at least of equal importance, if not greater, and that is the public health aspect. It was believed for a number of years before Professor Koch stated that there was no danger of transmitting tuberculosis from animal to man, that it was necessary to control this disease because it was communicable to human beings. Upon that platform the Federal Meat Inspection was inaugurated about 1892 (that was 14 years before the Federal Meat Inspection Act was enacted in Congress). The Chief of the Bureau of Animal Industry, at that time Dr. D. E. Salmon, saw plainly that in order to protect consumers of meat products from infection of diseases transmissible from animal to man, it was necessary to make post-mortem examinations on all animals slaughtered for food. His jurisdiction at that time was rather limited, but he established inspection in many parts of the United States, which gradually expanded until the Act was passed by Congress in 1906. Doctor Salmon was one of the veterinarians who took issue with Doctor Koch regarding the relationship of animal tuberculosis to man, and in a bulletin published by him soon after the Conference at London he pointed out the danger, and insisted upon the necessity of meat inspection as a safeguard for public health. Much could be said relative to the transmissibility from animal to man of tuberculosis, but time will not permit a lengthy review of work done by many investigators throughout the world. It is believed proper, however, to call to your attention the most excellent report made to the Medical Research Council of Great Britain by Dr. A. Stanley Griffith, Pathological Department of the Field Laboratories, University of Cambridge. This article, entitled "The Danger of Tuberculous Milk," being one of the most comprehensive papers on the subject, I take the liberty of reading it to you in full.

THE DANGER OF TUBERCULOUS MILK*

By A. Stanley Griffith, M. D.

There is general agreement among medical and veterinary men that the milk of cows with clinically recognizable tuberculosis, either of the udder or of the internal organs, ought not to be used as food. Such milk is liable to contain large numbers of tubercle bacilli, and as an article of diet is a source of grave danger both to man and the domesticated animals.

Medical opinion is, however, not unanimous upon the desirability of attempting to eliminate all tubercle bacilli from milk.

It has been suggested on purely theoretical grounds that the ingestion of small doses of living bovine tubercle bacilli in milk might protect children against serious infection from human sources. According to this hypothesis the complete eradication of cattle tuberculosis might deprive the community of a safeguard and might lead to an increase in the ravages of the human tubercle bacillus.

* Report to the Medical Research Council, from the Pathological Department of the Field Laboratories, University of Cambridge.

I should like to point out that the results of investigating human tuberculosis lend no support to the conception that the bovine tubercle bacillus exerts so favorable an influence. The actual figures show that the bovine tubercle bacillus is a menace to the community and a cause of suffering and death in children.

At the National Milk Conference held in London in 1922 I gave the results to that date of investigations made to determine the relative proportion of bovine to human infections in different varieties of human tuberculosis. These investigations showed conclusively that a considerable amount of human tuberculosis is caused in this country by the bacillus of bovine tuberculosis, especially in children under five years of age. The bovine tubercle bacillus was found in all the chief clinical varieties of tuberculosis, and in many cases of fatal general tuberculosis. The proportion of bovine to human infections was highest in children under five years of age, and in those forms of tuberculosis which affect primarily the mucous membrane or the glands of the alimentary tract.

The age incidence and anatomical distribution of the disease clearly pointed to cow's milk as the source of infection with bovine tubercle bacilli.

Table I, which gives the percentage of cases infected with bovine tubercle bacilli (a) in children under five years of age (b) in persons at all ages, shows at a glance the extent of the danger arising from the consumption of infected cow's milk revealed by these investigations.

I have continued my investigations of the subject and during the years 1922-23-24 I have examined material from forty-five persons suffering, except in four instances, from surgical forms of tuberculosis. The majority of these cases were under the care of Sir Henry Gauvain, to whom I am greatly indebted for his cooperation in my inquiries.

In Table II the results of the investigations of these forty-five cases are summarized.

TABLE I

Compiled from Royal Commission on Tuberculosis Reports and Papers Published by A. Eastwood and F. and A. S. Griffith.

Variety of Tuberculosis	Number of Cases	Percentage of Cases Infected with Bovine Tubercle Bacilli: Under 5 yrs. of age	All Ages
Cervical gland	125	85.0% of 20 cases	48.0%
Lupus	140	66.0% of 50 cases	51.0
Scrofulodermia	52	58.3% of 12 cases	38.4
Bone and joint	514	30.2% of 96 cases	19.2
Genito-urinary	21	....	19.0
Meningeal	12	....	16.6
Pulmonary	275	....	1.1
Post-mortem cases, children under twelve (L.G.B. series).......	113	21.3% of 61 cases	17.6
Post-mortem cases in children under twelve years of age classified according to the anatomical distribution of the primary lesions (L.G.B. and Commission's series) showing percentage of bovine infections.			
Alimentary	35	....	80.0
Respiratory, double portal (respiratory and alimentary) and uncertain	116	....	1.8

TABLE II

Variety of tuberculosis	Number of Cases	Under 15 years of age: Human	Under 15 years of age: Bovine	Over 15 Years of age: Human	Over 15 Years of age: Bovine
Lupus and scrofulodermia	22	11	11	..	..
Bone and joint........	13	6	4	3	..
Cervical gland	4	..	1	3	..
General	2	1	1	..	..
Meningeal	2	2	..	..	..
Kidney and testis......	2	..	..	2	..
	45	20	17	8	..

The figures show that 50 per cent of the lupus cases and 40 per cent of the bone and joint cases were of bovine origin. It will be seen that the latter percentage is higher than in the series of bone and joint cases in Table I, but the total number of cases is small.

There was one fatal case of bovine infection, and as this was of exceptional severity, a brief account of it will be of interest. I am indebted to Dr. J. F. Gaskell, Cambridge, for sending me the notes of the case and the material for bacteriological examination.

The patient was a girl, aged seven years, who lived on a small farm and was accustomed to drink large quantities of cow's milk. She died of general miliary tuberculosis after more than six months' illness in hospital. The autopsy showed a large tuberculous ulcer spreading from the ileocæcal valve a considerable way round the cæcum. In the mesentery extending from the ulcer was a chain of enlarged caseous glands. There were unusually coarse tubercles in liver, spleen, and kidneys. The lungs contained miliary tubercles throughout, and in the lower lobes there were, in addition, a few large greyish-red areas almost pultaceous in consistency. The tracheal and bronchial glands were not markedly enlarged. Tubercle bacilli were extremely numerous in all the organs. A bovine culture, highly virulent for rabbits, was obtained from the liver.

Interesting features in this case were the single ulcer in the intestines (in a situation which Doctor Gaskell believes to be a common seat of primary tuberculosis in children), the chain of enlarged glands extending from this ulcer, and the extremely large numbers of tubercle bacilli in the organs. The general infection in this case appears to have originated from a single primary focus in the intestines.

Discussion

The view that the ingestion of small numbers of bovine tubercle bacilli in milk may be beneficial to children is apparently based on two assumptions: (1) that the bovine tubercle bacillus is less virulent for man than the human tubercle bacillus, and (2) that small doses of living bovine tubercle bacilli taken with food raise the specific resistance of individuals without producing serious disease. In 1922 *(loc. cit.)* I gave the evidence which I think justifies the conclusion that the bovine tubercle bacillus is not intrinsically less virulent for man than the human tubercle bacillus. When a comparison was made of the post-mortem cases in which the portal of entry for the two types was the same, it was clear that the bovine tubercle bacillus produced tuberculosis, whether generalized over the body or apparently localized in one organ, in every way as severe as that caused by the human tubercle bacillus.

With regard to the second point there is no doubt that small doses of tubercle bacilli swallowed with food are less certain to infect than large doses. This fact was clearly brought out by the numerous feeding experiments of the Royal Commission on various species of animals. While it is true that many of the children who died of bovine tuberculosis of alimentary origin owed their infection to the ingestion of large numbers of tubercle bacilli (this is indicated by the extensive lesions in the intestinal tract and mesenteric glands, there is abundant evidence that much serious and fatal disease is caused in children by small doses of bovine tubercle bacilli.

In support of this statement, I will mention two fatal cases in children. They were aged two and six years respectively and both died of tuberculosis meningitis. At the autopsy in each case only a minimal lesion was found in the glands of the mesentery.

In addition, there is little doubt that the vast majority of the cases of surgical tuberculosis of bovine origin was produced by small doses of tubercle bacilli, since in these cases there was clinically no evidence of disease of the alimentary tract.

Conclusion

(1) A small dose of bovine tubercle bacilli may set up serious and fatal tuberculosis in a susceptible human being.

(2) In the present state of our milk supply the bovine tubercle bacillus causes a considerable amount of preventable disease and loss of life.[1]

In this connection the speaker had the privilege of attending several sessions of both the International and the National Tuberculosis Congress that met in Washington recently. Considerable discussion ensued relative to animal tuberculosis and its relation to man. It seemed to be the consensus of opinion that, while there are many points that are not thoroughly established relating to the disease, it is absolutely advisable to eradicate bovine tuberculosis, if such a thing is possible. Some of the speakers at the Congress expressed doubt as to the possibility of suppressing the disease, and one speaker referred to a particular herd that was free of the disease for several years, but on retest, reactors were found. We frequently hear such statements made. About a year ago investigation was made of a number of accredited herds that were removed from the list on account of having become reinfected, but of a total of 100,000 herds it was found that less than five per cent of breaks occurred, and the majority of these were caused by the addition of untested cattle to the herds. The speaker has no misconception of the danger of reinfecting accredited herds so long as tuberculosis exists to the extent which it does in the United States. As an indication of the danger of spread of infection from badly infected areas, your attention is called to the movement of cattle from parts of northern Illinois after the Chicago milk ordinance requiring the tuberculin testing of all dairy cattle, which went into effect April 1, 1926. There were several dealers of cattle in that section of the State who, being unable to get their herds tested, undertook to sell them all over the eastern part of the country. There were hundreds of such cattle moved interstate, and wherever they were located a high percentage of infection was found. We must reduce the infection in

[1] From *Veterinary Journal*, No. 598, Vol. 81, No. 4, April, 1925.

every section of the country before we can feel in any way sure that danger of the spread of the disease is past.

Progress in Accredited Herd Work

In 1926 there were nearly 9,000,000 tests made, and, judging from the reports received for this fiscal year, there should be at least 10,000,000 tests made during the current year. The accrediting of individual herds of cattle is not being followed up so closely now as before; therefore, much effort was put in the area plan of conducting the campaign. You will recall that the original plan for accrediting herds contemplated only pure-bred herds. This program was changed so as to include grade herds as well. I have no hesitancy in saying that many grade herds have been accredited without any benefit whatever to the owners. Such herds consisted of a few cattle which the owners had no occasion to sell, and from which they derived little benefit by supplying milk to the neighboring towns or cities.

The accreditation of herds is a wonderful stimulus to the work and should be continued, but the unimportant grade herds should be eliminated and only pure-bred and important grade herds kept on the list. These herds should be regularly tuberculin tested by accredited veterinarians. It is cheap insurance to the owner, and an assurance that he is maintaining his herd on a safe and sound basis.

Status of Area Work

You will recall the statement made many times that in the original program for tuberculosis eradication work, the second project was the eradication of the disease from circumscribed areas. This plan was not advocated until 1920, notwithstanding the fact that it had been tried out in the District of Columbia as early as 1908, and was found practicable. On June 30, 1926, all the cattle in 329 counties out of the 2900 agricultural counties in the United States were tuberculin tested. Not all of these counties are modified areas, because to attain modification it must be shown that the disease exists to less than one-half of one per cent. In addition to the above-mentioned counties there were 427 counties engaged in area work, making a total of 756. On that date there were 196 modified counties. On September 30, 1926, there were 228 modified counties.

Accredited Veterinarians

The speaker pointed out at the annual meeting of the United States Live Stock Sanitary Association in 1918 the field that was to be opened to the practicing veterinarians for retesting accredited herds. This was done to let them take part to a greater extent in tuberculosis eradication work. At that time there was considerable agitation and complaint that private veterinarians were being overlooked, but that thought was without foundation, because from the very earliest date of the campaign it was absolutely known that the number of regularly employed State and Federal veterinarians would never be large enough to tuberculin-test all the cattle in the United States, and that the vast amount of work would in time be carried on by the practicing veterinarians. As time progresses it becomes more apparent to the veterinary profession that the practicing veterinarians are to assume the greater burden of responsibility in assisting in tuberculosis eradication work and in maintaining thereafter herds free from tuberculosis.

As the years advance the proportion of work done will increase more rapidly than heretofore. The Bureau receives from time to time communications from interested persons who want to know if the Federal Government is going to retest accredited herds; if it is going to retest all the cattle in modified areas; if it is going to retest dairy herds supplying milk to towns and cities. The replies sent out state that Federal veterinarians are to be employed in eradicating tuberculosis from herds of cattle, and when that disease is eradicated they are not to be employed for the retesting of tuberculosis-free herds. Their services are to be made available to the owners of herds that have not been freed of the disease. Therefore, the policy of the Bureau as it goes on freeing herds and areas is to leave the work to the local veterinarians, who will, of course, work under State laws and State rules and regulations. The accredited veterinarians will be assuming a great responsibility in taking care of all that work, but it is the only class of individuals capable by training and practice of performing the work.

Tuberculosis of Poultry

The foundation upon which our poultry industry must be built is freedom from disease. A diseased flock cannot be maintained on a paying basis, even though it may represent the best blood in our country.

There are many ailments common to the poultry flocks of the United States, but, perhaps, tuberculosis is one of the most destructive diseases found throughout the Middle West. The losses due to avian tuberculosis run into millions of dollars annually, and are rapidly increasing. This disease not only affects poultry but swine also, and it is responsible for many retentions in slaughter establishments.

The Bureau has been studying tuberculosis in poultry for more than twenty-five years, and has endeavored to find a practical way to eliminate the disease, bearing in mind that any plan to be successful must be easy and cheap to apply, as the farmer will not devote much time and expense to the care of the average barnyard flock. With this thought in mind the Bureau issued instructions to its veterinarians engaged in tuberculosis eradication work to inspect the poultry on every farm visited, provided this plan met with the approval of the cooperating State officials. When suspicious birds are found they are posted, provided the owner's permission can be obtained. If lesions of tuberculosis are found, instructions are issued concerning methods to be employed in cleaning up the infection. The plans found most practicable for cleaning up poultry tuberculosis on farms where clinical cases are found are as follows:

(a) If the flock is of the common barnyard class, the quicker and more practicable method is to slaughter and burn all clinical cases and vacate the premises of all chickens for a reasonable length of time. The premises should be thoroughly cleaned and disinfected, and if the buildings are good, they should, if possible, be moved to clean ground. Restocking should be made with day-old chicks or mature birds from clean flocks.

(b) Another plan is to cull all clinical cases and slaughter same. Maintain the old flock in fenced quarters. Restock with day-old chicks raised in an inclosure on clean ground.

(c) Tuberculin-test the flock at intervals of 90 days. Practice cleanliness. Raise new flock on clean ground, in fenced quarters.

These plans are being extended in some States to provide for the testing of flocks where clinical cases are not found, thus giving an additional assurance of freedom from tuberculosis.

Each plan provides for a general educational campaign which is always necessary in combating any contagious disease.

The reports for the fiscal year ended June 30, 1926, covering work done by veterinarians engaged in cooperative tuberculosis eradication work under the plans as outlined, are as follows:

Flocks inspected	157,950
Flocks apparently free	148,099
Flocks infected	9,751
Fowls posted and found affected with tuberculosis	10,279 (.07%)
Estimated number of fowls inspected	14,012,923

Michigan reports the greatest amount of this kind of work done, with 41,649 flocks inspected, 39,559 of which were apparently free, and 2,091 being reported as infected. Two thousand and six infected birds were posted. A total of 3,454,885 fowls were reported as having been inspected.

Ohio ranks second with 20,994 flocks having been inspected, of which number 20,172 were apparently free, while 623 were found to be infected. One thousand and sixteen fowls were posted and lesions of tuberculosis were disclosed. It is estimated that approximately seven hundred thousand birds were inspected.

This is indeed a very creditable showing to be made, as this work was done without any additional expense in connection with the tuberculin testing of cattle.

Program of the Work

Several States have adopted a program for conducting tuberculosis work. This plan contemplates the accomplishment of so much work each year; the testing of herds in so many townships or counties; the gradual reduction of infection and the accrediting of counties when the infection has been reduced to less than one half of one per cent. The Bureau is in thorough accord with such a program. It does not overreach a reasonable outline for progressive steps of the campaign. It is true that conditions may arise to interfere with the carrying out of such a program, but it is believed that the Congress of the United States and the respective State legislatures will want to know as far as possible how long it is going to take, and how much money it is going to consume to reach the peak of the work, and approximately the length of time necessary to keep the campaign in active operation, and it is only a fair proposal to furnish the legislative bodies with some comprehensive plan of operation.

Replacements

One of the present-day problems of the campaign is: How are we going to obtain cattle to replace reactors removed from herds? Several years ago when an owner desired to increase his herd he used to buy replacements locally, or in some cases he sent out to other States for pure-bred cattle, but with the advent of tuberculosis eradication work and the precaution used by live-stock owners to prevent the introduction of infection into their herds, they avoid making purchases of cattle except from accredited herds, modified areas, or herds the health status of which is known. Many of the States are importing cattle from several States removed. The idea is to seek out territory and herds known to be free of infection. This plan has grown into very large proportions, as indicated by the number of cattle now being moved interstate. It would seem that the constant purchases of cattle from one community would so deplete the herds that it would be unprofitable to the owner, but the far-seeing owners in such localities have for several years been saving more of their female calves, which have proved profitable to them.

There are no grounds for believing that tuberculosis eradication work is going to ruin either the cattle or beef industry. Statements to that effect were made early in the campaign, but subsequent history has proved their fallacy. The industry is in better condition today than it has been in many years, notwithstanding the fact that from the 29,000,000 tuberculin tests that were made from 1917 to June 30, 1926, the 1,008,096 reactors that were removed were condemned and destroyed.

Conclusion

The degreee of success which has been attained in tuberculosis eradication work is due to the united efforts of those interested in the industry. Cooperation has been the key-note of the campaign. It was laid down at the outset as the principal foundation of the work, and it is hoped that it will never be less effectual than it is today.

The most potent influence in favor of the work outside the regulatory authorities has been the press and the agricultural papers. The editors, both of the daily press and the periodical farm papers, have watched the work carefully, pointing out from time to time ways by which the methods might be improved upon. They have encouraged the officials and live-stock owners to work together in this great enterprise. The live-stock exchanges throughout the country, recognizing the importance of checking tuberculosis, and realizing the future benefits to be derived through its suppression, lent their assistance by actively cooperating in appointing commissioners, who have carried on educational work and encouraged legislative bodies to provide adequate funds for the campaign. Active cooperation has been received from so many sources that it is difficult to enumerate those who have participated. The agricultural colleges, through their extension services and veterinary departments, have rendered valuable support. Practicing veterinarians throughout the country have rendered most excellent service, both by making private tuberculin tests for herd owners and by assisting county, State, and Federal forces in area work. More than 6000 veterinarians have qualified by written examination to do tuberculin testing under the Uniform Herd Plan. All in all, we have been working together harmoniously for more than eight years and it is the hope of the great organization which I have the honor to represent that this cooperative spirit shall prevail to the consummation of the work.

"Hope ever urges on and tells us tomorrow will be better."

REPORT OF COMMITTEE ON COMMUNICABLE DISEASES AFFECTING MAN—THEIR RELATION TO THE MILK SUPPLY AND TO THE PUBLIC HEALTH

DR. JOHN L. RICE, *Chairman*

Again this year your Committee on Communicable Diseases Affecting Man wishes to introduce its report with a note of optimism. The hundred billion pounds of milk consumed in the United States two years ago has probably increased during the past year, and still the amount of communicable disease related to this huge supply is strikingly small.

The three factors that have played the important rôle have been, first, pasteurization; second, cleanly methods of production and distribution of milk products; and, third, the tuberculin test.

PASTEURIZATION

The value of proper pasteurization in the prevention of milk-borne outbreaks has for a considerable period of time been well established. Each year, however, new evidence is brought forward substantiating this fact. Only one such incidence is here referred to. The following is quoted from the bulletin *Health News* of the New York State Department of Health, and brings out very clearly that an infected milk supply produced human disease, while the same milk, after pasteurization, was used with safety:

> "Two cases of typhoid fever developed on a dairy farm in the central part of the State during the month of December, 1925. Investigation revealed the fact that a milker employed on this farm had had typhoid fever in March, 1925. This man, who has recently been found to be a typhoid carrier, had made it a prac-

tice to deliver the milk from a single Guernsey cow to the household of his employer for the use of the latter's family, in which the two cases of typhoid fever occurred. The balance of the milk from forty cows was sold to a milk plant, and was pasteurized before delivery to consumers.

"It appears likely that an epidemic of typhoid fever was prevented by the process of pasteurization, as it is reasonable to suppose that the carrier may have infected other milk than that which was reserved for the use of the dairyman's family. Household contact as a source of infection was rendered extremely unlikely, as the carrier lived about a half mile away and had not taken meals at the home of his employer."

Your Committee again wishes to go on record as not only favoring but stressing the value of pasteurization. The general public is understanding more and more what this process means and what it does. Recently there has arisen some demand by people who use certified milk that it, too, be pasteurized.

Cleanly Methods of Production and Distribution

These are just as important as ever, and pasteurization should never be considered as a substitute for proper production. Considerable experimentation has recently been in progress looking forward to new and easier ways for the proper cleaning of milking machines and pasteurizers.

Tuberculosis

The relation between tuberculosis and milk is well summed up in an abstract of a paper presented a month ago at Washington by Dr. William H. Park before the International Union Against Tuberculosis. This abstract reads as follows:

"The amount of human infection with tubercle bacilli of the bovine type depends on a number of factors, such as the amount of tuberculosis among cattle, the amount of cow's milk consumed by infants and children, and the extent to which this milk is heated. The only accurate way to decide that an individual is infected with bovine type of tuberculosis bacillus is to isolate the bacillus in pure culture and test it for its characteristics on media suitable to differentiate the two types, and if possible also on rabbits. This can only be done by a trained bacteriologist. There is no conclusive evidence of the transformation in an individual case of a bovine into a human strain. I personally do not believe it occurs.

"The use of the tuberculin test semiannually by the combined use of the subcutaneous, intradermal, and ophthalmic methods makes it possible to eliminate tuberculosis from a herd of cattle in a section of country. If only individual herds are freed, they are apt to become reinfected by contact with infected herds or the reception of infected cattle into the herd.

"The heating or pasteurization of milk reduces greatly the amount of bovine infection in a community. If butter is also pasteurized, bovine infection is practically eliminated. The milk from infected cows should be heated before it is fed to calves.

"While a considerable proportion of the tubercular children of a community in which raw infected milk is consumed have an infection with the bovine type, it is not certain that the total amount of tuberculosis and especially deaths from it in the community is increased. Many of those who developed tuberculosis due to the bovine type might have been protected thereby from infection with the human type.

"Statistics bearing on this question show no evident difference. Notwithstanding this doubt, we should attempt to eliminate tuberculosis due to the bovine type. The amount of tuberculosis due to the bovine type has decreased to a much greater degree than that due to the human type in cities where pasteurization is in operation.

"The temperature advised for commercial pasteurization and the time of exposure is a minimum of 142 ° F. (61° C.)."

Ideally, this report should contain a complete list and digest of all the milk-borne outbreaks of disease occurring in this country since the last report a year ago. Complete data of reports since last year are, however, not available. Hence, herein will be cited only a few characteristic epidemics. These, it is hoped, will help to keep fresh in our minds the fact that milk and its products, with all their tremendous food values, have elements of danger which must be well guarded against.

Typhoid Fever

Volume 15, No. 10, of the *American Journal of Public Health,* reports an outbreak of typhoid fever of 22 cases from a small dairy supply of milk to Columbia, Missouri. The infection was traced to a carrier who was engaged in the handling of the milk.

Health News, of the New York State Department of Health, dated February 22, 1926, gives the following account of a typhoid outbreak in Herkimer County from raw milk.

> "A department representative recently examined two patients in the village of Poland, Herkimer County, whom the attending physician suspected of having typhoid fever. As there were rumors that there were other cases among persons who had used raw milk from the same dealer, an investigation was made at the dairy farm. This revealed the fact that a six-year-old child of the dairyman had died nearly four weeks previously after an illness of four weeks with what had been termed lobar pneumonia. At the time of the investigation it was learned that a brother had been ill for about a month with "bronchitis" and that both the mother and father were ill. The last three cases and twelve others have been reported as typhoid fever. All the patients with the exception of one child had used the suspected milk. This case gave no definite history of consuming the implicated milk, but one of the physicians was quite sure that the child had had some, as the patient had relatives in Poland. There were two deaths among the cases.

"In view of subsequent events it seems likely that the child who died of so-called pneumonia had typhoid fever and that infection from her reached the milk supply. As the dairyman sold his cows, the possibility of further cases from the same source has been eliminated."

A member of your Committee reports the following, relative to typhoid fever from milk occurring during the year 1925 in Winnipeg, Manitoba:

"Nine cases of typhoid occurred as the result of an infection of a milk route. Two of these died. Typhoid had existed to some extent in the country district in which the dairy whose milk became infected was situated and one of the persons living at the dairy contracted the disease. Spread took place to a limited extent among the customers of the dairyman. It was evident that only a small portion of the total amount of the milk delivered had become infected. Over three hundred people received their supply from this source, yet after carefully canvassing the entire route, only nine cases were brought to light. The dairy was prohibited from selling milk as soon as the Department became aware of the presence of the disease. Two cases occurred at the dairy after it had been closed."

Mr. R. E. Irwin, Chief of the Division of Milk Control for the State of Pennsylvania, reports for the year 1925 three typhoid outbreaks, with a total of 124 cases. Two of these outbreaks were from raw milk, while the third was from pasteurized milk. For 1926, he reports three additional outbreaks, all from raw milk, involving 92 cases.

Scarlet Fever

While no outbreak of scarlet fever referable to milk has been brought to the attention of your Committee as occurring during the year, the Michigan Department of Health, under date of January, 1926, reports an epidemic of scarlet fever spread by ice cream. This outbreak occurred in Flint, Michigan, during the summer of 1924. Following a half year in which there was a weekly average of six new cases of scarlet fever, suddenly 41 cases appeared during the week of July 22-28.[1] On investigation, the weight of evidence apparently pointed to a small ice cream plant as the source of the epidemic. This plant was a one-man affair and he, for three days after presenting the first symptoms of scarlet fever, continued the business. Of 94 cases studied in this investigation, the usual mild, moderate, and severe types were found. There were three deaths. Eighty-three cases were cultured, and of these, 70 showed hemolytic streptococci of the scarlet fever type. A similar hemolytic streptococcus was also isolated from the ice cream worker. Twelve cases of scarlet fever evidently associated with this ice cream outbreak occurred in two neighboring villages. The ice cream made by this small concern was eaten by 82 per cent of the cases studied, but its total output was less than 10 per cent of the total city supply.

Diphtheria

No outbreaks of milk-borne diphtheria have come to the attention of your Committee for the past year.

Septic Sore Throat

With the apparent decrease of milk-borne typhoid, diphtheria, and scarlet fever, recently, attention has been focused more on septic sore throat and other disease conditions in which milk may be playing a part.

For the past fifteen years septic sore throat has been brought into the foreground, conspicuously so due to outbreaks in Boston, Baltimore, and Chicago. During the past year two outbreaks of this disease have been reported, one from Logan, Ohio, and the other from Guilford, Connecticut.

[1] From July 25th to August 10th, 116 cases of scarlet fever were reported.

In the Guilford outbreak, which occurred during the past summer, there was a total of 212 cases, with five deaths. This outbreak presented most of the features characteristic of milk-borne septic sore throat. The onset of the epidemic was explosive, the majority of the cases having their onset within a period of two days. Some of the cases were extremely mild and lasted only a few days, while others were severe. There were five deaths. The type of case in which death occurred usually had a septic sore throat for a few days, then improvement took place for a few days, then there was a relapse with peritonitis and septicemia. Some of the cases remained in bed for weeks. The source of the infection was without doubt a small raw milk supply. When this dairy stopped distribution of milk, the outbreak promptly subsided.

Immediately following this outbreak of septic sore throat epidemic in Guilford, cases began to appear in New Haven and neighboring towns. In all, there were some eighty cases. The majority were using certified milk from a dairy in Hampden. At this dairy the cook was found to have septic sore throat, but probably had not infected the milk. There was, however, a milker who gave a history of having had a sore throat who well might have been the source of the infection. The milk was promptly pasteurized and no further cases occurred. The interesting point in this outbreak was that the usual explosiveness of onset of cases was absent. The cases developed gradually during two weeks. Probably the cleanliness and the care, particularly the prompt cooling of the milk, prevented the streptococci from rapid growth.

Poliomyelitis

Ever since poliomyelitis has been occurring in this country in epidemic form, a strenuous effort has been made to find out its methods of transmission. On a number of occasions milk has been brought forward as a possible vehicle or a mode of transmission of this disease. Until recently there has been no report in which there was sufficient evidence to incriminate milk. In January of this year, however, the New York State Department of Health reported ten cases of poliomyelitis in which there is considerable evidence suggesting that milk may be one of the methods by which this disease is spread. In this instance, a boy of sixteen who was a milker and helped in filling the cans at a certain dairy for three days continued this occupation after he was taken sick with poliomyelitis. Ten drinkers of this milk were taken with the disease. The details of this outbreak of infantile paralysis follow, as reported by the New York State Department of Health.

> "During the third week of December, six cases of poliomyelitis developed in the city of Cortland, which has a population of approximately fifteen thousand. All of the cases found by Dr. A. C. Knapp, Health Officer, had consumed milk obtained from the same dealer. This dealer furnished milk regularly to the families in which four of the cases occurred. The fifth drank it three times daily at a restaurant. The sixth case was discovered to have consumed some of the milk at a gathering which he attended six days before the onset of his illness.
>
> "Prior to this there had been three cases reported in Portland during 1925, the onsets of the cases being given as October 7th in all three. Despite their almost synchronous onsets, these three cases each took milk from a different source, and it was not possible to discover anything else in common.
>
> "On December 7th, seven days before the onset of the first case of this apparently milk-borne series, a boy, sixteen years old, who was working on the dairy farm where the milk concerned was produced, became sick with fever, headache, pain in the back, and some diarrhea. He vomited on December 11th. He continued at work, milking from eight to ten of the 20 cows on this dairy, though he noticed his hands were growing progressively weaker and that he had some pain and tenderness in his left arm. On December 11th, he was

definitely paralyzed in his entire upper left extremity and his right deltoid muscle, but succeeded in milking three cows with his right hand before his condition was noticed. He was immediately taken to his home in the city of Cortland, where he was isolated and subsequently cared for. In addition to the symptoms mentioned, he was said to have slight retraction of the head but no resistance to anterior flexion of the spine. His fever was reported as high (over 104° F.) when seen by the physician on December 11th. This boy, in addition to milking cows, carried the milk to the cooler, and also assisted in filling the cans from the cooler, thus having an opportunity to infect practically all of the milk produced on the farm.

"The onsets of the subsequent cases were December 14th (one), December 16th (two), December 18th (two) and December 19th (one). Two of the subsequent cases died from bulbar involvement, one on the second and the other on the fourth day after onset. There were no other cases in the city until December 25th, when three more cases developed—one in a child aged seven, who consumed the suspected milk at home; one in a boy aged 19, whose mother worked in a restaurant which bought 35 quarts of this milk daily. The third child has no history of contact with any of the other cases, did not consume the suspected milk, and is regarded as an extremely doubtful non-paralyzed case.

"An investigation at the dairy failed to discover any evidence of paralysis or illness among the animals except that five of the 20 cows reacted to the tuberculin test on December 14th. About two hundred and fifteen quarts of unpasteurized milk were sold from this dairy to a dealer in Cortland whose total daily output was 240 quarts. The total daily supply for the city is approximately five thousand, seven hundred quarts.

"The cases, which varied in age from 15 months to 22 years, were not located in the same section of the city and their social relations were extremely tenuous or nonexistent."

Without doubt, many more cases of poliomyelitis will be studied, with the hope that further evidence will clear up the point as to whether poliomyelitis may be milk-borne or carried.

In completing this report it is thought wise to mention two other outbreaks that have occurred during the past year: first, a group of children who developed nausea and vomiting shortly after drinking milk; second, a group of food-poisoning cases from cheese.

Vomiting Outbreak

This vomiting outbreak concerned 127 children of Saratoga Springs. The illness occurred on February 18 and 19, 1926, and was confined to a group of children who had consumed milk from a single source. The attack was sudden, beginning four hours after the consumption of the milk. There was a complete recovery in 24 hours. At the dairy involved a cow was found who had a chronic inflammation of the udder, but it was stated that the milk from this cow had been discarded for some time. Complete details of this report are also to be found in the bulletin *Health News* of the New York State Department of Health, under the date of March 15, 1926. This outbreak should focus attention again on the need for the careful physical inspection and examination of dairy animals.

Food Poisoning

The food-poisoning outbreaks from a streptococcus in cheese are published in the August 6, 1926, *Public Health Reports,* the first page of which reads as follows:

> "Two outbreaks of food poisoning attributed to cheese have been reported within the year—March, 1925-February, 1926. One outbreak, involving nine persons at Biddeford, Maine, was reported March, 1925, as attributable to eating an imported Albanian cheese. The second outbreak, of apparently 22 cases in Kansas City, Kansas, was reported in February, 1926. The cheese suspected of causing the second outbreak was an American cheddar manufactured in Wisconsin.

"The reports of the attending physicians in both cases were so similar and our bacteriological findings were such that they may be reported in one paper.

"In the first outbreak, Dr. C. J. Xaphes, of Biddeford, Maine, was called to attend nine persons suffering from what he diagnosed as food poisoning. The symptoms as given briefly by him are as follows: 'Pains in stomach, severe vomiting, diarrhea, expression dull, and pulse fast.' His investigation of the food eaten by those affected showed that cheese was a principal component of the single meal which all had taken together. None of the actual food consumed was available; but since suspicion was placed on the cheese, samples from the same lot were obtained and forwarded to the Microbiological Laboratory of the Bureau of Chemistry.

"The cases in the second outbreak, reported in February, 1926, were very similar. Dr. H. L. Dwyer, of Kansas City, in reporting the 18 cases which he treated, gave the following descriptions:

" 'The symptoms manifested were referable to the stomach and intestines and were characterized by nausea and vomiting, paroxysms of abdominal pain, and diarrhea. The nature of the symptoms and the sudden attack in so many individuals suggested a common cause, probably related to some dietary factor. Investigation along this line revealed the fact that all the affected persons partook of some cheese and this was the only substance which was eaten by every one of those affected.'

"A sample of the cheese actually used was obtained and forwarded to the Microbiological Laboratory."

These outbreaks were evidently caused by a streptococcus, the type of which has not yet been determined.

The aim of this report has not been to enumerate all outbreaks of milk-borne epidemics nor to give complete detail, but to bring to your attention a number of topics for general discussion.

"It is not the disease but neglect of the remedy which generally destroys life."

REPORT OF COMMITTEE ON MILK ORDINANCES

WM. B. PALMER, *Chairman*

At the 1925 meeting of this Association, a resolution was adopted calling for the appointment of a committee to consider the matter of milk ordinances and the unification of regulations governing milk production. The resolution reads as follows:

WHEREAS, Those in charge of milk supervision recognize the importance of proper milk ordinances, it is of special interest to note that in several of our States and cities, model milk ordinances have been developed and are gradually being adopted; and

WHEREAS, Unusual activity in this regard has been observed during the past year, together with a recognition of the desirability of securing greater uniformity of regulations and standardization of practice of milk control; in view of the importance of this problem and of the value to be gained by a thorough study of this situation in its many phases; be it

Resolved, That a committee on health ordinances as pertaining to milk (or committee on milk ordinances) be appointed in the usual manner to consider this problem during the coming year; and be it further

Resolved, That when appointed, this committee, possibly in conference with similar committees representing other associations interested in the problem, give special consideration to the desirability of formulating minimum requirements, or uniform regulations for the production, handling, and distribution of market milk, and present a progress report at the next meeting of this Association.

The American Public Health Association, at the St. Louis meeting in 1925, took action for the appointment of a committee with duties similar to those of the committee of this Association.

During the coming month, a conference is to be held in New York City of representatives of the State departments of health of seven States of the eastern section of the country for the purpose of considering the matter of unification of ordinances and standards.

Judging from the action taken by associations and official departments, it appears that the desirability and necessity for uniform regulations and standards is recognized and generally appreciated. The committee of the American Public Health Association may become the clearing-house for suggestions and recommendations on this subject and the cooperation of this Association is to be recommended.

In accordance with the instructions contained in the resolution of this Association creating this Committee on Ordinances, the chairman, in the absence of the other members, conferred with the American Public Health Association committee at its Buffalo, N. Y., meeting, and was advised that the A. P. H. A. committee proposes to consider the United States Public Health Service standard milk ordinance and to solicit suggestions or modifications of it from various organizations likewise considering standardization of milk regulations.

In view of the general action now under way, your committee has concluded that the only practicable recommendations which can be made at this time must be somewhat general in character. To this end, the following suggestions are offered as a basis for milk ordinances:

1. Ordinances should be prepared in conformity with State regulations and should be legally sound.

2. Pasteurization should be defined in ordinances, and the definition approved by this Association should be considered as standard; viz.:

"Pasteurization is the process of heating milk to a temperature of approximately 145° F., never lower than 142° F., holding every portion of the milk at that temperature for a period of at least 30 minutes, and then promptly cooling below 50° F. Invariable recording of temperature and holding period by a tested thermograph is imperative, as is also protection against subsequent contamination by filling into adequately sterilized final containers immediately after pasteurization and at the place thereof, by healthy operators, and storage below 50° F. until delivered to consumers."

3. Certified milk ought to be legalized by legislative action in the various States. Proper methods and standards for production and distribution should be established and maintained by legally authorized medical milk commissions. Official control by health departments is desirable.

4. Where possible legally, only certified and pasteurized milks should be specified by ordinances.

5. Only pasteurizing equipment officially approved should be permitted.

6. Grading of pasteurized milk should be incorporated to provide for two grades; viz., higher grade and lower grade.

7. Regulations should be specified for the healthfulness of cattle, employees, and also for the sanitary quality of the products as to sediment, bacteria, and temperature.

8. If raw milk other than certified is permissible, regulations for the same shall correspond to those for certified.

"From labor health, from health contentment springs."

OUTBREAKS OF MILK-BORNE DISEASES

SURGEON CHARLES ARMSTRONG,
United States Public Health Service,
Washington, D. C.

In the discussion of milk-borne outbreaks of disease, I shall consider as milk-borne all outbreaks spread through milk or its products, such as ice cream, butter, cheese, etc., and will attempt to give you a general picture of the situation in the United States as revealed by a rather exhaustive search of the literature on the subject.

Between 1881 and 1908, various writers collected 179 milk-borne outbreaks for this country, and from 1908 to 1926, Armstrong and Parran have collected 574 additional outbreaks traced to milk or its products—a total from 1881 to 1926 of 753 recorded outbreaks.

It will be noted that the number of recorded outbreaks by five-year periods, 1880 to 1926, shows a consistent increase to the period from 1911-1915, inclusive, during which years 235 outbreaks were recorded.

The maximum number for any one year occurred in 1914, when 55 outbreaks were noted; in 1915 there were 40, and since that time recorded outbreaks have varied between eight and 27 per year.

Obviously these figures are not complete, as many milk-borne outbreaks have probably gone unidentified, while others have not been recorded in the literature, and of those recorded it is probable that we have not located all. Neither does this compilation take note of cases of bovine tuberculosis which occur sporadically, or of scattered cases of infantile diarrhea which are, at least in part, due to improperly produced or handled milk.

It is apparent, therefore, that this compilation is to be considered as a minimal estimation of milk as a disease carrier but will serve to give us a cross-section of the situation over a period of years.

The commonest milk-borne outbreak in the United States during the past 18 years has been typhoid fever, of which we have collected 449 instances with over fourteen thousand cases. Four hundred and twenty of these outbreaks were attributed to milk, 26 to ice cream, two to butter, and one to cheese. In 20 instances the milk was said to be "pasteurized."

There is a greater prevalence of milk-borne typhoid outbreaks during July, August, and September than during other periods of the year. There are several factors which probably account for this fact:

1. Typhoid from all causes is more common at this period of the year and there is, therefore, an increased number of potential foci from which milk may become infected.

2. During the rush of harvest the dairyman often finds it necessary to employ additional help on the farm and a typhoid carrier is occasionally so employed. Several outbreaks which we have recorded were traced to such temporarily employed carriers.

3. Typhoid carriers are often "intermittent," and it may be that typhoid bacilli are more common in stools during the hot portion of the year, when bowel disturbances are more common. This would seem to be a reasonable assumption, since in intestinal carriers the focus of infection is practically always in the bile tract and any diarrheal condition would favor the prompt passage of the bacilli from duodenum to the exterior. Moreover, in the bacteriological examination of stools for determining the carrier state, loose stools have been found to be most favorable for the finding of viable typhoid organisms.

4. Flies are most prevalent during this period of the year.

5. Once infected, the greater difficulty of maintaining the milk at a low temperature in summer permits the more ready multiplication of the usually small initial contamination.

Source of Infection of the Milk

It is of interest to note that in 351 typhoid outbreaks where the source of infection was determined, there were 146 outbreaks traced to carriers; 129 outbreaks traced to active cases; 32 outbreaks traced to the use of improperly sterilized bottles from infected homes; 27 outbreaks traced to the use of polluted water or utensils; 12 to miscellaneous causes.

The carrier is therefore seen to be the most common single source of infection for milk, and his relative importance will probably increase as sanitarians continue to throw additional safeguards about the active case. The Army during the World War, in the examination of 30,000 healthy male food handlers, found somewhat less than 1 per cent to be typhoid carriers, while Gay estimated that 7,400 convalescent carriers are added to our population annually.

In the detection of carriers the history of a connection with past outbreaks or the history of an attack of typhoid in the suspected person are of importance, and every person who has had the disease should be considered as a carrier until proved otherwise. However, carriers are found who deny having had typhoid fever or prolonged fever of any kind. (Six outbreaks were traced to such individuals.)

The Widal test has proved to be of great value in the detection of carriers and has been found positive, according to Nichols, in about fifty per cent of carriers, usually in a dilution of about 1:40.

The final proof of a carrier state is, of course, the isolation of the typhoid bacillus from the bowel or urinary tract. A negative bacteriological finding to be conclusive should, however, be repeated at intervals over a considerable period of time, and it is desirable that the duodenal content be tested, as well as the stools and urine.

It is of interest to note that for 119 outbreaks traced to milk infected by carriers and 111 outbreaks traced to active cases, the peak month of onset for carrier outbreaks was August, and for outbreaks traced to active cases it was one month later.

The explanation of this fact is not clear, but it may be that the precautions taken in the presence of an active case delay in a measure the time of contamination of the milk.

Outbreaks traced to improper sterilization of infected milk bottles, of which 32 were found, are apt to produce scattered cases and to be devoid of the explosive character usually found in milk-borne outbreaks. Where an exchange of bottles occurs between different dairymen, cases may occur on several routes, a fact which greatly increases the difficulty of making a correct epidemiological diagnosis. The 27 outbreaks attributed to the use of polluted water on utensils scarcely require further consideration.

Septic Sore Throat

While typhoid fever has lead all other diseases in the number of recorded milk-borne outbreaks, in the number of persons actually affected during the past 18 years it is probably second to septic sore throat, of which 35 outbreaks were recorded with an estimate of over twenty thousand cases.

It is interesting to note that these 35 outbreaks have all been in the northern part of the country, the most southern one found in the literature being in Baltimore, Maryland. That septic sore throat may occur in more southern latitudes is indicated by the fact that the writer has recently investigated an outbreak of the disease in Georgia, which has not, however, been published. Three of the outbreaks of septic sore throat were traced to pasteurized milk and one to ice cream. The sources of the outbreaks were attributed to active cases found on the farm in 15 outbreaks, to mastitis among cows in three, to mastitis in cows and cases on the farm combined in eight, to carriers on farms in two, while the source of infection was undetermined in 11 outbreaks.

Scarlet Fever

Forty milk-borne outbreaks of scarlet fever have been recorded in the past 18 years. These, like septic sore throat, have all been in the northern United States, the most southern being in southeast Ohio. In two instances outbreaks were traced to pasteurized milk and in one to ice cream.

In 1903 Sir Henry Littlejohn pointed out some interesting features regarding the age distribution of milk-borne scarlet fever in Scotland. He noted a high adult incidence of the disease in milk-borne outbreaks, and this feature was utilized by Clark of Edinburgh for the purpose of diagnosing milk-borne scarlet fever. Clark took the line between juvenile and adult cases as the fourteenth year. In ordinary scarlet fever as observed in Scotland, the ratio of juvenile to adult cases was 48:1, while in milk-borne outbreaks the ratio approached 1:1. From case reports coming to his office Clark was able to surmise the milk-borne nature of various outbreaks and later to confirm his diagnosis by ordinary means. This relative increase in the number of adults affected in milk-borne scarlet fever outbreaks has not been stressed in this country. Godfrey, however, has noted it in New York State in some milk-borne outbreaks of both scarlet fever and diphtheria, and states that there was no peculiarity of age distribution among exposures to account for it. Ramsey also reports an outbreak in Michigan in 1924 traced to ice cream, in which a high percentage of adults were attacked, and at Netkong, N. J., in 1925, an outbreak of 53 cases occurred traced to raw milk, in which 40 per cent of the affected were over 16 years of age.

In view of the often observed relative preponderance of milk-borne typhoid fever among children, usually attributed to a greater consumption of milk at that period of life, the opposite occurrence in scarlet fever or diphtheria seems especially interesting and is a feature worthy of further observation and study.

Diphtheria

Twenty-five outbreaks of diphtheria were collected: one traced to pasteurized milk, one to certified milk, one to ice cream, one to butter. These outbreaks were also mainly in the northern States, but one outbreak was reported from Charlottesville, Virginia, and another from Austin, Texas.

Among other milk-borne outbreaks may be mentioned seven of paratyphoid fever, two traced to pasteurized milk, one to certified milk, and one to ice cream.

There were eight outbreaks of milk-borne dysentery, or diarrhea, and one outbreak each of appendicitis, parotitis, poliomyelitis, denguelike syndrome, one of Malta fever traced to goat's milk, and one of botulism traced to cheese.

In view of the fact that 28 outbreaks are reported on "pasteurized" supplies, it is of interest to view the circumstances and pasteurization methods a little more closely in these instances.

In 11 of these outbreaks the evidence pointed to infection of the milk subsequent to pasteurization.

In three outbreaks a possible substitution of raw for pasteurized milk could not be ruled out. In three outbreaks there was evidence that the heating was not to the specified degree. In two outbreaks the so-called "pasteurization" consisted in heating the milk in a starter can. In one outbreak the equipment was described as obviously faulty, while of the remaining eight outbreaks, one followed the flash method, and in the other seven outbreaks either the method of pasteurization or source of infection was not stated.

It is therefore apparent that these outbreaks, as far as the information is available, constitute no incrimination of what is usually considered adequate pasteurization in this country, but do emphasize the care that should be exercised in the construction and operation of pasteurizing apparatus and in the protection of milk from infection subsequent to its pasteurization.

On the other hand, that proper pasteurization does prevent infection has been indicated by instances in Illinois, California, New York, and Colorado where parts of infected supplies were rendered harmless through pasteurization while the raw portion gave rise to outbreaks of disease.

While the collection of 574 milk-borne outbreaks over a period of eighteen years, with an incomplete list of over forty-one thousand cases, bulks rather large in the abstract, it shrinks when the magnitude of the milk industry in the United States is considered, with its 7,000,000,000 gallons of milk produced annually. And when it is remembered that our milk supply today is better as a whole than ever before in the history of our country, the health officer can find in these figures no grounds for advising any general curtailment in the use of milk or its products, but remembering the value of milk as a food he should endeavor to encourage the consumption of dairy products, while improving the sanitary quality.

"Good sense, disciplined by experience and inspired by goodness, issues in practical wisdom."

THE SUPERVISION OF MILK PASTEURIZING PLANTS IN NEW YORK STATE

JOHN F. MILLER, D. V. M.,
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New York State Department of Health

In 1914 the Public Health Council, in accordance with the Public Health Laws, adopted the Sanitary Code, which applies to and is effective in all portions of the State except New York City. Chapter III relates to the production, pasteurization, and distribution of milk. It provides that every person selling milk or cream shall annually obtain a permit from the local health officer and that the latter shall make an annual inspection and scoring of all dairy farms where milk is produced for sale within his district. It also provides that milk shall be designated as Certified, Grade A Raw, Grade A Pasteurized, Grade B Raw, Grade B Pasteurized, Grade C Raw, or Grade C Pasteurized, and prohibits the use of any other term, except that cities of the first class may provide for additional grades of milk and cream subject to the approval of the Public Health Council. The Code further provides that the farms on which milk is produced shall meet certain requirements and that the milk shall be so produced, pasteurized, and handled as to meet certain bacterial standards, and that cows from which Certified Milk or Grade A Raw Milk is produced shall be subjected to an annual tuberculin test. This was our first attempt to grade milk, and after adoption of the Sanitary Code there was a notable improvement of the milk supply throughout the State.

The so-called model milk ordinance, which has been recommended by the Department as a practical ordinance for the larger municipalities to adopt, was prepared in 1923. This ordinance, with modifications in some cases, has been adopted by more than sixty municipalities throughout the State. It does not permit the sale of Grade B Raw Milk or of Grade C Raw or Pasteurized.

During 1917, the Department began intensive supervision of milk pasteurizing plants and 120 plants were inspected and reported upon during the year. The following is quoted from the 1917 report:

> "A rough classification of the one hundred and twenty plants inspected is as follows: ten were found to be of generally good sanitary construction, equipment, and manner of operation; some twenty-five may be said to be of fair sanitary construction, equipment, and operation; some forty were poorly constructed and poorly operated, and some forty-five were found to be in very unsatisfactory condition both with respect to construction and operation."

In reviewing reports on reinspection of these plants for 1919, it was found that most of the recommendations made by the Department had been carried out at 83 plants, nine plants had temporarily discontinued operation, and 28 had gone out of business.

Milk, because of its butter-fat content, muscle-building protein, and its essential salts and vitamines is a very valuable food. Every effort should be made to encourage its use and to make it safe. One of the reasons why the consumption is not as great as it should be is the fact that milk may readily become infected and thus transmit disease. It is a matter of record that from 85 to 90 per cent of milk-borne outbreaks in New York State have been due to infection at the farm. The following is a summary of milk-borne outbreaks in New York State:

	No. Outbreaks	No. Cases	No. Deaths
Typhoid Fever			
1914 to Oct. 1, 1926......	68	1091	66
Septic Sore Throat			
1914 to Oct. 1, 1926......	5	1543	10
Scarlet Fever			
1915 to Oct. 1, 1926......	13	514	27
Diphtheria			
1915 to Oct. 1, 1926......	5	152	8
Dysentery			
1912 to Oct. 1, 1926......	1	14	0
Other Diarrheal Disorders			
1924 to Oct. 1, 1926......	3	239	0
Poliomyelitis			
1925 to Oct. 1, 1926......	1	11	2

Regulation 12 of Chapter III is as follows:

"No milk or cream shall be sold or offered for sale as pasteurized unless it has been subjected to a temperature of 142 to 145 degrees Fahrenheit for not less than thirty minutes, and under such sanitary conditions as may be prescribed by the State Commissioner of Health; and no milk or cream which has been heated by any method shall be sold or offered for sale unless the heating conforms to the provisions of this regulation, provided, however, that any other process may be authorized by the Public Health Council upon demonstration of an equal efficiency for the purpose of pasteurization satisfactory to such Council.

"After pasteurization the milk or cream shall be immediately cooled and placed in clean containers and the containers shall be immediately sealed.

"No milk or cream that has been pasteurized in one plant shall be transferred to and bottled in another plant or place and labeled, sold or dispensed as pasteurized milk or cream, except that cream may, with the approval of the health officer of the municipality where the cream is to be consumed, be bottled at a plant other than the place of pasteurization provided the cream is bottled under clean and sanitary conditions, and adequate facilities for washing and sterilizing of apparatus, utensils and containers used in the handling, bottling and storage of the cream shall be provided.

"No milk or cream shall be pasteurized more than once."

In New York State there are about nine hundred and sixty-three milk pasteurizing plants, of which about five hundred ship their supply to and are under the control of New York City. The remainder, about four hundred and sixty-three, supply 92 "upstate" municipalities and are under the supervision of the State Department of Health. All pasteurizing plants in the latter group must meet the requirements of the Sanitary Code and comply with the regulations enacted by the Department in regard to construction, sanitation, equipment, and operation. The supervision of such milk pasteurization is one of the activities of the Division of Sanitation of the State Department of Health.

The investigation of a pasteurizing plant includes a careful inspection of the sanitary conditions in and around the plant and an examination of all the apparatus before the pasteurizing process is commenced in order to ascertain its condition with respect to cleanliness. During pasteurization, the heating temperature, the holding period, and the method of handling the milk are observed, and the accuracy of the recording thermometer checked. After pasteurization is concluded, the method of cleaning the apparatus, pipes, and pumps is noted. All inspections are made in cooperation with the local health authorities.

To determine the bacterial content of the milk, samples are collected at various steps during the process. The samples are usually taken of the mixed raw milk, directly from the holder after a thirty-minute holding period, from the cooler, and from the bottle filler. The results of the first two samples show respectively the condition of the raw milk and the bacterial reduction during pasteurization. The remaining two samples serve as an index of the cleanliness and sterility of the apparatus with which the pasteurized milk comes in contact.

Reports are prepared upon the investigations of these plants and copies are sent to the plant owner, the local health officer, and our own district State health officer. These reports describe in detail the construction, equipment, and operation of the plant, point out any defects and make recommendations for improvements necessary to comply with the Sanitary Code and the regulations of the Department.

Most plant owners have cooperated with the Department and, as a result, there has been a marked improvement in the construction of plants, the equipment used, and the method of operation. Almost without exception, new plants are meeting the requirements of the Sanitary Code and are complying with the Department regulations.

There has been a greater increase in the number of plants established during 1925 than during any similar period since the work began in 1917.

INCREASE IN NUMBER OF PASTEURIZING PLANTS EXCLUSIVE OF THOSE SHIPPING MILK TO NEW YORK CITY

Year	Number of Plants	Yearly Increase	Per Cent Increase
1922	315	...	...
1923	341	26	8.2
1924	353	12	3.5
1925	463	110	31.1

We feel that, in selecting or approving pasteurizing equipment, only such apparatus should be approved as will allow positive pasteurization, subjecting all of the milk to the same degree of heat and permitting an absolute holding time of 30 minutes. In this connection, it is encouraging to know that the United States Public Health Service is now conducting an investigation relating to the efficiency of pasteurizing apparatus. Unless the apparatus and containers with which pasteurized milk comes in contact are properly cared for, satisfactory results cannot be expected. It is essential that all pipes and apparatus, cans and other containers, and all bottles be thoroughly cleaned and sterilized.

During 1924 an investigation was conducted by the Conference of State Sanitary Engineers to determine the bacterial efficiency of the different types of bottle-washing and sterilizing apparatus. It was found during this investigation that when careful attention was given to the operation, all machines investigated were capable of producing a clean bottle. As a result of this study and the studies made by the Minnesota State Health Department, Chicago and Baltimore Health Departments, the following conclusions were drawn:

> "1. That the present unsatisfactory sterilization of milk bottles is due in most cases to carelessness on the part of the operators or ignorance of the principles of bottle washing and sterilizing.
>
> "2. That most of the bottle-washing and sterilizing machines on the market are capable of producing a bottle which will meet the public health requirements.
>
> "3. That for the sterilization of milk bottles at smaller plants, chlorine is more dependable than steam as applied in routine practice.
>
> "4. That in practice absolutely sterile bottles cannot be secured.
>
> "5. That an empty milk bottle which contains not more than one bacterium per cubic centimeter of bottle volume should be considered practically sterile."

The complete results of this investigation have been printed by the United States Public Health Service, Bulletin No. 160.

In addition to the regular inspection of milk pasteurizing plants, studies in several cities have been made by the State Health Department in cooperation with the State College of Agriculture, Department of Farms and Markets, and local health authorities for the purpose of furnishing information to health authorities, milk dealers, and producers, as well as to bring about improvements in milk supplies.

Rigid supervision at all times, tempered with patient explanations of the reasons why the regulations should be strictly carried out, helps to bring about improvements in equipment and methods which result in improved quality.

While it is undoubtedly true that frequent and effective inspection of dairy farms and milk plants will reduce the danger of disease germs getting into milk, we can never be absolutely sure regarding the safety of raw milk. Careful and conscientious adherence to the requirements both by the producers and local health authorities will in the case of Certified and Grade A Milk produce a reasonably safe raw milk. On the other hand, proper pasteurization will help to eliminate the remaining possibilities of danger, but in order to accomplish this, pasteurization must be efficient.

"Peace if possible, but the truth at any rate."

A COMPARISON OF THE FAT-READINGS OBTAINED IN THE 8 PER CENT AND 10 PER CENT BABCOCK MILK BOTTLES, USING A COLD CENTRIFUGE

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THE BABCOCK TEST

Although devised originally for the use of creameries and dairymen, this test is now extensively used for fat determination in the laboratory.

The Babcock test is based on the fact that strong sulphuric acid will dissolve the non-fatty solid constituents of milk and other dairy products, and thus enable the fat to separate on standing, making direct readings possible. To effect a speedy and complete separation of the fat, the bottles holding the mixture of milk and acid are placed in a centrifuge and whirled. The whirlings are three in number, the first being for four minutes. Hot water is then added to bring the liquid fat up to the neck of the test bottles, which are again whirled for one minute. After this whirling, hot water is again added. This washes the liberated fat and also brings it up into the graduated neck of the bottle. The bottles are then whirled for the third time to insure complete separation of the fat into the graduated column. The length of the column of fat is read directly as the per cent of fat in the sample.

Sulphuric acid is preferable to other acids for the purpose mentioned, on account of its affinity for water. When mixed with milk, the mixture becomes greatly heated, thus keeping the fat liquid without the application of artificial heat and rendering possible a distinct reading of the fat column brought into the neck of the test bottles by the washings. These readings are taken at a temperature between 57° and 60° Centigrade.

So far as is known, any kind of milk can be tested by the Babcock test. Breed, period of lactation, quality or age of the milk do not impair the usefulness of this test, so long as a fair sample can be secured. To make possible the use of this test in special milks, several modifications have been made to the original Babcock test.

There are several pieces of apparatus and steps of importance used in making this test. The apparatus necessary to perform the Babcock test correctly consists of a measuring pipette, an acid measure, Babcock test bottles, and a tester or centrifuge.

Measuring Pipette

This piece of apparatus is shaped like an ordinary pipette, differing in that it has a capacity of 17.6 c. c. and in that its point is narrower than the upper stem. It is standardized with water and must deliver the 17.6 c.c. in not less than five and not more than eight seconds, with a maximum error which shall not exceed .05 c.c. The water used to standardize must be at a temperature of 20° Centigrade. Every time it is used, the last drop of milk must be blown out.

Acid Measure

This may consist of a small graduate with a total capacity of 17.5 c. c., or a burette graduated into any number of divisions, each holding 17.5 c. c.

Acid

The acid used is concentrated sulphuric with a gravity between 1.820 and 1.830 at 15° Centigrade, which is equivalent to a percentage between 90 and 92.

Babcock Milk Bottles

There are two types of Babcock milk bottles at the present time in use, one having a fat column reading from zero to 10 per cent and the other from zero to 8 per cent. These bottles shall have a capacity of not less than 45 c. c., and in the case of the 8 per cent milk bottle, the graduations shall be of 0.1 per cent each, while those of the 10 per cent bottles shall be of 0.2 per cent each.

The 8 per cent bottles were approved by the American Dairy Science Association in 1922.

The main reason for the more extensive usage of the 8 per cent bottles over the 10 per cent bottles is that fat-readings can be taken with greater ease.

For standard Babcock milk bottles, the error at any point of the scale shall not exceed 0.1 per cent.

Testers or Centrifuges

There are various types of centrifuges on the market, some driven by hand power, others by electricity. They have a varied capacity of from eight test bottles to 48 or more. Another point of interest with regard to centrifuges is that of late a heated centrifuge has appeared on the market. This centrifuge is heated electrically and facilitates fat-readings, as they can be taken immediately after the whirlings, thereby doing away with heating the test bottles after the whirlings.

Sampling

The sample to be tested is first mixed by pouring the milk from one vessel to another two or three times, so that every portion thereof will contain a uniform amount of butter-fat. The measuring pipette is filled with milk immediately after the mixing is complete. The point of the pipette is placed in the neck of the Babcock test bottle and the milk is allowed to flow slowly down the inside of the neck. The bottle is held at an angle, thereby insuring no loss while pipetting.

Addition of Acid

The acid cylinder, holding 17.5 c. c., is filled to the mark with sulphuric acid of the proper strength, which is carefully poured into the test bottle containing the milk. In adding the acid, the test bottle is conveniently held at an angle, so that the acid will run down the wall of the bottle and not in a small stream into the center of the milk, the bottle being slowly rotated and thereby clearing the neck of any adhering milk.

Mixing the Milk and Acid

After adding the acid, it is mixed with the milk by a rotary motion. In doing this, care should be taken that none of the liquid is shaken into the neck of the bottle. When once begun, the mixing should be continued until complete. A partial or interrupted mixing of the liquids will often cause more or less black material to separate with the fat when the test is finished. Clots of curd which separate at first by action of the acid on the milk must be entirely dissolved by continued and careful shaking of the bottle. Difficulty is often encountered in dissolving the curd if such preservatives as formaldehyde have been used.

Whirling the Bottles

The milk and the acid being thoroughly mixed, the test bottles are immediately placed in a centrifuge and whirled for four or five minutes at a speed of 600 to 1200 revolutions per minute, according to the diameter of the centrifuge. It is not absolutely necessary to whirl the bottles in the centrifuge as soon as the milk and the acid are mixed, but this method of procedure is much to be preferred. They may, however, be left in this condition for any reasonable length of time (24 hours) without the test being spoiled. If left until the mixture becomes cold, the bottles must be placed in warm water (at about 160° F.) for about fifteen minutes before whirling.

Adding the Water

Hot water is now added by means of a pipette or some special device until the bottles are filled to near the scale on the neck. The bottles are then whirled and hot water added a second time, until the lower part of the fat column comes within the scale. This second washing frees the fat from any flocculent matter which might otherwise be entangled therein and render the reading uncertain or too high. A final whirling of one or two minutes completes the separation of the fat.

Measuring the Fat

The amount of fat in the neck of the bottle is measured by the scale or graduations on the neck. Each division represents 0.2 per cent on a 10 per cent Babcock bottle and 0.1 per cent on an 8 per cent bottle. The space filled by the fat shows the per cent of butter-fat contained in the sample tested. The fat is measured from the lower line of separation between the fat and the water to the top of the fat column. Comparative gravimetric analyses have shown that the readings obtained in this manner give correct results. While the lower line of the fat column is nearly straight, the upper one is curved, and errors in the reading are therefore easily made unless the above is observed. Results with 8 per cent bottles agree fairly well with those obtained with 10 per cent bottles where care is taken to read the fat column to the extreme top of the meniscus.

Conclusion

Nine lots of milk were tested, the total number of samples being 135. These samples were run in duplicate; that is, in each case two determinations were performed, one with a 10 per cent and another with an 8 per cent Babcock test bottle, and the readings compared.

SUMMARY OF RESULTS

Lot No.	No. Determinations	8% Unequal	10% Unequal	Total % Unequal
1	17	1	1	11.76
2	6	1	0	16.66
3	13	1	0	7.69
4	11	1	0	9.09
5	20	1	1	10.00
6	14	0	0	0.00
7	19	1*	0	0.00
8	17	1	1	11.76
9	18	1	1	11.11
Total...........	135	7	4	

*Reading showed difference of 0.4 per cent, which was checked as an error in technique and was not counted.

Total lots, 9
Total determinations, 135
Total 8 per cent readings unequal, 7
Total 10 per cent readings unequal, 4
Total unequal readings, 11
Average per cent unequal, 8.67
Per cent of samples showing difference in readings, 8.148

With the facts from this table, it can be readily seen that there is a possibility of either a higher or a lower fat-reading eight times out of every hundred samples run for fat-content. It would be to the advantage of all concerned if the Babcock 10 per cent bottle were discarded and the use of the 8 per cent bottle made compulsory by law, because 63 per cent of the unequal readings in the table showed that the 8 per cent bottle had the advantage over the 10 per cent.

There are several reasons why the 8 per cent bottle is more accurate:

1. Divisions are of 0.1 per cent each, thereby making the readings easier and more accurate.

2. The scale being lower and the neck of the bottle being the same length as that of the 10 per cent bottle, a longer fat column is obtained, insuring accuracy.

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"Today's discoveries are the triumph of applied research."

REPORT OF COMMITTEE ON REMADE MILK

DR. J. H. SHRADER, *Chairman*

The recommendations which I presented last year have been submitted to a number of food authorities for their opinions and have also been submitted to the Milk Committee of the American Public Health Association, who now have the recommendations under consideration. Pending their reply, I consider that the matter should be held in abeyance.

I strongly recommended that for the ensuing year the Committee make a careful study of the methods available and the limit of accuracy for determining the presence of reconstituted milk or milk powder when admixed with regular milk.

"The hope of all earnest souls must be realized."

MEDIA COMPOSITION AND BACTERIA COUNTS OF MILK

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During 1925 and 1926, a committee representing several national organizations interested in bacteriological media collaborated under the direction of Dr. H. J. Conn to study the relation between ordinary bacteria counts (estimates of the number of colonies) by the standard agar plate method and a number of peptones. Ten samples of peptones under code names were sent to the collaborators to make up into standard media and to use for plating milk and water samples. A series of milk counts was made in our laboratory. As a check on the bacteriological work, I had biochemical analyses made of the nitrogen fractions in the finished media. When the bacteriological data were turned in, the "counts" were so variable that I was led to scrutinize them in the light of the chemical composition of the media. Dr. H. J. Conn kindly consented to the publication of my own observations.

The nitrogen metabolism of bacteria has been quite extensively studied. Some of the early workers (Emmerling and Rieser, 1902, and Taylor, 1902) stated that there are strains which attack protein, although later work largely contradicts such conclusions. Several workers, such as Sasaki (1912, 1913), Otsuka (1916), and Kendall (1923) show that some bacteria presumably attack polypeptids. That amino acids only (or principally) are concerned in the nitrogen assimilation of bacteria has been shown by many

* Miss Lillian W. Conn and Dr. J. C. Swenarton collaborated in this work by making the chemical and bacteriological analyses, respectively.

workers, such as Frankel (1894), Uschinsky (1893), Rivas (1912), Sears (1916), Robinson and Rettger (1918), Berman and Rettger (1918 a), Long (1919), and Masucci (1920), although Goodman and Moore (1922) obtained different results. Sears (1916) showed that ammonia is utilized direct. Berthelot (1899) showed that some species thrive on nitrogen from the atmosphere as the only source. A number of workers have shown that protein digestion products are necessary for bacterial growth, among whom were Sears (1916), Sperry and Rettger (1915), and Rettger, Berman, and Sturges (1916). Bacteria have been shown to produce various protein decomposition products ranging all the way from the proteoses down to ammonia, and to utilize them all the way down to atmospheric nitrogen.

Much further light has been thrown on the nitrogen metabolism of bacteria. Bainbridge (1911) showed that a number of strains, among which were *B. coli com.*, *B. enteriditis*, *B. typhosus*, etc., do not attack pure protein, but that *B. proteus* can attack it. These conclusions were fully confirmed by Sperry and Rettger (1915), Sears (1916), Rettger, Berman, and Sturges (1916), and Berman and Rettger (1916). The latter went still further and showed that even purified proteoses and peptones follow the same law of resistance to direct bacterial action as do the proteins. They showed that bacteria attack proteins only by enzymes or other proteolytic agents, and that during the early stages of inoculation, these agents are not able to effect decomposition of the complex nitrogenous compounds; so that if the organism would live, it must use simpler forms of nitrogen until it can elaborate enzymes in sufficient number or quantity or power to successfully attack the more complicated nitrogen compounds.

Berman and Rettger (1918 a) state: "It is the amino acids and other simple nitrogenous substances, however, to which commercial peptone chiefly owes its value as a food for bacteria." Furthermore, they show that "gelatin-nonliquefying bacteria and some of the liquefiers are feeble in their action on Witte's peptone. A much better utilization of the biuret-giving substances occurs in media containing commercial peptone which has been subjected to more extensive digestion in the process of preparation, as, for example, certain of the American brands." "The value of a cultural medium for bacteria depends on the immediately available food substances which it contains. For this reason it appears quite reasonable that those commercial peptones which contain the largest amount of amino acids and other nitrogenous products of simple composition are most conducive of active and abundant bacterial development, everything else being equal. This supposition is fully borne out by experiment."

Rettger (1918) further says: "A most satisfactory culture medium, or one that will of itself eliminate bacterial lag, will be a medium which furnishes satisfactory substitutes for the intermediate bodies, in the form of amino acids and perhaps amines of simple composition, and also certain growth-accessory substances. When such an artificial medium is available, our methods of enumerating * * * bacteria by the plating process will be attended with much greater success than they are now."

On the other hand, Wyon and McLeod (1922-3) hold that some amino acids, particularly the cyclic ones, inhibit bacteria growth and that amino acid at 0.9 per cent concentration was utilized, but at 1.1 per cent concentration, it was inhibitory. Tarrey and Buckell (1922) state that high concentrations of amino acids yielded no better growth for the genococcus than the usual 1 per cent peptone, and the same was true regarding the presence of glucose. Hucker (1925) shows that the micrococci do not grow on pure amino acids but that the colon-typhoid group grows abundantly on such media.

Berry (1914-15) states that with several American peptones, cultures of typhi, streptococci, and coli gave better, sometimes equal, and sometimes poorer colonies. She secured better results with tryptic digestion of her meat for broth. Heuer (1923) tested two new peptones and found one superior to Witte's for the growth of several commonly used groups, and the other was inferior.

Rettger, Berman, and Sturges (1916) state that amino acid content of American peptones is considerably greater than in the Witte product.

Tilley (1921) studied the influence of peptone on indol production by *B. coli* and found that the use of six different peptones produced such wide variations in results that he recommended: "It is advisable to test each new lot of peptones used in order to determine its suitability for indol production and also for optimum incubation time."

Moreover, Chamot and Georgia (1926) studied eight American peptones and found that they varied in pH value in that the latter bears no relation to the degree of buffer action and the peptone itself. They showed that for cultivation of *B. coli,* quite different optimum reactions were obtained for media made from different peptones, and hold that statements which appear in the literature with regard to optimum reactions for the cultivation of bacteria are of little value unless accompanied by complete information regarding the ingredients used in the preparation of the culture media.

It is thus clear from the great amount of experimental data already accumulated over the past thirty years that:

1. Media of different nitrogen compositions greatly affect the cultural characteristics of various bacteria.
2. Different kinds of nitrogenous compounds are necessary for various bacteria.
3. Peptones vary in their cultural effects.

4. Amino acids in proper strength are generally the most important nitrogen compounds for culture media.
5. Bacterial culture media must possess the lower nitrogen compounds for proper growth.

In a recent survey of the practice of a large number of laboratories using the standard bacteriological methods of milk analysis, Breed (1926) reported the following number of laboratories which used peptones of different manufacture and amount:

Brand of peptone	Number of laboratories using 5 gms. peptone	10 gms. peptone
Difco	123	27
Witte	26	8
Parke, Davis & Co.	4	1
Armour	3	3
Fairchild	3	1
Merck	1	2
Allen & Hamburg	1	

The variation in "peptone" practice is striking.

In collaboration with the committee, as stated above, the samples of submitted peptone were marked with code letters and sent to our bacteriological laboratory for incorporation into media. Each peptone was made into a liter of medium according to the following formula:

15 gms. of shredded agar (Market)
3 gms. of beef extract (Liebig)
5 gms. of peptone
1000 c. c. of distilled water

A liter of medium was made according to the same formula except that the peptone was omitted. Care was taken to follow exactly the same technique in the preparation of each different medium. The reaction was adjusted to pH 7.1 before sterilization.

In plating, the milk was first diluted 1-10 by adding 10 c. c. of sterile distilled water. Higher dilutions were made in the same way. The same pipette was used to inoculate all plates of the same dilution. Two plates were run on each dilution. Plates were incubated at 37° C. for approximately 44 hours. Two samples of pasteurized and four of unpasteurized milk were used.

In Table I is presented the tabulated data from the bacteriological laboratory:

TABLE I

BACTERIOLOGICAL ANALYSES OF PEPTONE AGAR MEDIA

Sample Designation	pH	Recorded Count (Average of 2 Plates) Pasteurized		Unpasteurized			
F. B.	6.6	14,000	6,100	180,000	86,000	150,000	4,900
N. P.	6.6	7,700	2,700	110,000	29,000	40,000	6,300
F. D.	6.6	12,000	3,400	120,000	75,000	110,000	5,500
D. T.	6.7	11,000	2,500	110,000	67,000	140,000	3,600
P. D.	6.7	7,400	2,100	220,000	41,000	84,000	4,800
D. B.	6.7	8,900	3,500	130,000	27,000	63,000	5,500
O. P.	6.8	9,400	2,000	180,000	42,000	61,000	3,800
F. A.	6.6	9,700	3,800	170,000	69,000	170,000	6,700
D. P.	6.6	9,900	2,500	160,000	55,000	130,000	4,200
F. C.	6.7	9,100	2,900	53,000	39,000	110,000	2,500
Without Peptone	6.4	6,700	2,500	41,000	33,000	60,000	3,900
Laboratory	6.7	12,000	3,200	150,000	55,000	80,000	4,700

In Table II is presented the biochemical nitrogen analyses of the respective media. The respective nitrogen fractions are expressed in terms of percentage of total nitrogen.

In order to ascertain the relative value of the different media for growing milk bacteria, the samples were arranged in descending order of bacteria counts. This was effected by rating each sample on the scale of 100, giving the full value of 100 to the sample with the highest count, giving 90 to the next to the highest, 80 to the second from the highest, and so on down to the last. Where the counts were alike, the same rating was given. The total score of each sample was then ascertained, and the samples arranged in descending order of the score. In Table III are tabulated the individual sample scores.

TABLE II

BIOCHEMICAL ANALYSES * OF PEPTONE AGAR MEDIA

Sample Designation	Protein Nitrogen	Polypeptid Nitrogen	Amino acid Nitrogen	Ammoniacal Nitrogen	pH Value	Total Solids
D. B.	15.98%	41.04%	39.00%	3.98%	6.4	3.48%
D. P.	42.45	22.42	25.89	9.24	6.1	2.64
D. T.**	13.15	0.0	91.57	7.58	6.5	2.87
F. A.	20.88	17.59	61.53	0.0	6.2	2.49
F. B.**	52.67	0.0	35.33	13.21	6.3	2.25
F. C.	55.64	24.55	12.41	7.41	6.2	3.80
F. D.	40.25	28.28	31.47	0.0	6.2	2.84
N. P.	65.64	24.44	8.70	1.22	6.2	3.03
O. P.	50.72	24.57	19.45	5.26	6.4	2.97
P. D.	25.32	22.03	30.31	22.34	6.3	2.64
Laboratory	38.92	32.64	27.41	1.03	6.3	3.28
Without Peptone	.....	.....	.....	.....	...	.....

* The analyses were made according to the procedure outlined by Kendall and his coworkers.

**There is a marked discrepancy between the sum of the non-protein nitrogen fractions and the non-protein nitrogen as found by precipitating the protein.

TABLE III

SAMPLE SCORE FOR ARRANGEMENT IN DESCENDING ORDER OF BACTERIA COUNTS

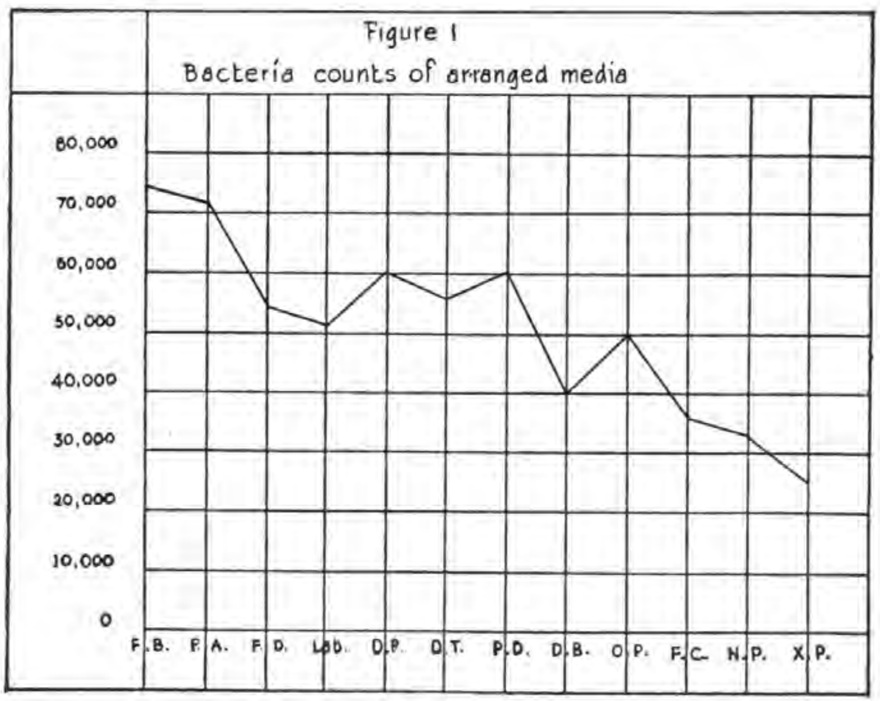
Sample Designation	Pasteurized Milk		Unpasteurized Milk				Total Score
F.B.	100	100	90	100	90	60	540
N.P.	20	40	30	10	0	90	190
F.D.	90	70	40	90	60	80	430
D.T.	80	30	30	70	80	10	300
P.D.	10	20	100	40	50	70	290
D.B.	30	80	50	0	30	80	270
O.P.	50	10	90	50	20	20	240
F.A.	60	90	80	80	100	100	510
D.P.	70	30	70	60	70	40	340
F.C.	40	50	20	30	60	0	200
Without peptone	0	30	10	20	10	30	100
Laboratory	90	60	60	60	40	50	360

It is clear that the samples fall into the following arrangement in order of descending bacteria counts:

1. F.B.
2. F.A.
3. F.D.
4. Lab.
5. D.P.
6. D.T.
7. P.D.
8. D.B.
9. O.P.
10. F.C.
11. N.P.
12. X.P.*

* Without peptone.

This method of ascertaining the relative order of the media in terms of their ability to grow milk bacteria was adopted for the reason that it gave a rating which was less susceptible to the influence of individual variations and "sport" values of bacteria counts. In other words, the rating was based on six positions out of 72, whereas if the total bacteria counts of each sample had been used, the rating would be based on one position out of twelve. However, for the purpose of ascertaining the general shape and trend of the bacteria curve, the individual counts were plotted against the above bacterial order of media, as plotted in Fig. I.



The biochemical data is plotted against the bacterial order of media in Figs. II and III.

It is noteworthy that samples designated as P. D. and Lab. were from the same manufacturer, showing a similar order of bacteria count and biochemical analysis, with the exception of ammonia. Sample D. T. was a special tryptophane

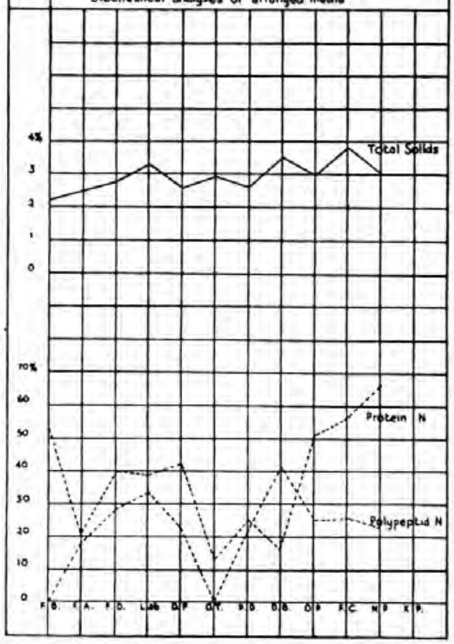


FIGURE II

Biochemical analyses of arranged media

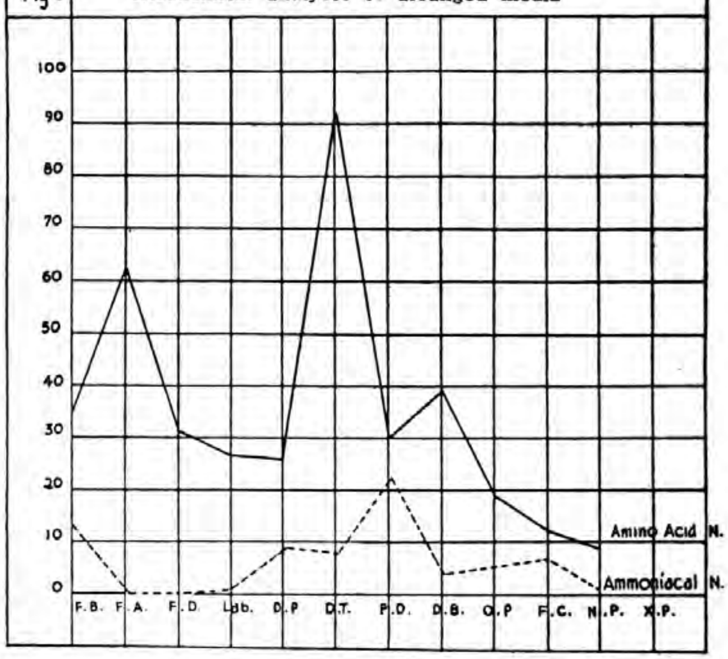


Fig 3

Biochemical analyses of arranged media

broth. Samples D. T. and F. B. both showed analytical discrepancies, particularly the former, and these are the ones most variant from the general curves.

The protein (polypeptid) and ammonia curves show no noticeable relation to the bacteria curve, unless we can say that the polypeptid content was least in the media of maximum counts and rose (with the above-cited discrepancy) to a rather constant value. The percentage of solids rather regularly increased, but this was doubtless caused by the protein. The only curve which showed a tendency to follow the bacteria curve was that of the amino acids (with the exception noted).

It is thus apparent from the work recorded in the literature and from the meager results accorded by the analysis of the above few samples that amino acids must be considered as occupying a dominant rôle in the nutrition of milk bacteria. Since the technique of "counting" milk bacteria is really an application of nutritional phenomena, and since the latter is a function of bacterial metabolism, it is clear that unless the latter is made biochemically quantitative, there is little hope that the former will be.

In connection with this whole subject of a more exactly specified and chemically controlled bacterial culture medium, it might be advisable to consider several other factors which play an important rôle in bacterial nutrition.

Several workers from time to time have called attention to the desirability of incorporating some sugar in the standard culture media for milk bacteria. Frobisher (1923) compared milk bacteria counts made on standard, lactose, and milk powder media and found that while the lactose media gave a higher total count, the colonies were larger, more uniform in size, and more regular in appearance, certainly highly desirable characteristics in milk plating technique.

Sherman (1916) showed that when lactose was added to the extent of 1 per cent, the bacteria count was increased, but particularly noteworthy was the effect on the morphology of the colonies whereby they were made much larger, particularly the acid-formers.

Supplee, Whiting, and Downs (1921) showed that dextrose agar had distinct advantages over plain or lactose agar, particularly because of less discrepancies in the bacterial counts. But Norris (1918-9) states that glucose, when added to a tryptic or acid digestion of meat, inhibited growth of *B. typhosus.*

Moreover, a number of workers have shown that the addition of carbohydrate to bacteria culture media operates as a "protein sparing" factor. Kendall (1922) showed that the relative amounts of carbohydrate and nitrogenous food available for bacterial nutrition determines very generally the kind of metabolic products which the bacteria will yield. For example, he shows (1923) that whereas in broth media *B. diphtheriæ* produces a soluble toxin and *B. proteus* elaborates a proteolytic enzyme, the addition of glucose to the same kind of culture medium effects such a striking alteration of the bacterial metabolism that in both cases merely lactic acid is formed. Berman and Rettger (1918 b) show that the hydrogen-ion concentration plays the important rôle in inhibiting the nitrogen metabolism in a medium which contains a fermentable sugar and that the failure to attack protein is dependent on a coincident rise in the acidity of the medium, but when they added K_2HPO_4 as a buffer, the protein metabolism became as marked as was observed in plain peptone broth without any sugar. Thus, the failure of certain organisms to attack complex nitrogenous bodies in a medium containing carbohydrates is due to the accumulation of products which inhibit growth, but which may be neutralized by sufficient buffer. They state that carbohydrate supplies the energy but nitrogen supplies the growth.

Foster (1921) found that the *Strep. hemolyticus* grew at a maximum rate when glucose utilization (with acid formation) and output of ammonia were at a maximum.

Jones (1916) attributed the failure of *B. proteus* to grow in a sugar-containing medium in which it had produced its maximum acidity to the paralyzing effect of the hydrogen-ion on the endo-enzyme of the bacteria, since neutralization of the media restored the bacterial vegetative functions.

Brown (1921) showed that the amount of glucose which a given organism can consume is influenced by the buffer content of the medium which aids in holding the concentration of the hydrogen-ion from the toxic limit. Samples of plain meat-infusion bouillon from different laboratories varied in buffer index from 1.7 to 5.95, and samples from the same laboratory made under supposedly uniform conditions varied in buffer index from 3.45 to 5.25.

Wolfe (1920), on the other hand, states that buffer salts inhibit gas formation or produce a lag.

Kligler (1916) confirms Kendall's development of the nitrogen-sparing effect of carbohydrate but believes that the concentration of peptone and primary phosphates is an appreciable factor in controlling the nutrition. He showed that different peptones had markedly different effects upon the growth of the colon-typhoid group.

All of these considerations direct our attention to the above conclusions of Rettger (1918) and Supplee, Whiting, and Downs (1921), who wrote: "It is essential that all factors tending to cause variations and discrepancies be reduced to a minimum." By using media with wide variations in content of amino acid, we apparently introduce a factor which contributes to discrepancies already far too large for the uses to which they are put.

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1912* Sasaki: Biochem. Ztschr., 41, 174, 462.

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1918 Berman and Rettger:
a) J. Bact., 3, 366.
b) *Ibid.* 3, 389.

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1919 Long: Amer. Rev. of Tuberculosis, 3, 86.

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* Quoted from Sears (1916)

1921 Tilley: Amer. J. Pub. Health, 11, 834.
1922 Tarrey and Buckell: J. Inf. Dis., 31, 125.
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1922-23 Wyon and McLeod: J. Hyg., 21, 376.
1923 Frobisher: Amer. J. Pub. Health, 13, 474.
1923 Kendall: Physiol. Rev., 3, 438.
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1923 Heuer: Centralbl. f. Bakteriol. I. Abt. 90, 491. Abstr. of Bact., 1924, 8, 164.
1925 Hucker: Proc. Amer. Soc. Bacteriol., 9, 40.
1926 Breed: Am. J. Pub. Health, 16, 811.
1926 Chamot and Georgia: J. Amer. Water Works Assoc., 13, 661.

"Science surpasses the old miracles of mythology."

REPORT OF COMMITTEE ON FOOD VALUE OF MILK AND MILK PRODUCTS

PROF. IRA V. HISCOCK, *Chairman*

The reports of this committee during the past three years have dealt in considerable detail with the unique qualities of milk as a food for the American family. Emphasis has been repeatedly given to the public's need for an adequate supply of safe milk. It has been noted that "one quart of milk per day should be the allowance for every growing child, and that adults would be greatly benefited, physically and mentally, by the drinking of one quart of milk daily" (McCollum). The value of proper pasteurization has been stressed, because this seems to be the most practical means at present available for producing a large amount of safe milk on a commercial basis.

Increased emphasis has been directed in recent years to the importance of systematic education of producers in the application of sanitary methods of milk production. As the quality of milk supplies has improved, stimulus has also been given to increased consumption. In this educational program, the inspector has come to occupy a responsible position. It has, therefore, seemed appropriate to review periodically the results of the most important investigations of the nutritive properties of milk.

In view of the extensive use of milk in the diet of infants and children, an effort has been made to obtain the opinion of pediatricians concerning the use of raw, of pasteurized, and of boiled milk. The report of the Committee on Pasteurization of this Association in 1925 stated in a brief historical sketch that "Jacobi in New York and Soxhlet in Munich reported favorably on the practice of heating cows' milk, as a method of safeguarding the lives and health of artificially fed infants and other milk consumers. Some other clinicians and the American Pediatric Society reported adversely, and there was a division of opinion in medical circles regarding the process." This was apparently prior to 1898, and was certainly before modern methods of pasteurization were introduced. A somewhat careful study of proceedings and correspondence with officers and members of the American Pediatric Society and of the Pediatric Section of the American Medical Association failed to reveal any specific action taken in recent years concerning these problems.

The following letter was, therefore, sent April 5, 1926, to fifteen of the leading pediatricians of the United States, and a similar communication was addressed to a few representatives of public health organizations, including the United States Public Health Service:

> "As Chairman of the Committee on the Food Value of Milk of the International Association of Dairy and Milk Inspectors, I am very anxious to secure from some of the leading pediatricians their own opinion concerning the use of properly pasteurized milk in infant feeding. By properly pasteurized milk, I have in mind the following definition: 'Pasteurization is the process of heating milk to a temperature of approximately 145 degrees F., never lower than 142 degrees F., holding every portion of the milk at that temperature for a period of at least thirty minutes, and then promptly cooling below 50 degrees F.' It is also understood that pasteurization is not intended as a substitute for clean production and handling.
>
> "I shall appreciate your kindness in giving me your own personal opinion concerning the relative merits of properly pasteurized milk in infant feeding, particularly as compared with certified milk (raw), and with milk which has been treated by boiling."

The response to this inquiry was most gratifying, and the Chairman desires to express at this time his appreciation of the cooperation received. Extracts from these replies seem worthy of quotation, as follows:

Howard Childs Carpenter, M. D., Philadelphia:

"I believe from a municipal health point of view, pasteurized milk is the best, providing it is delivered within twenty-four hours after pasteurization. I believe boiled milk is the most easily digested, and is the safest in warm weather; but during the winter months, I prefer to prescribe raw certified milk for the normal, artificially fed infants under my professional care."

L. R. DeBuys, M. D., New Orleans:

"I am in accord with your definition of pasteurization, only that the temperature in pasteurization should never be below 145 degrees F.

"It cannot be emphasized too forcibly that pasteurization is not intended as a substitute for clean milk. When pasteurization is employed, the milk should primarily be Certified Milk. Pasteurization is an added safeguard to a clean milk. A boiled milk and a pasteurized milk should never be used after twenty-four hours have elapsed from the period of heating when the milk is kept under ideal conditions."

Martha M. Eliot, M. D., Director, Child Hygiene Division, Children's Bureau, U. S. Department of Labor:

"I am strongly in favor of using pasteurized milk for all children. I believe that all milk for infants under two years of age should also be boiled. This not only renders it absolutely safe from a bacterial point of view, but also, I believe, makes it more digestible. Since I believe in giving all infants an antiscorbutic in the form of orange juice or tomato juice, I do not feel that it is dangerous to use boiled milk which has been previously pasteurized. I believe that all milk for children should come from dairies which produce milk under the best possible conditions. But I also believe that pasteurization adds a factor of safety to such milk which is very important."

John Foote, M. D., Washington:

"In feeding very young, premature or newborn infants, I use a certified raw milk boiled 2 minutes. Later, when possible, I use a certified or Grade A raw milk unboiled. I continue this until the child is one year of age if possible, economically and otherwise. When obstacles arise in this program, I advise using pasteurized milk after seven or eight months when other foods are given, as vegetables, orange juice, and meat and egg foods. Pasteurized milk after one year is optional provided vitamin C is supplied in the diet.

"The higher vitamin content of raw milk is my reason for pursuing this course. I believe that two minutes of boiling is less harmful to the nutritive properties of milk than pasteurization at 145° F. for 30 minutes or longer."

Rowland G. Freeman, M. D., New York:

"In reply to your letter, I would say that I use no raw milk in infant feeding, nor do I use commercially pasteurized milk. I use, so far as possible, certified milk, and have that properly pasteurized in the home."

Henry F. Helmholz, M. D., Mayo, Clinic, Rochester, Minnesota:

"I have not used any raw milk in the feeding of infants. I have felt that the advantages of raw milk were insignificant compared with the danger of infection of tuberculosis, diphtheria, scarlet fever, and septic sore throat that have been known to have been spread even by certified milk.

"My advice to parents has always been to obtain the very best milk possible and then to boil it for two minutes. As between pasteurized and two-minute boiling, I have advised the latter."

Julius H. Hess, M. D., Chicago:

"I am of the opinion that fresh milk, pasteurized, and which has been held at 145 degrees Fahrenheit for at least 30 minutes, and then promptly cooled below 50 degrees Fahrenheit, is safe milk for infant feeding.

"I think you will agree with me that unless the milk is fresh when put into the pasteurizer, that pasteurization alone does not make it a good food."

E. J. Huenekens, M. D., Minneapolis:

"In response to your letter of March the fifteenth: I think that properly pasteurized milk as per your definition is absolutely safe and proper to use in infant feeding.

"My own personal practice has been to have all milk, whether certified, pasteurized, or ordinary raw milk, boiled from two to three minutes for the use of children up to two years of age. Of course, I see to it that all such children have orange juice to make up for any damage to the antiscorbutic vitamin. I feel that the boiling of milk is much safer and in regard to its casein curd makes it more easily digestible."

J. H. M. Knox, Jr., M. D., Chief, Bureau of Child Hygiene, State Department of Health, Baltimore:

"I can only give you my personal view, which is derived from clinical experience. I have made inquiry and find that the American Pediatric Society has never made an official expression on this subject. I believe that commercial pasteurization has been of great value in rendering the milk supply less dangerous for infants and I think it can be shown that a definite reduction in infant mortality in large cities is probably due to commercial pasteurization. I am aware, of course, that this process has been accompanied by an improvement in our dairy methods. From a nutritional point of view, I have never noticed any reduction in the value of pasteurized milk over that of raw milk. My own practice has been for many years to boil the milk in infant feeding one to two minutes, even though the milk has been previously pasteurized. I have always felt that there was a possibility of some contamination by disease-producing germs in handling the milk after pasteurization.

"As you, of course, know, it is the universal custom now to give some antiscorbutic diet, usually orange juice, regularly to young infants and to begin with cereals and vegetable broth made with meat stock as early as six months of age. Cod liver oil is usually given throughout infancy in small quantities.

"Pasteurized or boiled milk is practically free from disease-producing germs, although it may be deficient in certain of the vitamins. Since the latter can be readily supplied from other sources, it seems to me that heated milk is a safer product in infant feeding."

William C. Lucas, San Francisco:

"We routinely advise boiling the milk before making up our formulas. Our boiling the milk for infant feeding, of course, has a duofold purpose, not only to render the milk sterile, but also to break up the curd. In the case of older children, I see no reason why pasteurized milk should not be given without subsequent boiling, and I believe this would be better in most instances. Certified milk would naturally be the ideal for older children. It might be argued that pasteurized milk subsequently boiled would be inadvisable, but we feel in the case of infant formulas it is still essential."

E. A. Park, M. D., New Haven:

"I think that certified raw milk is a dangerous milk for babies on account of the possibility of contamination with pathological organisms. All milk fed to babies should be boiled, whether it has been pasteurized or not."

Lawrence R. Royster, M. D., University, Va.:

"I presume that in a large city such as New York, Chicago, and the like, pasteurization is probably the safest procedure, provided we mean by this, milk marketed after pasteurization at the dairy. In my hospital work in Virginia, milk is delivered for the diet kitchen within four hours after milking and is boiled immediately on its receipt in the hospital. In directing mothers in the homes, I advise boiling the milk as soon as it is received, the making up of formulas at once, and, of course, keeping the bottles in close contact with the ice. The use of lactic acid milk has become so general with me that I feel reasonably safe when I know that boiled milk has been properly acidified. I believe at the present moment that the two important factors in prevention of infectious diarrhea, particularly during the summer season, are universal boiling of milk and of water."

Richard M. Smith, M. D., Boston:

"I am perfectly satisfied to use a properly pasteurized milk. Of course, it is understood in this connection that it is not intended as a substitution for a clean milk. I much prefer to use certified milk and boil it in the home. By this means one is sure of getting a superior grade of milk and the boiling makes it absolutely safe."

F. B. Talbot, M. D., Boston:

"I advise pasteurization in all cases, hoping that it is properly done for the purpose of preventing milk-borne tubercular infection. I hope I am not deceiving myself."

Borden S. Veeder, M. D., St. Louis:

"It is rather difficult for me to express any opinion as to the relative merits of pasteurized, boiled, and raw milk in infant feeding for the following reason: For several years I have been teaching as well as following out the plan in my own work and in the health centers of St. Louis of only giving boiled milk to infants under one year—this regardless of whether the milk is raw, pasteurized, or certified. After one year, we usually change to a good grade A pasteurized milk or certified milk unless the change should come in the middle of summer. We feel that this has to a very large extent eliminated diarrheal conditions and has been a large factor in reducing the infant mortality rate in St. Louis. Of course, one must routinely furnish vitamins in the form of cod liver oil and orange juice throughout the entire period that boiled milk is being fed. In addition, we have added cereals to the infant's diet at about the fifth month and green vegetables at the sixth, so that there is sufficient food substance in the diet.

"I believe thoroughly in the pasteurization of the milk supply of a community and in the production of certified milk, as the milk should be as pure as possible before it is boiled in the infant's diet.

"I can only say that I feel that our infants have done much better since they have been put on boiled milk with sufficient accessory food substance than in the days when we fed the raw milk and depended upon the raw milk for vitamins. Personally I think that the argument between raw, pasteurized, and boiled milk is one of past medical history and of little practical importance at the present time."

These replies seem to be in general agreement upon certain fundamental principles:

1. Milk for infant and child feeding should be produced and handled in accordance with the best sanitary practice. Whenever possible, milk should be obtained from dairies of the highest grade, as those certified by medical milk commissions.

2. Most of the pediatricians agreed that milk for infant and child feeding should be boiled or properly pasteurized as an added safeguard against communicable diseases which may be transmitted by raw milk. Most pediatricians now agree that boiling of milk also renders the product more digestible for infants.

3. Whether or not the milk is boiled or pasteurized, it is generally agreed that fruit juices or other substances rich in antiscorbutic vitamins should be included in the diets of infants and other children.

The Surgeon General of the United States Public Health Service replied to our communication as follows:

"The Bureau takes the stand that properly pasteurized milk originally produced and handled in a cleanly manner is by all means the best milk for city supplies from a public health standpoint. For the purposes of this letter, your definition of pasteurized milk is quite acceptable.

"The Service has been importuned to sponsor and to recognize, officially, certified milk. This it has found impossible to do, although it willingly and even gratefully acknowledges the impetus given by the certified milk movement to better milk production and handling many years ago. The reasons for unwillingness to comply with these requests are chiefly these:

(1) It is not believed possible for the central association of Medical Milk Commissions to supervise sufficiently stringently the many commissions throughout the country so that their personnel and activities can be confidently assumed at all times to be effective. (2) It is impossible to advise the relegation of official responsibility for milk control to a nonofficial agency. (3) No system of handling or of medical inspection of operatives is believed adequate to assure the absence of human contamination from milk. (4) Certified milk is too expensive to be available in sufficient quantities to those groups which need milk most. (5) The nutritional advantages claimed for raw milk are too slight and uncertain to offset the disadvantages mentioned.

"Milk boiled in the home is known to be successfully used in Europe and feeding experiments have shown boiled milk not to be inferior nutritionally when large groups are compared. Preboiled milk, however, is unmarketable in America on account of the alterations in taste and appearance, and does not come into consideration for community supplies. If properly handled, it would, of course, have the same advantage as pasteurized milk regarding nontransmission of infection."

Taliaferro Clark, Senior Surgeon, U. S. P. H. S., London, England:

"Personally and unofficially I am inclined to believe that properly pasteurized milk is best for infant feeding because:

1. It is a safe milk.
2. It is presupposed that the milk is made safe under official regulation and supervision.

3. It obviates, or rather minimizes, secondary handling.

4. Its nutritive properties are negligibly impaired.

"Personally, and again unofficially, I have to advise you that I have always advocated the use of milk boiled in the home when the milk supply is uncertain and pasteurization is not carried out under proper supervision. I am inclined to think that there is a convergence of opinion to the effect that the digestibility of milk is increased by cooking (boiling), that the curds are finer, and that the nutritive value is unimpaired except as boiling affects the antiscorbutic vitamin. This defect will be overcome by the use of orange juice or other suitable antiscorbutic.

"Please allow me to suggest that in your report you emphasize the limited period following pasteurization during which pasteurized milk is free from danger, due to the destruction of the acidophilic bacteria which exercise an inhibitory effect on the growth of the proteolytic organisms."

S. J. Crumbine, M. D., General Executive, American Child Health Association, and Field Secretary, Conference of State and Provincial Health Authorities of North America:

"While I cannot speak for the American Pediatric Society, not being a member of that organization, yet as I understand it, this society has never made a definite announcement expressing the society's opinion on pasteurization. On the other hand, I think I am expressing the views of the majority of the most prominent pediatricians when I say that they believe all milk, before being used for infant feeding, should be effectively pasteurized in the sense in which you have defined it in your letter, some even going to the extreme of requiring sterilization by boiling. Some of the foremost pediatricians are insisting that even certified milk be effectively pasteurized.

"I also believe I am voicing the opinions of the State health officers, quite unanimously, when I say that they are of the general belief that effective pasteurization should be required for all milk that is sold or offered for sale. They believe that whatever minor chemical changes may take place by pasteurization—and I believe there are unimportant changes from a nutritional point of view—the potential dangers from raw milk are so great that public safety demands pasteurization or some type of sterilization.

"Boards of health universally insist that their water supplies be chlorinated, even after they are filtered by modern processes. The danger from nonpasteurized milk is infinitely greater, in my judgment, than that of nonchlorinated water. This consensus of opinion is pretty well expressed in the appraisal form (for City Health Work of the A. P. H. A.), for the chief credit of milk control is that of pasteurization."

Finally, it is noteworthy that the American Public Health Association at the annual meeting held in Detroit in 1924 passed the following resolutions: "Pasteurization of Milk.—WHEREAS, pasteurization of milk has proved of inestimable value in the prevention of tuberculosis of children as well as other diseases; and—WHEREAS, it is at present the most practicable and rapidly carried out measure for the safeguarding of the milk supply; be it *Resolved,* that this Association go on record as endorsing the pasteurization of milk supplies for human consumption."

A brief review of the literature regarding certain problems above mentioned may be added in this connection. Data from different laboratories have shown that the antiscorbutic property of milk is not of constant and uniform potency. Cohen and Mendel [1] found that 70 c. c. of fresh raw milk fed daily afforded guinea-pigs complete protection from scurvy, whereas 50-c. c. quantities failed to do so. Hart, Steenbock, and Smith [2] state that an average consumption of 84 c. c. of raw whole milk per day provided absolute protection and that 30 c. c. of the same milk

[1] Cohen, B., and Mendel, L. B.: J. Biol. Chem. 35:425 (Sept.) 1918.
[2] Hart, E. B.; Steenbock, H., and Smith, D. W.: J. Biol. Chem. 38:305 (June) 1919.

delayed the onset of the disease. Hess and Unger [3] state that 80 c. c. of fresh milk per day furnish adequate protection for the guinea-pig. Chick, Hume, and Skelton [4] report adequate protection only when from 86 to 130 c. c. were fed. Barnes and Hume [5] found that 98 c.c. daily were insufficient to prevent scurvy, and that from 119 to 147 c. c. quantities were necessary to effect a cure.

Supplee [6] has pointed out that the variable amounts of milk found necessary to protect guinea-pigs from scurvy may easily be explained by the difference in potency of the milk as caused by the amount of vitamin C in the feed of the lactating animal. Hart, Steenbock, and Ellis [7] report that 50 c. c. per day of milk produced in the summer were adequate for complete protection, whereas from 75 to 80 c. c. were necessary when milk produced in the winter was used. Dutcher and his coworkers [8] found that 20 c. c. per day of summer milk were equivalent in antiscorbutic potency to 60 c. c. of winter milk, but that both quantities were inadequate for protection. They found, however, that from 70 to 80 c.c. of winter milk gave satisfactory protection. Hess and his collaborators [9] have also clearly shown that wide variations in the vitamin C content of milk may result from differences in the ration fed during the period of lactation.

Aside from the variability in antiscorbutic potency of milk, caused by inherent variations in the ration of the cow, other factors introduced by the processing of milk apparently influence the potency of vitamin C in this product.

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[3] Hess, A. F., and Unger, L. J.: J. Biol. Chem. 38:293 (June) 1919.

[4] Chick, H.; Hume, E. M., and Skelton, R. F.: Biochem. J. 12:131, 1918.

[5] Barnes, R. E., and Hume, E. M.: Biochem. J. 13:306, 1919.

[6] Supplee, G. C., and Dow, O. D.: "Variations in the Antiscorbutic Properties of Dry Milk," A. J. Dis. Children, 31:41 (Jan.) 1926.

[7] Hart, E. B.; Steenbock, H., and Ellis, N. R.: J. Biol. Chem. 42:383 (July) 1920.

[8] Dutcher, R. A.; Eckles, C. H.; Dahle, C. D.; Mead, S. W., and Schaefer, O. J.: J. Biol. Chem. 45:119 (Dec.) 1920.

[9] Hess, A. F.; Unger, L. J., and Supplee, G. C.: J. Biol. Chem. 45:229 (Dec.) 1920.

The work of Hess and Weinstock[10] shows that the contamination of milk by small amounts of copper during pasteurization diminishes its antiscorbutic properties. The results which have been obtained from desiccated milk indicate that the methods of drying affect the potency of this vitamin in such products. The observations of Hess and Unger,[11] Hart, Steenbock, and Ellis,[12] Johnson and Hooper,[13] and Jephcott and Bacharach,[14] are in close agreement in regard to the relative antiscorbutic properties of dry milk made by the Just process, and that made by the spray method. The conclusion reached by these investigators is to the effect that the roller process powder, especially certain brands, shows little or no reduction in antiscorbutic value as compared with natural fluid milk, whereas the spray process products in most instances show a marked diminution of this factor. The difference in results obtained from milk powder prepared by the two methods has been frequently attributed to the difference in degree of oxidation to which each of the products is subjected during desiccation. This hypothesis is supported by different investigations which have clearly demonstrated the deteriorating effect of oxidation on this vitamin. Cavanaugh, Dutcher, and Hall,[15] however, have recently reported a high degree of protection from scurvy for guinea-pigs, with as low as 42 c. c. per day of reconstituted spray process powder produced from milk of late fall and early winter. As a result of their studies, they conclude that the spray method of drying causes no diminution in the antiscorbutic factor. Although a marked variation in the vitamin C content of milk may

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[10] Hess, F. C., and Weinstock, M.: J. A. M. A. 8a :952, 1924.

[11] Hess, A. F., and Unger, L. J.: Am. J. Dis. Child. 17:221, 1919.

[12] Hart, E. B.; Steenbock, H., and Ellis, N. R.: J. Biol. Chem. 46:309 (April) 1921.

[13] Johnson, J. M., and Hooper, C. W.: U. S. P. H. Rep. 37:989 (April 28) 1921.

[14] Jephcott, J., and Bacharach, A. L.: Biochem. J. 15:129, 1921.

[15] Cavanaugh, G. W.; Dutcher, R. A., and Hall, J. S.; J. Indust. and Engin. Chem. 16:1070, 1924.

result from differences in the ration of the cow, the exact causes of the variations in protective ability of milk powders made by different methods are as yet not clearly explained. In view of the constantly increasing use of dry milk for infant feeding, the investigations noted below, which are the first of a series, were designed to ascertain, if possible, some of the reasons for the discordant results previously reported from this product.

Experiments carried on by Supplee and Dow are recorded in a valuable paper [16] which has been liberally utilized in this report. Their results show that as high as 80 c. c. of reconstituted spray process whole milk powder per day is insufficient to protect guinea-pigs from scurvy when either of two common basal scorbutic rations are used. The results are in substantial agreement with those of many other investigators, who report a deficiency of the antiscorbutic vitamin in desiccated milk made by certain spray processes.

The data also show that dry milk made by the Just roller process, and stored in an atmosphere at room temperature for two years, has an antiscorbutic potency substantially equivalent to that reported for fresh milk produced at the same time of the year.

It is concluded that neither the differences in the scorbutic basal ration nor the period of storage serves as an adequate explanation for the low antiscorbutic values reported for certain milk powders.

A note from Norway calls attention to the difference in the vitamin A content of milk during different periods of the year. [17] The author shows by curves considerable difference in vitamin A content of cows' milk in spring, summer, and fall. For four weeks, rats were given a ration, complete in all respects, except that it did not contain

[16] Supplee, G. C., and Dow, O. D.: "Variations in the Antiscorbutic Properties of Dry Milk," A. J. Dis. Children, 31 (Jan.) 1926.

[17] Eva Sopp, Norsk. Mag. f. Lægevidensk. 85:123, 1924, abstracted in Amer. Jour. Dis. of Children, 29:262, 1925.

any vitamin A. Then 1 c. c. of cows' milk was added to the ration. This addition during spring from April 18 to June 9 did not have any effect on the weight curve, which was nearly horizontal during the whole period mentioned. The same addition of summer milk in the period from June 18 to July 16 gave a very good gain in weight in the rats. A gain, but not so good, was also seen during fall. The author believes the explanation is to be sought in the way the cows are fed.

Studies have been made of the antirachitic property of milk and its increase by direct irradiation and by irradiation of the animal.[18] Rats were fed on a diet which produced rickets. The addition of at least 12 c. c. of cows' milk daily was necessary to cause recovery of the rats from rickets. If the milk were exposed to ultraviolet rays, however, only 1 c. c. was needed for recovery. Similar experiments with goats' milk showed that 0.5 c. c. of irradiated milk was equivalent to 12 c. c. of unirradiated milk in healing rickets. When a goat was irradiated one hour daily for four days, its milk showed healing properties.

Lenstrop has attempted to ascertain in what forms and quantities phosphorus is ingested by the breast-fed child and the artificially fed child.[19] For the analysis of cows' milk, there was used a mixture of the milk from 30 selected cows found healthy by regular examinations. The milk was analyzed fresh, with precautions against contamination by bacterial decomposition or otherwise. The normality of the milk was further confirmed by determination of the fat and solid contents and specific gravity, and by microscopic examinations. Comparison of average results showed that a liter of cows' milk contained 6.7 times as much total phosphorus as a liter of human milk, 6.6 times as much acid-insoluble phosphorus, 6.7 times as much

[18] H. Steenbock, E. B. Hart, C. A. Hoppert, and Archie Black, J. Biol. Chem. 66:441, 1925.

[19] Lenstrop, E., J. Biol. Chem. 70:193, 1926.

acid-soluble phosphorus, 13.1 times as much inorganic phosphorus, and 1.7 times as much acid-soluble organic phosphorus. Studies of possible seasonal variation showed that in the main the casein phosphorus and organic acid-soluble phosphorus remain the same throughout the year, but that inorganic phosphorus is high from September to May, and low during June, July, and August. The low values correspond to the period during which the animals were in pasture, the high values to the period of stall feeding.

While milk occupies a unique position as a food in that it is a natural, complete ration for young animals, attempts to use it as such for the raising of animals to maturity have usually failed. Davenport, [20] Eckles, [21] Fitch, Hughes, and Cave, [22] and McCandlish, [23] found that calves developed normally on milk alone for a period of only about three months, after which they did not do well. Huffman and Robinson [24] have recently reported on data from 14 calves which were fed rations of milk alone or milk supplemented with various materials, and their results compare with those of previous observers. They state that the fundamental cause of the symptoms noted is still problematical, but that vitamins are apparently ruled out. The similarity of the symptoms of their animals with those of parathyroid ectomized animals is striking. According to their reports, parathyroid removal or impairment is accompanied by a depletion of the blood calcium.

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[20] Davenport, E., Illinois Agric. Exp. Sta. Bull. 46, 1897.

[21] Eckles, C. H., quoted by Henry, W. A., and Morrison, F. B.; Feeds and Feeding, 18th ed., 432.

[22] Fitch, J. B.; Hughes, J., and Cave, H. W., quoted by Henry, W. A., and Morrison, F. B.: Feeds and Feeding, Madison, 18th ed., 1923, 432.

[23] McCandlish, A. C.: J. Dairy Sc. 6:54, 1923.

[24] Huffman, C. F., and Robinson, C. S., Jour. Biol. Chem. 69:101, 1926.

"It is not the insurrections of ignorance that are dangerous, but the revolts of intelligence."

REPORT OF COMMITTEE ON METHODS OF BACTERIAL ANALYSIS OF MILK AND MILK PRODUCTS

George E. Bolling, *Chairman*

The chief work of the Committee, the past year, has been an attempt to ascertain the value of the determination of the hydrogen ion concentration of milk.

Methods of conducting such tests were regarded by many as cumbersome, requiring much apparatus and time, until an improved, portable outfit for this purpose was recently placed upon the market by the LaMotte Chemical Products Company of Baltimore.

Reference to a possible value of the hydrogen ion reading of milk samples was made at last year's meeting in a paper by Russell S. Smith. As stated by Mr. Smith, the testing of milk with the LaMotte outfit can be carried on rapidly and samples can be tested as fast as milk arrives at a receiving station. No incubation period is required, the results being immediately available. Our work, as participated in by five laboratories, has been an attempt to correlate the hydrogen ion value with the data obtained from plate counts and reductase tests on the same samples of milk.

The five laboratories were situated too far apart to render possible exchange of samples; therefore, each selected several grades of milk. The data obtained from the testing of nearly seventeen hundred samples by the three methods—plate count, reductase, and hydrogen ion—is presented for your observation.

A brief description of an hydrogen ion outfit may not be amiss at this point for those who may be altogether unfamiliar with it. The portable outfit as loaned to each of the five collaborating laboratories by the LaMotte Chemical Products Company consists of a polished mahogany case, thirteen inches long, five and one-half inches wide, and eleven inches high, with a handle for carrying. The top and sides are hinged, and when open the entire apparatus is most conveniently located for manipulation. Nineteen vials with individual pipettes contain buffer solutions reading from pH. 4.8 to 8.4 in intervals of 0.2 pH. The indicator solutions—methyl red, brom cresol purple, brom cresol blue, and phenol red—are provided in somewhat similar vials. Two dozen glass cells, 10 mm. in diameter by 3 mm. in depth, an opal glass plate, a platinum wire loop, and various pipettes are included in the outfit.

The method of procedure is to fill one of the glass cells with distilled water by means of a pipette, then add a loopful of the milk to be tested and one drop of the phenol red solution. If a red, pink, or orange color results, the hydrogen ion concentration lies in the range of phenol red, unless it is more alkaline, in which case another indicator must be used in a fresh sample.

Select the buffer solution which is thought to be nearest to the hydrogen ion concentration of the milk sample. Fill a glass cell with this solution and add a drop of the indicator solution and compare the color of the two cells.

When, as is usually the case, a number of milk samples are to be examined, it is convenient to make up the whole range of buffer solution standards, and the matching of colors can be carried on very rapidly.

The following tables present the data afforded by the various tests, the participating laboratories being designated by the State in which they are located:

TABLE I

Laboratory	Plate Count Number	Plate Count Per cent	Below 100,000 Reductase Test 5½ hours or more Number	Per cent	pH 6.8 or above Number	Per cent
Kentucky	10	100	9	90	7	70
Massachusetts	128	100	127	99	64	50
Michigan	19	100	18	95	18	95
Ohio	540	100	475	87	277	50
Texas	66	100	...	...	0	0

Actual average 6.6

TABLE II

Laboratory	Plate Count Number	Plate Count Per cent	100,000 to 500,000 Reductase Test 3 to 5½ hours Number	Per cent	pH 6.4 or above Number	Per cent
Kentucky	41	100	34	85	41	100
Massachusetts	40	100	37	92	40	100
Michigan	33	100	33	100	33	100
Ohio	254	100	147	58	246	97
Texas	24	100	...	...	3	12

Actual average 6.6

TABLE III

Laboratory	Plate Count Number	Plate Count Per cent	500,000 to 1,000,000 Reductase Test 2 to 5 hours Number	Per cent	pH Below 6.4 Number	Per cent
Kentucky	16	100	9	56	0	0
Massachusetts	30	100	30	100	0	0
Michigan	26	100	26	100	0	0
Ohio	97	100	64	66	3	3
Texas	3	100	...	...	2	67

Actual average 6.6

TABLE IV

Laboratory	Plate Count Number	Plate Count Per cent	1,000,000 to 4,000,000 Reductase Test 2 to 5 hours Number	Per cent	pH Below 6.4 Number	Per cent
Kentucky	60	100	24	40	4	7
Massachusetts	40	100	20	50	10	25
Michigan	59	100	37	63	0	0
Ohio	80	100	11	14	1	1
Texas	1	100	...	...	1	100

Actual average 6.5

TABLE V

4,000,000 to 20,000,000

Laboratory	Plate Count Number	Plate Count Per cent	Reductase Test 20 min. to 2 hours Number	Reductase Test 20 min. to 2 hours Per cent	pH Below 6.4 Number	pH Below 6.4 Per cent
Kentucky	40	100	28	70	8	20
Massachusetts	24	100	19	79	2	8
Michigan	45	100	34	75	0	0
Ohio	5	100	2	40	0	0
Texas	0	0	...	...	0	0

Actual average 6.8

TABLE VI

Above 20,000,000

Laboratory	Plate Count Number	Plate Count Per cent	Reductase Test less than 20 min. Number	Reductase Test less than 20 min. Per cent	pH Below 6.4 Number	pH Below 6.4 Per cent
Kentucky	0	0	0	0	0	0
Massachusetts	0	0	0	0	0	0
Michigan	3	100	1	33	0	0
Ohio	0	0	0	0	0	0
Texas	0	0	0	0	0	0

Actual average 6.4

Based on the bacterial plate counts and following the classification given for grouping by the reductase tests, all the samples of milk are divided into six groups: Below 100,000; 100,000 to 500,000; 500,000 to 1,000,000; 1,000,000 to 4,000,000; 4,000,000 to 20,000,000, and above 20,000,000.

In the case of the 763 samples of the first group, an average of 93 per cent was found to be placed in this classification by the reductase test. Previous workers having mentioned a pH value of 6.8 or above for pure milk, this was tentatively considered equivalent to milk with a count below 100,000 and not reacting to the reductase test in five and one-half hours. It is seen that the percentage of samples reaching a pH of 6.8 vary from 0 to 95 per cent, the average being 53 per cent, the actual average found being pH 6.6.

In the second group, the reductase test placed 84 per cent of the samples correctly. Here a reduction in pH value to 6.4 or above was allowed, and an average of 82 per cent of the samples were found in accord. For the first four laboratories the average is over 99 per cent, the actual value found being pH 6.6.

In the third group, 80 per cent of the samples were correctly placed by the reductase test, while in the case of but one laboratory only was there any corresponding lowering of the pH value, the actual average found being 6.6.

In the fourth group, the reductase test places an average of but 42 per cent of the samples correctly. The pH values for even such high count milk were found to vary so slightly from those yielded by milk with greatly lower counts that in this group the tentative pH value was not changed nor was it for the remaining two groups, the actual average found being pH 6.5. Here, the values, as reported, varied as widely as was possible, from 0 to 100 per cent. The 100 per cent figure stands for but a single sample, however, and disregarding it we have an average of 8 per cent of the samples with a bacterial count ranging from one to four million, giving a pH value below 6.4.

In the fifth group, the reductase test placed 66 per cent of the samples correctly, while the average of those falling below pH 6.4 was 7 per cent, the actual average found being pH 6.4.

In the last group, we have but three samples with a count over 20,000,000 and 33 per cent of these were correctly placed by the reductase test, though the other two samples required but slightly more than the standard 20 minutes allowed for decolorization. Even with this high-count milk, none gave a pH value below 6.4, the actual average found being pH 6.8. These samples were from one laboratory only and from there the pH values were found to be 6.8 for all six classes.

As will be observed, the results of this work tend to show that we may expect most milk with a bacterial count below 500,000 to have a pH value of 6.4, or above. However, in the case of milk with much higher counts there is little corresponding change in the pH value.

To us, it appears that the colorimetric determination of the hydrogen ion concentration of milk fails to yield information of sufficient practical value to recommend itself to the milk inspector or dairy station. In the case of the latter, occasions might occur when milk near the turning point, but neither tasting nor smelling sour, might be detected as unfit for pasteurization. In the inspector's laboratory, however, particularly in determining the pH value of culture media, the outfit has a most useful application.

One feature of this year's work that should not be allowed to pass without comment is the greater variance with bacterial results shown by the reductase test than was the case in the report of this committee two years ago. This is particularly noticeable in milk with a count greater than 1,000,000 per c. c.

As empowered by vote of this Association in 1923, we have continued to examine dehydrated media intended for use in plate counts of milk. Our approval was given to the product of the Digestive Ferments Company, which was found to give results within acceptable limits with those obtained with standard media. In the new edition of the Standard Methods for the Bacteriological Examination of Milk, it is probable that Bacto-Nutrient Agar (Dehydrated) will be included as a standard medium on a par with meat-extract peptone agar.

"The slowest of us cannot but admit that the world moves."

STATE AND MUNICIPAL MILK REGULATIONS

R. E. Irwin, *Chief,*
Division of Milk Control,
Pennsylvania Department of Health.

At present milk control is being promoted by national, State, and municipal governments. Doubtless, each has a part in this important work, though the relation of one to another is not always clear. State and municipal governments are required by legislation to assume a direct responsibility and it is with these two agencies that we shall deal in this paper, although the value of national assistance is recognized and shown to be fundamental.

Having a working knowledge of conditions in Pennsylvania, the writer makes direct reference to his own State, assuming that conditions in other States are similar.

The national Government cannot assume the responsibility for milk control in Pennsylvania. It can, however, regulate interstate commerce and thus indicate by example what it believes to be good practice. Furthermore, the national Government may recommend regulations which it believes necessary for the protection of the public health in the States. National recommendations have a great influence upon State procedure. A State department of health would hesitate to allow national recommendations to go unheeded when founded on thorough and unbiased research or shown to be practical and necessary by experience.

The State Government can assume the entire responsibility for milk control within its territory. Some believe this a proper function of the Commonwealth, while others feel that the municipality should assume either the whole or a greater part of control, leaving only State-owned institutions and unincorporated territory under State supervision. In Pennsylvania there is a division of responsibility between the Commonwealth and the municipality. The State has enacted certain laws to be enforced by State officials and it has also authorized municipalities to carry on supervision under local ordinances. The municipality may increase the requirements of the State. In either case adequate control is possible only as the State or municipality provides practical regulations and these regulations are enforced by competent inspectors.

The writer is of the opinion that there is need for national as well as State and municipal supervision and that each has a proper relation one to the other. Because of this, he is bold enough to submit his views for your constructive criticism, believing the following division of activities possible under present legislation in several of our States, including Pennsylvania:

I. National

1. Tuberculin testing of dairy herds.
2. Definition of whole milk, skimmed milk, pasteurized milk, etc.
3. Efficiency reports on new processes and equipment, such as pasteurizers, washers, etc.
4. Standard laboratory equipment and methods.
5. Requirements for temperature recorders and controllers.
6. Requirements for milk fat and milk solids.
7. Directions for the medical examination of milk handlers.
8. Regulation of interstate traffic in milk.
9. Promotion of interstate cooperation.

II. State

1. Carry out national policy.
2. Promote interstate cooperation and good-will.
3. Recommend general regulations suitable for municipalities within the State.
4. Provide detail regulations for areas directly under State supervision.

5. Promote municipal supervision and cooperation.
6. Assist in establishing municipal control and in the instruction of local inspectors when requested.
7. State control of municipalities where milk supervision is useless or unfair.
8. When requested, make inspections of dairy farms, receiving stations, and treatment plants. This to be done in company with the municipal inspector or health officer.
9. Investigate complaints received from consumers, civic organizations, producers, distributors, etc., when such complaints cannot be handled by local inspector.
10. Act as adviser and arbitrator, on request.
11. Protect municipalities and those interested financially in the milk business against fake methods and equipment.

III. Municipal

1. Provide detail regulations to meet municipal needs and State requirements.
2. Employ trained local inspector.
3. Cooperate with nearby municipal inspectors and with State inspectors.

The success of such a division of activities is dependent upon municipal regulations and upon State and municipal inspection.

The scope of the municipal ordinance and the qualifications of the inspector are as follows:

Municipal Ordinance

1. Acceptable to the legal adviser.
2. Each regulation necessary and practical for the protection of the consumer.
3. Each regulation in harmony with fair competition.
4. Clear in meaning.

5. Suited to present-day conditions.
6. As far as possible tells what is wanted and leaves the method and equipment to be selected by the producer and distributor.
7. Increases milk consumption.
8. Provides penalties in keeping with the violations.

Municipal Inspector

1. School-trained, mature in age and judgment, and experienced in the milk business.
2. Thoroughly acquainted with the methods and equipment for the production and distribution of clean, safe milk.
3. Capable of interpreting in an official way the regulations he is enforcing. Makes a clear declaration of what is legal and what is illegal.
4. Enforces regulations by prosecution as a last resort but is firm and insistant when once legal procedure begins.
5. Provided with equipment necessary to measure the efficiency of the processes inspected.

The need for direct supervision by the State and the adoption and successful enforcement of municipal ordinances depends largely upon the political divisions into which the State is divided. In this, States differ. Pennsylvania is divided into 67 counties. Within these counties there are cities of the first class, second class, and third class, boroughs and townships of the first class and second class. These divisions number as follows:

Cities of the first class	1
Cities of the second class	2
Cities of the third class	40
Boroughs	931
Townships of the first class	60
Townships of the second class	1501

Cities, boroughs, and townships of the first class are municipalities having their own government, which includes Boards of Health, and authority to supervise their public milk supplies.

The Pennsylvania Department of Health has the right to take over the health activities of a municipality when the Secretary of Health determines that the protection of the public health warrants such action. At present there are 110 municipalities so regulated.

Townships of the second class have no local health officials and are under State supervision. These townships have a total population of approximately 2,225,000, or about one fourth of the State's population. Small municipalities—in fact the majority of those under 5000 population—have difficulty in carrying on adequate milk control unless adjacent to other, and usually larger municipalities, with whom they may cooperate. That there are many small boroughs and cities is shown in the following table:

Number of cities and boroughs in the State giving populations as indicated (1920 census):

Over 20,000	33
10,000 to 20,000	44
5,000 to 10,000	88
2,500 to 5,000	141
1,000 to 2,500	242
100 to 1,000	414
Under 100	12
Total	974

The 426 boroughs having a population less than 1,000 represent a total population of 137,000. It is apparent, therefore, that adequate control of the milk supplies in the State cannot be carried on through city supervision but is a problem pertaining to small communities (boroughs and townships) having a combined population equal to about one third of the entire State. The majority of these small communities cannot support a pasteurizing plant and unless they are adjacent to large boroughs or cities they must be content with a raw milk supply. This is a fact many State officials would like to forget. To obtain the universal pasteurization of milk for human consumption under present conditions means that the Commonwealth or some philanthropist must contribute to the support of many small milk treatment plants.

Until pasteurized milk is available I feel it is the duty of State health officials to recognize the tuberculin testing of dairy herds as a health measure, to supervise the medical examination of milk handlers, and to insist on the proper cleansing of milk containers.

The National government has not been active in promoting the requirements assigned to it in this paper. However, of the nine requirements mentioned, the Pennsylvania Department of Health is using five:

First, the tuberculin testing of dairy herds when milk is sold to the consumer as raw milk.

Second, the national definition of pasteurized milk.

Third, the installation of approved temperature recorders.

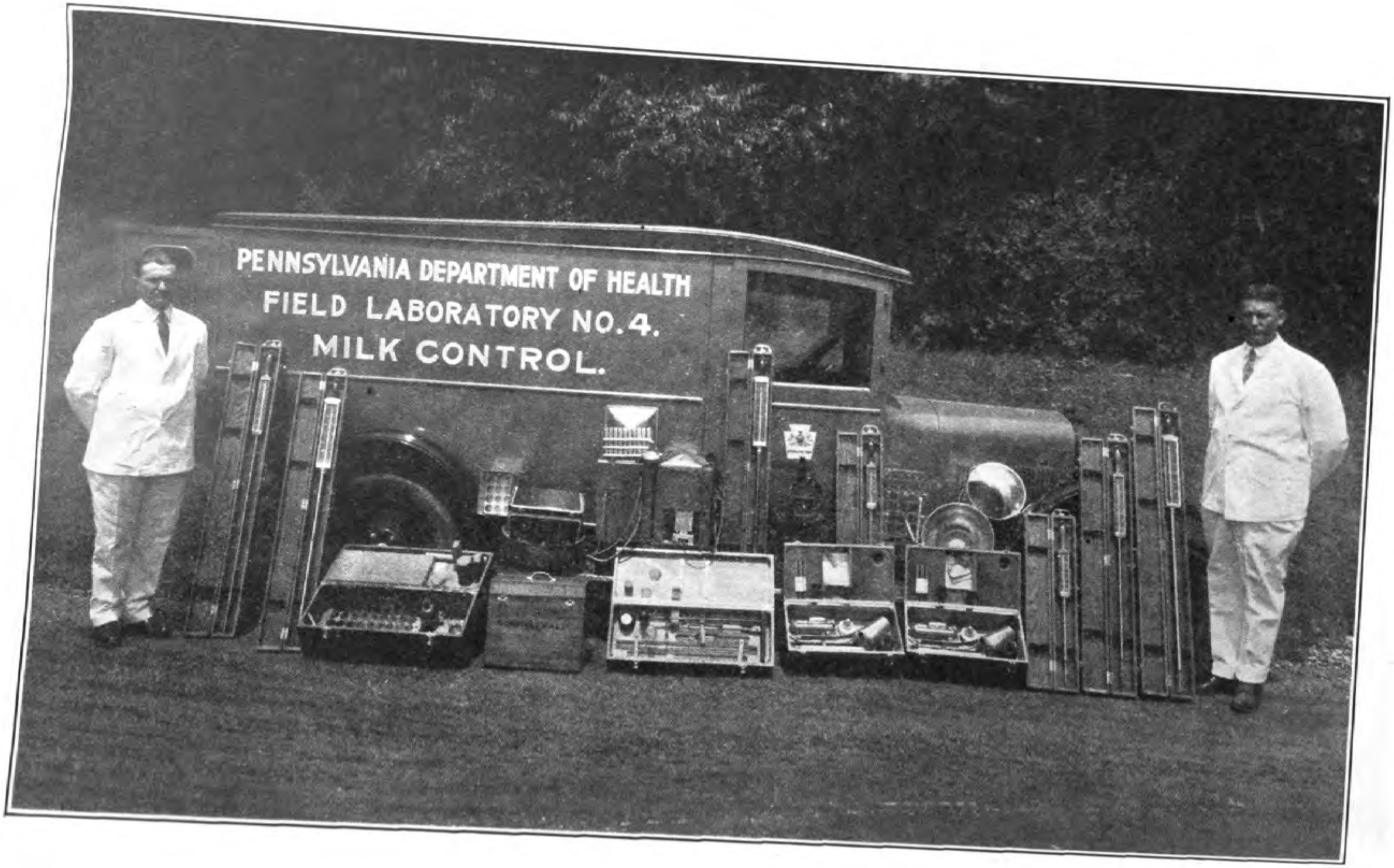
Fourth, medical examination of milk handlers.

Fifth, interstate cooperation. New York, New Jersey, and Pennsylvania are at present considering the adoption of similar milk regulations.

In a small way we have studied new methods, having recently made a rather complete study of the Electropure process of milk treatment.

Of the list of State regulations, some attention has been given to each but not to the extent desired. We can report progress and give examples of activity in each endeavor.

Over 100 municipalities are fully or in part carrying on supervision worthy of the name. This is being done under municipal ordinances containing regulations similar to those


PENNSYLVANIA DEPARTMENT OF HEALTH
FIELD LABORATORY NO. 4.
MILK CONTROL.

in the ordinance recommended by the State. These municipalities employ milk inspectors, 20 of whom are full-time employees and 16 part-time employees. In the remainder, the supervision of milk supplies is carried on as a part of the duties of the municipal health officer.

The milk inspectors, together with the health officers doing milk control work, have formed an association which meets at least annually and publishes an annual report for their mutual benefit. I understand this phase of the work is to be presented by the Secretary of the Pennsylvania Association of Dairy and Milk Inspectors.

Municipal cooperation is being successfully carried on in three areas. One area comprises three municipalities; the other two, six each.

The Pennsylvania Department of Health does not intend to centralize supervision but rather to promote municipal responsibility. Four field workers are employed for this purpose. Within the last two years one type of assistance has been started in which you may be interested.

Two trucks have been equipped with apparatus for promoting the production and distribution of clean, safe milk. The equipment consists of:

1. Thermometers for taking the temperature of milk in cans as delivered from the dairy farm.
2. Thermometers for determining the temperature of milk during pasteurization.
3. Thermometers for checking recording thermometers.
4. Methylene blue outfits for determining the keeping quality of milk.
5. An outfit for indicating acidity quantitatively.
6. Sediment testers and cards for mailing disks.
7. Babcock outfit for determining butterfat.
8. Lactometers.
9. Microscopes for direct counts.

This equipment is built into a truck and is sufficient in quantity for two men, each inspecting a small treatment plant or both working in a large plant. The accompanying photograph shows the equipment on display.

In conclusion, may not emphasis be placed on the following:

1. That there is a need and a place for national, State, and municipal supervision over public milk supplies.

2. State or municipal cooperation means better milk for less money.

3. City supervision does not mean state-wide supervision and usually is not applicable to small communities.

4. The problems surrounding supervision in small incorporated communities need recognition and attention.

5. The State should give detailed attention to the milk supply of the consumer in unincorporated territory and in small incorporated municipalities where supervision is usually inadequate.

"Government and industry both should possess a living faith that the rightful function of Government is primarily to preserve fair play between individuals."

REPORT OF COMMITTEE ON TRANSPORTATION OF MILK AND MILK PRODUCTS

DR. J. J. FREY, *Chairman*

Understanding it to be the purpose of the International Association of Dairy and Milk Inspectors to register annually through its published committee reports the advancement or achievements in each aspect of dairy control work as represented by its several committees, your Committee on Transportation of Milk and Milk Products has in the preparation of this report sought to review briefly the subject matter covered in previous reports, reviewed current literature on the subject, sought data on commercial trends bearing on the question of dairy products transportation, sought the results of research on the subject, investigated pertinent problems of immediate import, and renders a report on the principal points of interest gleaned from any of these sources.

SUMMARY OF PREVIOUS REPORTS

In 1921, W. E. Ward and Thomas Holt, both New England officials, submit a joint report wherein the principal defects which come under their observation are enumerated; as, insufficient icing facilities, insanitary handling by railway employees, lack of proper protection at receiving platforms, unclean cans, etc. They report good cooperation on the part of railroad officials where defects are properly brought to their attention. Though there is reported a great deal of interstate movement of milk by rail, most of the supply for smaller and some larger cities was transported in cans by truck. Their principal recommendations for further improvement were that inspectors give closer attention to transportation matters and enlist the cooperation of other officials and transportation employees, stressing

(1) Proper ice cooling before transportation; (2) Roadside protection to products awaiting trucks; (3) Protection of containers from weather while in transit; (4) Expeditious delivery after receipt by distributors.

In 1922, Dr. C. W. Eddy calls attention to the necessity for giving attention to dairy products other than market milk, especially cream for churning. He reports the development of the glass-lined tank truck and tank cars, and predicts the truck as the principal future means for milk conveyance wherever it can be used. He calls attention to the necessity for more specific temperature regulations for rail transportation, both summer and winter, and charges the responsibility for this action to the Interstate Commerce Commission.

In 1923, Russell S. Smith calls attention to the problems of the railroads in meeting the rapidly expanding dairy trade. He stresses the desirability of cooperation between different branches of the industry, and makes definite suggestions whereby each group may assist in a practical manner to improve conditions pertaining to the transportation of milk. Among these are the production of milk of good quality (low initial count), the use of sterile containers, adequate cooling and maintenance of low temperatures, and several other definite suggestions contributing to the accomplishment of the foregoing fundamental considerations. He suggests that the inspector act as a coordinating and harmonizing agent between the other agencies involved, as the producer, the transportation companies, and the milk dealer.

Again in 1925, as chairman of the Committee on Transportation of Milk and Milk Products, Smith makes a very complete summarization of modern developments in milk transportation and pronounces it a distinct credit to the dairy industry, but insists that there should be no relaxation in our efforts to continue to improve. He discusses at length tank car installations, briefly describing their construction and giving statistics down to January, 1925, concerning their development, capacities, etc. The same information is recorded relative to tank trucks and refrigerated trucks, and statistics are given on refrigerated car service. His report is concluded by a series of interesting current events relating to transportation of dairy products which are suggestive of the possibilities which may be expected in the way of future development. These include accounts of long-distance, bulk shipment of milk from Pittsburgh to Milwaukee; milk sent through the air from San Francisco to Atlantic City; certified milk shipped across the country from California to the Atlantic Coast, and winning first prize with a score of 99.5 points; portable milk-receiving stations for use in emergencies; butter made from sweet cream and carried around the world without refrigeration by packing in sealed tins; and ice cream carried in the refrigerator of a round-the-world excursion steamship for the supply of its passengers during a four-and-a-half months' cruise.

This report is a very fitting summary of the dairy product transportation situation at the end of the first half of the present decade.

Transportation from Farms to Plants and Final Distribution

The transportation of milk from the farms where it is produced to plants where it is processed or manufactured and put into final form for consumption may be done by truck to country receiving stations, thence by train to factory or distributing plant, or by truck direct from farms to plant, and sometimes by train or truck from one plant in one community to another. The economics of this problem, although entitled to sympathetic consideration by inspecting agencies, is primarily a problem for the commercial branches of the industry. The inspecting agencies are mainly concerned in preserving quality during this movement. Some of the problems which deserve particular attention from inspectors as affecting this phase of transportation are: Preparation for shipment; condition of transportation containers; insulation of trucks; cleanliness of trucks, cars, and attendants. The other phase of transportation problems concerns the distribution of bottled milk to grocery stores, restaurants, and family trade, and the distribution of the manufactured dairy products to jobbers and retail dealers. Here inspecting agencies are concerned with proper icing or other means of maintaining low temperatures in hot weather, proper identification of the product, cleanliness of conveyance, and the health and habits of the attendants.

Preparation for Shipment

One of the very greatest essentials in the successful transportation of dairy products without deterioration is an initial low bacterial count, which can only be accomplished by thorough sterilization of all equipment with which the milk comes in contact, by the use of moist heat at a high temperature. One hundred and seventy degrees of moist heat applied for at least fifteen minutes, or the equivalent in bacteria-killing power, is the minimum. Bacteria which get into milk from unsterilized equipment are particularly liable to grow at low temperatures and a high initial contamination is difficult to overcome, rendering subsequent attempts to preserve the product by physical means less successful and more expensive.

Containers

The condition of containers in which milk or any of its products are transported is a primary consideration. Milk is in contact with the interior surface of the transportation container longer than any other article of equipment. If these are not sterile, all other attempts to produce milk of low bacteria count and good keeping quality will be futile.

The biggest little thing that can be done to secure high-quality dairy products is to require the thorough washing, sterilizing, and drying (all three are essential) of milk or cream cans when these are used as containers for transporting the product. Some of the mechanical can washers that are in ordinary use will not do this, even when operated under the best conditions, and none of them will do it when operated beyond capacity or when not in good working condition. Several plants on the Pacific Coast have developed means for applying superheated steam to cans with the ordinary factory-made can-washing equipment. This is exceptionally effective. Persons who may be interested in this type of equipment may secure references to plants where it is in use by addressing a communication to the Bureau of Dairy Control, State Department of Agriculture, Sacramento.

A survey of the can-washing equipment throughout the United States would undoubtedly indicate that much of the equipment which was built for thorough sterilization and drying as well as washing of the equipment is not operated in an efficient manner. Cans which are well cleaned and fairly well sterilized, but which remain moist, develop a very disagreeable odor resulting from the growth of the bacteria which survive the sterilizing process and which are enabled to grow because of the presence of moisture in the can. Thus, by the time the can is ready to receive milk or cream for transportation, there is contained in it a splendid starter of the very most objectionable types of bacteria; namely, the spore-forming putrefactive organisms which survive inefficient attempts at sterilization. It goes without saying that cans must be in a proper physical condition to permit of thorough cleaning. Cans which are rusty or which have open seams should be condemned until reconstructed and retinned.

Parchment Paper Gaskets for Sealing Cans

Some shippers follow the practice of using parchment paper gaskets under can lids with the idea of preventing loss from spillage and preventing contamination from dust which might settle around the lid or from the lid itself, as some mechanical can washers provide no means for satisfactory sterilizing of the lids, although the inside of the can may be thoroughly steamed. With the idea of obtaining some accurate data, a few observations have been made on the use of these gaskets on cream cans compared with other cans fitted with lids without gaskets.

A simple experiment was made by Mr. F. A. Silver on pasteurized cream shipped from Gustine, California, to San Francisco, a distance of about one hundred miles. The cream arrived in the city plant at a temperature of about fifty degrees F. The average bacteria count of cream contained in cans without gaskets was 18,000 per c.c. before shipment, and 21,590 per c.c. after shipment, an increase of 19.94 per cent. The average bacteria count of cream contained in cans with gaskets was 25,341 per c.c. before shipment, and 19,691 per c.c. after shipment, a decrease of 22.3 per cent.

In addition to the foregoing, some observations of the effect of using gaskets under can covers have been made under practical operating conditions. In making these observations, the lids of several cans (usually ten) were fitted with parchment paper gaskets for comparison with an equal number of cans fitted with lids without gaskets. Both groups were weighed before and after shipment to note loss, if any. Bacteria counts were made on the contents of all cans before and after shipment and the increase and percentage increase recorded. Each can was judged upon reaching destination for flavor and odor.

The following is a summary of comparative results noted by Dr. Charles C. Wing, of Oakland, on raw milk hauled from Tracy to San Francisco, a distance of about fifty miles, with atmospheric temperature in Tracy of 86 ° and in Oakland of 66 °. The milk temperature increased during shipment two degrees; namely, from 60 ° to 62 ° F.

	Without gasket	With gasket
Average loss in weight per can......	9 lbs.	7 lbs.
Average increase bacteria count......	22,500	14,000
Per cent increase bacteria count......	105.9%	87.5%
Flavors and odors....................	No record	No record

The following is a summary of the comparative results noted by Dr. H. E. Torgensen on raw milk, with mean atmospheric temperature of 60 ° F., based on one can with and one can without the gasket, over a period of ten days from August 31 to September 8.

	Without gasket	With gasket
Average loss in weight per can......	No record	No record
Average increase bacteria count......	4,860	1,366
Per cent increase bacteria count......	112%	20%
Flavor and odor......................	Good	Good

The following is a summary of the comparative results noted by Mr. J. V. Quigley on skim milk hauled 35 miles in the vicinity of Kansas City, with a mean atmospheric temperature of 80 ° F., September 17 to 21 inclusive.

	Without gasket	With gasket
Average loss in weight per can......	Difference in scales masks losses, if any.	
Average increase bacteria count......	177,540	136,560
Per cent increase bacteria count......	80.6%	68.2%
Flavor and odor......................	Good	Good

Although the foregoing is insufficient to justify general conclusions, it appears that the limited data presented is in favor of the gaskets. As a practical consideration, there is a great deal of mixing of can lids in usual trade practice, with the result that unless lids are attached to cans, there are many ill-fitting lids. Also, the rough usage which cans and lids receive often makes the lid fit badly. Under these circumstances, the use of a gasket will keep the lid from popping out and prevent them from slopping over to a considerable extent. In this way they are of real value. It may further be said that the use of gaskets should render lids of cream cans, especially, more easily cleanable.

Route Cream in Individual Containers

In California, and perhaps in other sections of the United States, there has developed a practice of sending cream trucks out from receiving stations to collect milk and cream at the farms and weighing and sampling the cream at the ranch, whereupon the product of small dairies is combined with that of other small dairies and brought to the plant in composite lots. There is, perhaps, some slight economy in transportation resulting from this system, but it is very destructive in other ways, and the evils which follow in its wake far more than offset any possible benefits. In the first place, cream should be delivered to the plant in the individual containers of each producer so that it may be graded for quality upon receipt at the plant and in order that an inspector may call at the plant to determine the source of the poor quality of the raw materials. Again, it is unusual to find a cream truck driver who is sufficiently well informed and careful in his methods so that an accurate sample and weight is obtained. It creates an opportunity for all sorts of abuses by juggling weights and samples, favoring some patrons at the expense of others, or at the expense of the plant, or favoring the plant at the expense of patrons. The opportunity for checking the accuracy of work which is conducted at many places along the roadside by inspectors is not readily possible. Further evils result from this system, in that dairymen are discouraged from taking good care of the cream produced, for they see it regularly mixed with the product of other dairymen who are less careful than they, knowing full well that this mixing overcomes any benefits that might accrue from any special care given to the product.

Transportation of Milk in Tank Trucks

The difficulty attendant upon the transportation of milk in numerous small cans or tanks has been overcome in large measure where large quantities are available at one time, by making bulk shipments in glass-lined tank trucks. These tank trucks, by reason of their smooth interior surfaces with rounded corners, are easily cleaned and may be adequately sterilized by simply closing the tank and injecting steam under a small degree of pressure for as long a time as may be desirable. These tank trucks not only serve as containers for the product, but are so insulated that they serve to maintain low temperatures in the same way as a thermos bottle. The efficiency of the truck in maintaining low temperatures is illustrated by a comparative observation made by Mr. J. V. Quigley, Dairy Adviser of the Kansas City Consumers' League, who reports concerning a truck loaded with cans containing skimmed milk, two deep, and covered with dry canvas securely fastened to the sides of the truck, which drew a trailer carrying a 1200-gallon thermos tank filled with milk. The truck traversed 37 miles of open road during a time that the mean atmospheric temperature was approximately 80°. The temperature of the skimmed milk in the cans on the canvas-covered truck rose in shipment from 40° F. to 52° F. in the center of the load, and to 72° F. in the cans on the outer corners. The rise of temperature of the milk in the thermos tank behind this truck was but 3° F.

Observations at San Francisco, where milk is transported in glass-lined tanks for a distance of 134 miles where the mean atmospheric temperature averages around sixty degrees F., show that it usually does not increase more than two degrees in making the 134-mile trip. The cost of one of these tanks of 1250-gallon capacity, ready to mount on a truck in San Francisco, is recorded to be $1,588. A 1500-gallon truck of this type is listed at $1,800 f. o. b. factory.

The cost of transporting milk in this manner is believed to be about two and a half cents per gallon for 100 miles.

The following average figures are taken from a compilation showing the development of bacteria in representative shipments of milk under the conditions above indicated:

Average volume in shipment, 1400 gallons
Average number bacteria per c. c. before shipment, 33,200
Average number bacteria per c. c. after shipment, 39,940

Insulated Truck Compared to the Ordinary Canvas-Covered Truck for Hauling Milk

When tank trucks are not available for the transportation of milk or when conditions are such at the collecting end that they may not be loaded at one time or in one place, the insulated box truck as developed under the direction of Dr. Charles C. Wing, Assistant Health Officer of Oakland, has proved very serviceable. The following data submitted by Doctor Wing are very convincing:

Twelve shipments of milk were transported in a closed truck an approximate distance of 60 miles. The average length of time during which each shipment was in transit was six hours. The average rise in temperature of shipments during transit was 2.7 °, while the average rise in bacteria content was 3,341.

Six shipments were transported in a canvas-covered trailer for approximately 52 miles. The average length of time during which each shipment was in transit was four hours and 53 minutes. The average rise in temperature of shipments during transit was 8 °, and the average rise in bacteria content was 82,333.

There has more recently been developed refrigerator trucks equipped with refrigeration apparatus operating directly from the truck's motor. These will undoubtedly be found valuable under conditions which will not permit milk to be readily brought together at one point for quickly loading into the glass-lined tank trucks for bulk shipment.

Cumulative Record of Transportation Data

One member of our committee proposes the adoption of a uniform method of tabulating temperature data with regard to the transportation of milk by railway and truck, to which additional figures may be added from year to year by members of this committee, or, in fact, the whole membership of the Association. The following form is suggested:

Kind of Transport	Volume of Milk	Mean Atmospheric Temperature	Time of Transit in Hours	Temperature of Milk	Amount of refrigeration used, expressed in equivalent pounds of ice per gallon of milk

Cleanliness of Trucks and Attendants

Truck drivers are likely to be mechanics, and as such do not take particular thought of matters pertaining to sanitation. Although the Committee is not informed of any typhoid epidemics which originated from carriers among truck drivers, there is at least one epidemic on record in California which resulted from hand-capping the bottles by a typhoid carrier. It is possible that those who have sought to trace the source of infection in milk-borne epidemics have not given consideration to the wagon driver. Occasional isolated cases of typhoid might result in this way which would appear to be accidental and could very easily be attributed to another source.

Delivery Wagon Advertising

Another consideration which does not pertain particularly to milk quality, but which nevertheless concerns the consuming public and inspecting departments, is the deceptive advertising which often appears on milk wagons. Things which would not be tolerated for a moment on milk bottle caps frequently are accepted without challenge if they appear as advertisements on the truck. The deception of the public is the same in either case. Laws which are designed to prevent deception and fraud in the labeling of foods should likewise be made to apply to advertising, particularly when the advertisement appears on milk conveyances used in the retail distribution of milk.

Transportation of London Milk Supply During Strike

The following is an excerpt from an article by P. B. Tustin in the June issue of the *Milk Dealer:*

> "The problem of providing the citizens of London with their daily milk during the recent crisis was entrusted to a committee composed of members of the dairy trade of the metropolis. The sudden stoppage of all workers on the railways, tramways, omnibuses, newspapers, and dockyards, threatened the very life of the country, but the government had made all the necessary arrangements for carrying on the vital public services, and for the maintenance of an adequate milk supply the most complete plans had been laid. The establishment of Hyde Park as a milk depot was one of the outstanding features of the efforts made to keep going the essential services of the nation during the great general strike. Thousands of churns of milk were handled and dispatched with methodical precision. Hundreds of lorries (trucks) of all shapes and sizes quickly lined the roadways of this world-famous park. For the first three or four days virtually the whole of the milk supply for London was transported by road, and it says much for the organization that after the first morning, when there was a slight shortage, every one of London's four thousand milk dealers received as much milk as their customers could consume. Small and big dealers were served alike. It was one of the first considerations of the pool committee to insure that the small dairyman should obtain his fair appropriation even if some of the large members had to go short. The maximum number of vehicles employed was 1,100 and the average amount of milk received in Hyde Park each day was 3,200,000 pounds, and the total amount dealt with by the pool was 44,720,000 pounds.

"After the first 48 hours, trains manned by volunteer engine drivers, firemen and guards began to run on all the railroads and it was found that many of the lorries could be withdrawn, until, exactly one week after the strike had begun, all lorries used for the transport of milk from the farms to London had been withdrawn. Every churn of milk was then brought by rail to the big termini, and handled by volunteer porters, mostly medical students and university undergraduates. Any rolling stock that was handy was used, and on many occasions milk churns arrived in London reclining somewhat awkwardly on first-class carriage seats. It was the desire of the government that the milk pool should be self-supporting as regards administration costs, and for this reason it was found necessary to increase the price of milk by four cents, but beyond this the public suffered no inconvenience as far as their milk supply was concerned."

Milk Transportation Conditions in Canada

Mr. D. K. Douglas, of the city of Regina, Saskatchewan, makes the following interesting report relative to milk shipping conditions of Central Canada:

"In this district the transportation of milk does not give us so much concern as a large city drawing their supplies from a large radius. While we get milk from points 100 miles away, the bulk of it comes in on the transcontinental railroad main line, and three hours is about the longest time the milk is on the train. The trains run very regularly on time. We have tried to interest the railroad companies in providing sheds in which the milk cans during the hot weather might be protected from the sun's rays while waiting for the train, but they claim they lose money on the milk business. The rates are 25 cents per can for 100 miles; this includes returning the empties. Failing here, we are now trying to interest the Farmers' Local Unions to work in cooperation along this line. So far, nothing definite has been done. The cans used are 8-gallon and 5-gallon sizes, Imperial measure.

"The climatic conditions are very favorable for milk hauling, for even in the short summer season we have cool evenings, and the average temperature of farm well-water is about forty degrees F., and in addition every one can have an ice hole in which to put the cans containing the evening milk and many shippers have such ice holes.

"The bacteria counts on batches taken at the plants during the hot weather last year showed results ranging from 500,000 to 900,000, rarely going over the million mark, the higher count on only the hottest days, so I think you will agree with me we have ideal conditions for cooling and storing milk for pasteurization."

This last statement illustrates the great difference in quality ideals in different parts of the world, when contrasted with figures given in the foregoing references to the bacteria counts of milk delivered for pasteurization in California.

Wisconsin Milk Shipped to Florida

In February, 1926, milk was successfully shipped from Marshfield, Wisconsin, to Miami, Florida, a distance of 1800 miles, the car making the journey with the regular passenger service.

This milk was shipped in glass-enameled tanks in an enclosed car, the body of the car and roof being insulated. The floor of the car was covered with acid-resisting waterproof material and the car contained two 3,000-gallon glass-lined, seamless and heavily insulated tanks. The tanks were mounted in a cradle forming part of the under-framing and were arranged to insure complete drainage. Each tank was equipped with a 20-inch manhole for cleaning purposes, and an inlet valve and an outlet valve through which the milk passes, being forced out of the tank by means of compressed air.

The car was equipped with a motor-driven agitator used to reincorporate the fat in the milk before the tank was emptied. The car and the tanks were equipped with electric lights.

The milk, at 35 ° F., was placed in these tanks at Marshfield, Wisconsin, and upon reaching Miami it was reported that the temperature was 36 ° F. The car was also equipped with a refrigeration system which was used when necessary to maintain an even temperature. It is reported that two hundred cars of this type have been built by the American Car Company to be used by dairymen in this country. The journey to Miami is the longest trip made by any of the milk tank cars.

Plans are being made to have ten cars running regularly between Wisconsin and Florida in this milk service, which will handle 6,000 gallons of milk, produced from tuberculin-tested cattle, every day.

Although it is reported that the health officers in the principal cities of Florida which receive a great deal of shipped milk are not well satisfied with the product, this is in all probability due to the handling of the product before shipment, rather than the actual transportation under the conditions above described.

Milk Cars for Passenger Train Service

The Southern Railway pictures in the *Southern News Bulletin* for September, 1926, a string of ten new Southern Railway milk cars recently fitted up for passenger train service at Knoxville, Tennessee. These cars were built to take care of the increasing dairy products traffic originating along the lines of the Southern.

The cars are painted standard passenger car color and have been fitted with standard cast steel wheels, steam heat, and air signals, in addition to passenger car brake equipment and couplers. They are lined with metal on the inside so that ice can be piled on top of the milk cans when so desired. In other respects they are standard refrigerator cars with ice bunkers in each end.

Refrigerated Milk Containers for Dining Car Service

A special design of milk can lid is in use for dining car service on the Santa Fe Railroad. It is in two parts, the bottom part fitting into the neck of the can in the ordinary way, but having a cone-shaped projection which reaches downward nearly to the bottom of the can. This cone-shaped hollow of the lid, when in use, is filled with ice and the top part of the lid serves as a cover for the ice chamber. By covering the outside of the cans with an insulated wrapping, milk for dining-car service is carried in these containers from Bakersfield, California, to Chicago.

Cottage Cheese

The development of the consumption of cottage cheese in some sections has been phenomenal. In California this increase has mounted from one and a half million pounds, two years and a half ago, to ten million pounds at the present time. For this purpose large amounts of skimmed milk are utilized, and instead of transporting the skimmed milk to the centers of population where it is consumed, the curd is developed and whey extracted in plants. This curd is then transported in ordinary 10-gallon cans to the city distributing plant, where it is mixed with an appropriate amount of sweet cream and sold either in carton packages or in bulk to delicatessens and retail markets.

Ice Cream

An interesting recent development in the transportation of ice cream has been inaugurated by an enterprising ice cream manufacturer of Seattle. It is reported that this manufacturer, upon noting the very great demand for American-made cigarettes in China, sought to investigate the Chinese taste for ice cream. He found that they were greatly fascinated by the product and has developed an extensive business in shipping frozen ice cream by refrigerated steamers from Seattle to the Orient. The preparation of a powdered ice cream mix which will meet the requirements of this market without transporting it in such bulky form from the United States is an enterprise which is now developing.

An insulated jacket for ice cream cans has been developed and is now in extensive use in some quarters, for which it is claimed that ice cream for distribution from manufacturing centers to dispensers at points many miles distant may be just as well preserved as with the old ice tubs, which are more expensive and annoying because they must be kept packed with ice and because of their very great weight and correspondingly greater shipping cost.

Interstate Statistics on the Transportation of Dairy Products

The Federal Government and many States have gone to great lengths to secure adequate statistics concerning the production of dairy products in the several States. One of the greatest possible ways in which such statistics may be utilized is in the calculation of per capita consumption, which is the measure of public appreciation for any product and the true index to progress. These statistics are, however, worthless for this purpose unless the amount of the several products shipped into, and out of, the several States can be made available. Economists who have been engaged in making economic surveys pertaining to the dairy industry report that California is the only State for which this information is at present available. Suggestions as to how such statistics may be developed by other States will be supplied by the Bureau of Dairy Control, California State Department of Agriculture, Sacramento, to any who may inquire.

Milk Bottle Exchanges

The public does not generally appreciate the great cost involved in the retail distribution of milk, and is therefore led to believe that there is an undue spread between the price paid for milk to the producer and the price which is paid by the consumer. Although the principal facts in this connection are due to vehicle upkeep and the employment of men to distribute the milk, one important item in distribution costs is that of bottles. It has been estimated that the average number of trips made by a milk bottle in the United States is but seventeen. This would make the cost for containers amount to something like one third of a cent per quart. By means of a bottle exchange developed in the Los Angeles metropolitan area, the number of trips by a milk bottle has been increased to seventy. This may be seen to be a vital factor in reducing costs for the distribution of milk. Details concerning the plan on which this exchange is operated may be obtained by addressing a communication to Mr. Nathan Volen, in charge Los Angeles Bottle Exchange, California Department of Agriculture, 1028 Sun Finance Building, Los Angeles.

ACKNOWLEDGEMENTS

The Chairman of this Committee desires to express his appreciation to those members of the Committee who have rendered assistance in the preparation of this report, and the entire Committee is appreciative of the splendid cooperation rendered by the Paterson Parchment Paper Company; F. A. Silver, of the Dairy Delivery Company of San Francisco; Dr. H. E. Torgensen, Dairy Products Laboratory, San Francisco; and by Mr. Russell S. Smith, United States Public Health Service, former chairman of this Committee.

"The world is a great book, of which they that never stir from home read only a page."

TUBERCULIN-TESTED MILK AND THE 150-MILE ZONE

DR. ROY F. LESLIE, *Chief,* Bureau of Food and Dairy Inspection, Cleveland, O.

No well-informed person today questions the advisability of the program of tuberculin testing as conducted under the Area Plan. Some fifteen years' work in milk control and food inspection, a part of which was spent on the killing floors of the packing houses at Columbus, Omaha, Chicago, and Cleveland, has only strengthened our position on the subject.

Some three years ago the area work was taken up in the State of Ohio, and some of the interested dairymen, milk dealers, and others formed a committee and the work was started in Cuyahoga County. Cleveland is located in this county, yet in some sections of it dairying is still followed quite extensively. It was soon found that many dairymen would not cooperate with the plan, but it seemed reasonable that any dairyman in this day and age afraid to submit his herd to the tuberculin test must have some reason to suspect the health of his cattle. That being the case, the city of Cleveland did not care to receive milk from such a herd, and the official tester was authorized to exclude all dairies shipping to Cleveland that refused to have their herds tested. It was now necessary to get the work started in other counties.

It was not long, though, until opposition began to develop, and it was seen that an ordinance on the subject would be needed. In the meantime, the Riggs bill, a State law, was passed in Ohio, which put the Area Plan on a definite basis. All of these things began to gradually educate the public, and the passage of the ordinance was seen to be only dependent on the time when it could be assured that the milk supply would not be seriously reduced.

In any step of progress there is always the group that says "It can't be done," and that the step is one influenced by improper motives. In this case it was said by the opposing dairymen that the ordinance was a move to drive local dairymen out of business. To overcome this propaganda, an additional section was incorporated in the ordinance, that reads as follows:

> Sec. 587-2. Whenever the enforcement of the provisions of the sections of this chapter relating to milk and dairy inspection requires inspectional visits to points beyond 150 miles from the general offices of the Bureau of Meat and Dairy Inspection in City of Cleveland, the reasonable cost of such inspectional visits including time consumed and expense incurred in traveling by Bureau employees shall be paid by the firms, persons, or corporations whose premises are so inspected. When more than one establishment handling milk or milk products is included in any inspection trip made by Bureau employees, the proper proportion of traveling expenses of said employees shall be paid by each person, firm or corporation whose premises are so inspected.

The above section is the one that prompted us to write these lines under the heading of "Tuberculin-Tested Milk and the 150-Mile Zone," and the ordinance providing for milk from tuberculin-tested cattle and the above costs of inspection outside of the 150-mile zone is now in effect, with January 1, 1927, as the date set for the enforcement of the provisions governing the tuberculin test.

What is the significance of the passage of an ordinance placing a so-called milk zone around a city? May I be pardoned at this time if I refer to the paper presented at the meeting of this Association at Detroit in 1924, entitled "Proper Production the First Essential?" This thought was early instilled in my mind in making country dairy inspections and finding that with proper production a great load was lifted from the many problems of an adequate and pure milk supply. How, then, may we encourage proper production?

I believe, as time goes on, proper production will be encouraged by proper protection and that the development of the so-called milk zones around our cities is one of the first steps in this direction. One of the next logical steps is the grading of raw milk.

For several years most of the milk coming into the larger cities has been marketed through producers' cooperative organizations, and most all milk has been sold on the pool price, which was determined by adding the money received for Class 1 milk, or milk sold for bottling purposes, to the money received for Class 2 milk, or milk sold for manufacturing purposes, and then dividing the result by the total amount of milk. This arrangement allows of no premium to the careful dairyman who produces milk of good quality, and the known mixing of his product with that of other milk of a low standard is a demoralizing influence, as it is a tendency worldwide to do no more than the other fellow if there is no incentive for additional effort. The milk distributor has to pay Class 1 price to the cooperative associations for the milk that he uses for his bottled milk trade. Why, then, should not the distributor receive a Class 1 product?

We believe that he should, and that it can be brought about without any increased cost to the consumer, by simply grading the dairies and classifying those of a higher standard as approved dairies. The extra amount that these dairies would receive, were they to be given Class 1 price for their product, would assure the development of an adequate supply of milk of excellent quality, and it would not be long until there would, no doubt, be a waiting list of dairies of this type waiting for an opening to be advanced from the Class 2 grade.

Section 482 of Cleveland's milk ordinance reads as follows:

Sec. 482. Approved Dairy. Any dairy, having good sanitary surroundings and having a score of 75 or more on the official score card, using small top milk pails, having a tuberculin tested herd, whose owner has signified his intention to cooperate with the division of health, City of Cleveland, in every way in securing a good milk supply, shall be listed as an approved dairy, and a numbered certificate bearing the signature of the official charged with the enforcement of this chapter shall be given him, which shall continue in force until revoked for failure to comply with the regulations or until a change in ownership is made when the certificate may be transferred to the new owner by his applying for such transfer.

Under this section some one hundred and sixty-three dairies have already been classified as Approved Dairies. During the first part of this year a list of the dairies approved up until January 30, 1926, was published in the Cleveland Sunday *Plain Dealer*. This publicity helped considerably, and while much work is still to be done before a change such as proposed can be brought about, yet as more approved dairies are developed and a larger supply of milk from such dairies becomes available, it will gradually become easier to make the classification as outlined.

While the tuberculin test and many other items have contributed greatly to the improvement of the milk supply generally during the last few years, is it any more than logical that as another improvement, we really have a Class 1 milk for the Class 1 grade or classification?

"Human improvement is from within outward."

THE TUBERCULIN TEST AND PASTEURIZATION

DR. C. S. STIRRETT, *Inspector of Milk and Provisions,*
New Bedford, Mass.

Until a comparatively recent time, milk inspection was almost exclusively a matter of detecting adulteration. Inspection now includes more than the detection of adulteration, though many people continue to speak of "pure milk" as milk that is not watered and contains no preservative, and overlook the more important bacterial condition of milk, which should always be taken into consideration. The chemical, bacteriological, and sanitary conditions of milk should not be confused.

Three main factors in milk control of cities are:

(a) Dairy farm and milk plant inspection.
(b) Dairy instruction.
(c) Laboratory control.

Tuberculin testing, of course, is an important public health measure. After years of consistent tuberculin testing, however, a small residual percentage of reactors may persist. Tuberculin testing should therefore be regarded as a factor of safety from the public health point of view and as an economic necessity for the dairy industry, but not as a final and complete safeguard.

Proper pasteurization constitutes an effective measure against the dangers of disease transmission by milk. It invites scrutiny as to extent of protection offered and relative expense. It is the obvious answer to the health official's problem of the incubating, the mild, the missed, the suppressed, and the carrier types of communicable diseases occurring on dairy farms and during the process of handling milk.

New Bedford was the first city in the State of Massachusetts to adopt rules and regulations for pasteurized and certified milk, in January, 1924. There developed a demand for a raw milk other than certified milk, which resulted in an addition to the rules and regulations permitting the sale of milk of officially tuberculin-tested cows, to be bottled and sealed upon the farms where it is produced. This amendment was adopted October 8, 1925, and only three dealers took advantage of the amendment.

Pasteurization, as defined in our regulations, shall be performed by a process whereby milk is subjected to a temperature of not less than 142 ° F. for not less than 30 minutes. Said milk shall be immediately cooled to 50 ° F. or below, and kept at or below that temperature while at the pasteurization plant, and delivered to the consumer within 24 hours after pasteurization. The adoption of the rules and regulations at first met with much opposition, but they are now being enforced along lines which will eventually work out satisfactorily. It is most essential that the pasteurizing apparatus be of a type that can be operated in a manner in harmony with the rules and regulations.

Holding pasteurization is an adequate safeguard for milk supplies. There are obstacles in connection with the so-called flow-type method, especially when handled by untrained people. The methods of temperature control in connection with pasteurization are of utmost importance, and accurate control of the temperature during pasteurizing and the holding period is most essential. In checking recording-temperature devices, variances may have to be accounted for, due in part to improper handling or oversight on the part of the operator. The recording-temperature devices may be checked with a thermometer of known accuracy. The check temperature should be taken at different depths in the milk and at the center, and also the inlet and outlet.

At present, there is only one method of pasteurizing used by the dealers under my supervision, and that is the holding method. Automatic controls are not used. The first of this year we had 68 licensed milk dealers, who obtain their supply from 475 farms.

It is an acknowledged fact that much attention is necessary in order to obtain a good wholesome supply of milk at the source. We have established a system of dairy farm inspection whereby it is possible to inspect the farms at least once a month. Samples of milk are taken for bacteriological and chemical analysis. The same applies to the milk plants. Samples are also taken from the delivery vehicles. If a sample after analysis is infected with streptococci, we immediately trace back and find the animal from which the infected milk came. Thirty-six hours has so far been the longest time required to trace such infection back and to isolate the offending cow.

"He who has not the spirit of his age has all the misery of it."

REPORT OF COMMITTEE ON DAIRY AND MILK PLANT METHODS

DR. H. A. HARDING, *Chairman*

This Committee is charged with the problems surrounding the handling of the milk at the plants. The problems with which the milk plant is confronted arise in many cases from the deficiencies of the raw milk supply as delivered to the plants. However, as this Association has a committee on the subject of improving the raw milk supply, this report will concern itself with other problems, merely indicating a development in consequence of which the problem of a better milk supply is steadily becoming entwined with the activities of the milk plant.

It has long been the practice to take samples of the raw milk at the receiving stations and milk plants. Earlier, the object of this sampling was to conserve and direct the energy of the dairy farm inspector. Having thus identified the producers whose product was most deficient, and having determined the nature of the deficiency, the field inspection could be conducted most efficiently.

There is now developing a system of modifying the payment to the producer upon the basis of tests made of these samples. The results, from this new basis of payment, upon the quality of the raw milk supply will be followed with interest. We mention it in this connection because this handling of the problems of a raw milk supply brings it into and makes it a part of the milk plant laboratory operations.

IMPROVED CAN WASHER INSTALLATION

It is generally recognized that the cleanliness and the dryness of the cans as returned to the producer are large factors in connection with the keeping quality of the raw milk supply. It is a common experience that improvement in can handling is followed by a decrease in the germ content of the incoming milk.

In earlier installations, circular can washers were most common, probably both because they seemed to fit better the available space and because they cost less. While some circular can washers both wash and dry cans well, such results are rarely obtained with most washers of this form.

There is now a pronounced movement toward the installation of straightaway can washers in such a way that the can, when emptied at the scales, is immediately placed in the washer by the man emptying it. The washed and dried can is delivered by the machine to the man on the delivery truck. In some of these machines the cover is successfully replaced on the washed and dried can by the machine. The elimination of hand labor resulting from such installation makes economical the use of this type of machine and the resulting clean and dry can commends it to the sanitarian. This plan necessitates locating the scales about twenty feet from the entrance. The cans travel from the truck to the scales on a gravity conveyor beside the can washer.

Relative Merits of Filter and Clarifier

Comparisons of the action of the milk filter and of the milk clarifier by Dahlberg and Marquardt at the New York Agricultural Experiment Station in 1924 indicated that they were about equally efficient in removing visible insoluble sediment; that the composition, flavor, acidity, and keeping quality of the milk were not noticeably affected by either treatment; that the creaming quality of the milk was not noticeably affected by either treatment when the clarifying took place below 95° F.; that the bacterial count was not measurably influenced by filtration and that the clarifier decreased the bacterial plate count of milk with a count below 100,000 per cubic centimeter and increased that of milk with a count above that figure; and that leucocytes, other cells, and cell fragments were not removed from milk by filtration, but clarification removed over half of them.

The Boston Department of Health has observed that during 1925, in the case of 16 pasteurizing plants with an average bacterial plate count of 1,302,500 bacteria per cubic centimeter of the raw milk, and in which clarifiers were used preliminary to pasteurization, the bacterial reduction was 97.40 per cent.

In 23 similar pasteurizing plants with an average bacterial plate count in the raw milk of 1,426,000 per cubic centimeter and filtering the milk, the bacterial reduction was only 95.42 per cent. In other words, with raw milk of essentially the same bacterial plate count, the pasteurized milk which had been clarified previous to pasteurization had an average bacterial count of 33,900 per cubic centimeter, while that which had been filtered had an average bacterial plate count of 65,000 per cubic centimeter.

These results, in connection with the effect of clarifiers upon the bacterial plate count, are not as discordant as they appear, since the milk studied by Dahlberg and Marquardt had just passed the clarifier, while the Boston plate counts refer to milk which had been clarified and later pasteurized.

It is quite conceivable that the tendency to break up colonies of bacteria which is commonly ascribed to the clarifier may lead to a greater destruction of these fragmented colonies during pasteurization.

Your Committee recommends that this question of the relative influence of filtration and clarification upon the bacterial plate count of the pasteurized milk be given further study, and that in this study consideration be given to the effect of the treatment upon milks of various germ contents.

Proper Location of Filter in Milk System

In some installations the milk flows from the holder of the pasteurizer through the filter on its way to the cooler. This location of the filter is objectionable from the sanitary standpoint, since the changing of the filter cloths brings the operator into immediate contact with the pasteurized milk.

One installation was encountered where the filter was interposed between the heater and the holder of the pasteurizer. In this instance the temperature of the milk dropped nearly ten degrees Fahrenheit between the outlet of the heater and of the holder.

The proper location for the milk filter, when used, is in the milk line before the final heating and holding of the milk in the pasteurizing process.

Best Temperature for Clarification

In the use of the clarifiers which have been available until recently, practice seems to have developed two points in the temperature scale at which clarification seemed to be favored, one at approximately 90° F. and the other at about 75° F. Comparative measurements of the effect of the operation at the two different temperatures are lacking. There is probably less foam developed at 75° F., and the clarifier should operate more efficiently at 90° F.

The newer type clarifier is especially adapted to clarification at low temperature, but measurements of its effects are still lacking.

Temperature Range on Recording Thermometers

The available scale on the recording thermometers in common use has a width ranging from two and one half to three and one half inches. Within this range provision is commonly made for recording variations through 200° F. Under such conditions the range available for a single degree is necessarily very limited. On such recorder charts, the mark of the recording pen usually covers the space allotted to two degrees, and where the pen is worn this mark may cover a range of five degrees.

Where recording thermometers of this type are used, it is difficult to determine actual temperature of pasteurization from these records within a variation of approximately three degrees Fahrenheit. Many milk plant operators, recognizing the unreliability of these records, have provided other mercury thermometers for guiding the operator of the pasteurizer. In such cases the money spent for the recording thermometer is an economic waste, since it serves neither the purposes of the milk distributor nor those of the milk inspector.

There are now available various makes of recording thermometers adapted to a range of approximately 50° F. Such thermometers devote four times the space to a single degree provided on the earlier mentioned types. On these newer type thermometers, it is practicable to read the record to a fraction of a degree and it should be dependable to within about one degree. Since the first cost of these useful thermometers is the same as the unserviceable ones earlier described and they well serve the purpose of both the pasteurizer and the milk inspector, there is every reason why health officials should insist upon their being used in connection with the discharges from the milk heater and from the holder of the pasteurizer where the two are separate.

Drop in Temperature During Pasteurization

Except in those cases where the hot milk is surrounded by equally high temperature, radiation from the milk is certain to occur, resulting in a fall in the temperature of the milk during the thirty minutes' holding period unless additional heat is supplied.

An installation was observed where a milk filter was interposed between the heater and the holding vat. In this case the loss in temperature between the discharge from the heater and that from the holder amounted to practically ten degrees Fahrenheit.

Even in good installations there is commonly a fall of approximately two degrees during the holding period, often approximately one degree being lost in traversing the sanitary pipe between the heater and the holder.

Attention should be given to the temperature of the milk, to the end that it be held fully up to the pasteurizing temperature during the thirty-minute holding period.

Where the fall in temperature during the thirty-minute holding period exceeds two degrees, consideration should be given to the possibility of providing better insulation or better holders.

Milk-Borne Epidemics and Their Relation to Pasteurization

During the present year the United States Public Health Service has reported a list of milk-borne epidemics for the year 1924. This list may be summarized as follows:

Disease	Epidemics	Number of Cases	Deaths
Typhoid	33	1500	96
Paratyphoid B	1	50	0
Scarlet Fever	5	265	0
Diphtheria	1	23	0
Dysentery	2	10	1
Septic Sore Throat	1	89	0
Total	43	1937	97

It will be noted that as the information regarding such outbreaks becomes more complete, the record of such epidemics approaches fairly close to an average of one epidemic per week for the United States.

Comparison of the data in the above-mentioned report with that of the original sources indicates that the record of the milk-borne typhoid epidemic at Santa Ana, California, was confused with that of a water-borne epidemic of typhoid at the same city at approximately the same date. This milk-borne epidemic was held responsible for 340 cases and 16 deaths, but 292 cases of typhoid and 32 deaths from the same disease due to a water-borne epidemic are included in the above tabulations.

All of the above-mentioned 43 outbreaks are attributed to raw milk with the exception of one occurring at Carthage, Missouri. An application to the State Department of Health of Missouri for details regarding this epidemic elicited the information that this outbreak had been carefully studied by their representatives, that a number of dairies were involved in the outbreak, that a typhoid carrier had been found in one pasteurizing plant, and that while this carrier may have contributed to the outbreak, the primary trouble seemed to be failure to properly treat the milk bottles returning from houses where there were cases of typhoid fever. Typhoid germs were isolated from a milk bottle returned from one such house. Only 14 of the 35 cases gave a history of having consumed milk from the pasteurizing dairy in question.

The presence in a dairy of a typhoid carrier, particularly when he is connected with the washing of bottles which are later imperfectly sterilized, and who is charged with hand-capping the filled bottles, is very objectionable from the sanitary standpoint. Attention should be called to that portion of our definition of pasteurization which requires as a part of pasteurization "protection against subsequent contamination by filling into adequately sterilized containers immediately after pasteurization and at the place thereof, by healthy operators."

The pasteurization at the Carthage plant was evidently defective both in the preparation of the containers and in the condition of the operator. Under such circumstances the participation of this dairy in a typhoid epidemic is not surprising. On the other hand, it is evidently inaccurate to attribute this epidemic to pasteurization when only slightly more than one third of the cases had partaken of milk from this plant.

Canadian Raw-Milk-Borne Epidemics

A committee of the Canadian Public Health Association reported the following:

City	Province	Month	Year	Disease	Cases	Deaths
St. John.....	N. B.	....	1923	Typhoid	10	..
St. John.....	N. B.	....	1906	Typhoid	40	3
Glace Bay...	N. S.	....	....	Typhoid	60	10
Montreal	Que.	Nov.	1921	Typhoid	5	..
Montreal	Que.	Sept.	1922	Typhoid	33	3
Montreal	Que.	Jan.	1924	Typhoid	16	2
Quebec	Que.	Jan.	1918	Typhoid	23	2
Quebec	Que.	Feb.	1924	Typhoid	8	..
Quebec	Que.	Feb.	1924	Paratyphoid	5	..
Sherbrook ..	Que.	Aug.	1923	Typhoid	7	2
Vinelands ...	Ont.	....	1921	Typhoid	20	..
Arnprior	Ont.	July	1923	Typhoid	6	..
Hanover	Ont.	Sept.	1923	Typhoid	46	4
Winnipeg ...	Man.	....	1912	Typhoid	92	7
Winnipeg ...	Man.	....	1916	Typhoid	23	0
Winnipeg ...	Man.	....	1919	Scarlet	73	0
Winnipeg ...	Man.	....	1922	Scarlet	10	0
Winnipeg ...	Man.	....	1922	Scarlet	29	0
Winnipeg ...	Man.	....	1925	Scarlet	17	0
Regina	Sask.	Oct.	1920	Typhoid	83	9
Calgary	Alta.	....	1913	Scarlet	13	0

These may be summarized as follows:

	No. Epidemics	Cases	Deaths
Total typhoid fever	16	477	42
Total scarlet fever	5	142	0
	21	619	42

It will be noted that the majority of these Canadian epidemics are limited to St. John, Quebec, Montreal, and Winnipeg. This does not signify that the milk supply in these cities is particularly bad, except that much of it has been consumed raw. On the other hand, these reports signify that in these cities there are well-developed departments of health which recognize and record these epidemics. Undoubtedly a large number of similar outbreaks occur in both Canada and the United States which are not recorded through the lack of proper health supervision.

Additional Raw-Milk-Borne Outbreaks

The Public Health Service reports a typhoid fever outbreak with 100 cases and eight deaths at Lincoln Memorial University, Harrowgate, Tennessee, in June, 1925.

The Ohio State Department of Health reports 28 cases and three deaths from typhoid during April and May, 1925, at Woodsfield; 60-case outbreak of typhoid during July-September, 1925, at Sandusky; and in September, 20 cases and one death from typhoid in Ashtabula. All three outbreaks were spread through raw milk.

In November of 1925, Winnipeg, Manitoba, experienced a typhoid epidemic from raw milk causing 12 cases and two deaths.

An outbreak of 10 cases of poliomyelitis in Cortland, New York, in December, 1925, is reported by the New York State Department of Health as caused by raw milk. This epidemic deserves more than passing mention, since this is probably the first instance of milk having been recognized as a vehicle for the spread of this disease. The New York State Department is entitled to special recognition for having made this contribution to our knowledge of diseases spread through raw milk.

In February, 1926, the New York State Department of Health reports a typhoid epidemic due to raw milk causing 15 cases at Poland and Cold Brook.

The Ohio State Department of Health also reports that in August, 1925, there was a raw-milk-borne epidemic of septic sore throat at Logan, causing 295 cases.

The New York State Department of Health reports a scarlet fever epidemic at Deposit, spread through raw milk and causing 19 cases.

Through the kindness of Dr. Millard Knowlton, Director, Bureau of Preventable Diseases, Department of Health of Connecticut, we were furnished the following information:

During the late fall of 1925 a number of septic sore throat cases occurred in East Hampton. An epidemiologist of the Department who studied the outbreak obtained records of 45 cases, of which 26 used milk from one supply of approximately 60 quarts per day.

Four milk-borne outbreaks of typhoid fever were reported, the first and largest occurring in July. The dairy held responsible for this outbreak was located in Newington, but the milk was distributed in Hartford. Thus ten of the total of 12 cases in the outbreak were among Hartford residents, while the other two were persons who consumed the milk in Hartford but returned to New York before becoming ill. Of the ten Hartford cases, nine used the infected milk, while one contracted the disease by contact with one of these nine patients.

Five cases of typhoid fever, three in Middlefield and two in Middletown, occurred in August among the users of milk from a small dairy situated in Middleford.

During September, 1925, there were five cases of typhoid fever in Norwich among customers of a dairy supplying approximately 90 quarts of milk per day. Pasteurization was required as a condition for continuing the sale of the milk. No additional cases have been reported.

A milk depot at Cornwall collects milk from thirty sources and ships something like four thousand quarts per day to New York City. Among ten families who were furnished with this raw milk, four cases of typhoid fever developed and no source of infection other than the milk could be found. Pasteurization was required and no further cases developed. No typhoid developed at New York, where the same milk was delivered pasteurized.

The Department of Health of New Haven, Connecticut, reports two recent septic sore throat epidemics spread through raw milk, one at Guilford of 220 cases and five deaths and the other at Hampden of 80 cases. Pasteurization promptly stopped each epidemic.

The Massachusetts State Department of Health reports an epidemic of diphtheria during May and June, 1925, at

Stoneham, involving 25 cases. A worker in the dairy supplying these patients was the first case of the series.

During July, 1925, there appeared five cases of typhoid on one milk route at Danvers. A search for carriers was unsuccessful, but some of the dairy employees had left before the study was made.

The Illinois State Department of Health reports that at Robinson, Illinois, in 1925, 19 cases of typhoid fever occurred during September and October. It was noted that these 19 patients had used milk from the same dairy.

The State Department of Health of New Mexico reports a typhoid epidemic due to a carrier at Carlsbad during May and June, resulting in nine cases but no deaths.

The State Department of Health of Missouri reports an undoubted milk-borne typhoid epidemic at Lebanon due to a typhoid case at the dairy, but detailed studies are not yet completed.

The State Board of Health of New Hampshire reports a milk-borne epidemic at Nashua, but details have not yet been received.

Indiana also reports two or three recent milk-borne epidemics, but they are too recent to furnish details.

In addition, we have learned in various ways of about a dozen additional epidemics which are believed to be due to raw milk, but the details of these have not yet been reported in a form which justifies definitely assigning them to this cause.

It is highly significant that in connection with these 88 comparatively recent milk-borne epidemics, the question of pasteurized milk being involved in the epidemic has arisen but once—at Carthage, Missouri. In this epidemic the dairy furnishing pasteurized milk was connected with only about one third of the cases and the connection was explainable without raising any question as to the adequacy of the pasteurizing process in protecting the milk up to the time it left the holding vat.

Under such circumstances this epidemiological evidence indicates very clearly that the temperature of pasteurization as commercially applied over the country is sufficient to destroy the bacteria of the epidemic diseases.

On the other hand, the experiences at Carthage furnish the strongest of evidence that those charged with the operation or supervision of pasteurizing plants should take every reasonable precaution to see that the pasteurized milk shall not become reinfected between the pasteurizer and the consumer.

Pasteurization is the great safeguard for milk supplies, but the heat treatment must be accompanied by adequate protection after heating, if the safety of the public is to be complete.

Some Limitations to Chlorine Disinfection

It was early observed in water chlorination that the presence of organic matter necessitated the addition of increased amount of chlorine in order to destroy the germs in the water. The amount of organic matter necessarily present in milk apparatus is such as to raise a question as to the efficiency of chlorination of such apparatus.

Chlorine is frequently applied as the final treatment to milk bottles. The Department of Health at Richmond, Virginia, observed a chlorine tank in such a bottle washer where there was an abundance [1] of chlorine present and the disinfecting solution gave a bacterial plate count of over 150,000 per cubic centimeter. Thorough cleansing of the

[1] "The powder used was Chloramine T, which contains about 12½ per cent chloride, or, as is usually expressed, approximately 25 per cent available chloride. One pound of this powder was used in 150 gallons of water at the start of the day's run, and one-third of a pound added every two hours. Samples of this rinse water were taken for bacteriological examination after the powder had been dissolved and before any bottles had been rinsed, and at frequent intervals thereafter. All these samples showed high bacteria counts, and the bacteria were apparently all of one species—*Fecalis alkaligenes*."—T. J. Strauch, Chief Dairy Inspector.

chlorine tank with sufficient alkali to saponify the fat, followed by vigorous scrubbing, removed the difficulty.

The readiness with which the chlorine content of such tanks becomes reduced is frequently met by providing a constant addition from a reservoir of strong chlorine solution. In practice the supply is cut off at the close of operation and started with the beginning of the washing of the following day. Too often the reservoir becomes empty before the close of the washing operation and the strength of the chlorine in the bottle disinfecting solution falls to negligible quantities.

The whole question of the relation of chemical disinfectants to milk plant practice deserves more study than it has yet received.

"Perseverance is irresistible."

THE PHILADELPHIA INTER-STATE DAIRY COUNCIL

R. W. BALDERSTON, *Secretary,* Philadelphia Inter-State Dairy Council.

The Dairy Council is the health organization of the dairy industry, organized for the purpose of disseminating information as to the importance of milk and its products in the diet. Its success is due to many factors, but chiefly to the broad health program which was insisted upon by its early leaders.

The use of milk has not been overemphasized, and the Dairy Council has insisted on the observance of all health rules as fully as that of using a quart of milk a day, and did not urge that milk be used beyond that point which was recommended by recognized health authorities. The Dairy Council assumed a prominent place as a health and welfare agency.

THE PHILADELPHIA INTER-STATE DAIRY COUNCIL

After the war, prominent dairy leaders in the Inter-State Milk Producers' Association and among the Philadelphia distributors realized that the recent discoveries in the field of nutrition emphasized more fully than heretofore the importance of milk as an all-important factor in the human dietary.

M. D. Munn, President of the National Dairy Council, was invited to address the annual meeting of the Inter-State Milk Producers' Association in December, 1920. Out of the mutual interest of producers and dealers an organization was formed, and it was decided to cooperate with the National Dairy Council. The first meeting of the local Council was held in December, 1920, and the Board of Directors was composed of producers, dealers, and a third advisory group representing the public.

Financing

The funds collected from producers, dealers, and manufacturers are turned over to the Dairy Council and expended in equitable amounts in the various cities and communities.

Programs

It was realized by the Dairy Council that the best cooperation for public welfare could be secured if it organized for a program along the following lines:

(a) Public schools
(b) Women's organizations
(c) Men's organizations
(d) Agricultural departments
(e) Agricultural colleges and experiment stations
(f) County farm bureaus
(g) Local units of the Milk Producers' Association

The educational platform was based on the eight health rules now so generally recognized:

1. Brush teeth every day.
2. Eat fruit every day.
3. Drink at least four glasses of water every day.
4. Eat some vegetable besides potato every day.
5. Use four glasses of milk every day.
6. Play part of every day out of doors.
7. Take bath oftener than once a week.
8. Sleep many hours with the windows open.

The activities through which this was to be accomplished were:

1. Development of sound nutritional practices.
2. Health and food demonstrations.
3. Dramatic presentations carrying a health message.
4. Motion pictures.
5. Newspaper and trade press.
6. Suitable literature, posters, etc.

The attention of the public was early drawn to the value of milk served by the Council to the undernourished children in the schools. Very soon mothers of children in average health began to clamor for milk service for their children in the schools. The school system itself began to develop and encourage milk service, so much so that in a year over half the schools in Philadelphia were serving milk to all the children who could afford to purchase it.

In discussing with the school authorities the question of Dairy Council cooperation in the school health program, it was agreed that it was the primary responsibility and function of the teaching force to impart health instruction in the schoolroom. It was agreed that the nutrition lectures, talks, and plays would be helpful in stimulating interest in health habits and particularly in the consumption of an adequate amount of milk and its products.

Quality Control Department

One of the clauses incorporated in the program of the Philadelphia Inter-State Dairy Council at its inception was that which pertained to an improvement in the quality of milk through educational work with producers and dealers in order that this product should become increasingly desirable to the consumer. For this purpose a section known as the Quality Control Department was formed.

If the interest and cooperation of the producer is aroused in his milk marketing problems, so that he himself recognizes the importance of quality in his product, much greater results can be obtained than by any other means. The local dairy interests have a program for milk improvement which includes regulations adopted by the producers and dealers fully as exacting as those made by many city boards of health.

Producer-Dealer Cooperation

The greatest difference between the type of work done in the Quality Control Department of the Dairy Council and that done by city and State authorities is that the Dairy Council representatives act as teachers, while the latter function as policemen. The Dairy Council is teaching methods which should be pursued instead of laying down laws with which the farmer must comply. Notwithstanding that the Council acts in the relationship of teacher through the sanitary regulations, it holds the power to enforce the regulations and to invoke that power whenever necessary. This power comes through the co-operation of milk dealers. The majority of dealers will not purchase milk from producers who do not hold a permit issued by the Dairy Council, so that approximately 85 per cent of all the milk sold in Philadelphia comes under the supervision of the Dairy Council.

This work has been materially aided in the Philadelphia district by local boards of health, State departments of agriculture, and the local units of the Inter-State Milk Producers' Association, and by the active support of the county agents throughout the territory.

The emphasis in the work has been, "Good methods and care are the only magic really necessary to produce clean milk." The value of visual education is not overlooked, and portable motion-picture projectors are used and several Dairy Council films have been produced for country use.

Elimination of Bad Flavors in Milk

The attention of the Department was early directed to the garlic flavor in milk, which for a long time had caused such widespread trouble to the industry. The Department concentrated its efforts in the worst affected areas, inspecting milk and visiting individual farmers to assist them in freeing their milk of the seasonable garlic and grass flavors.

New Market for Producers

An illustration of the type of service which this Department rendered from the very beginning might be found in the series of meetings and demonstrations held in Dorchester County, Maryland, June, 1923.

These farmers were particularly anxious to supply milk for the market of a satisfactory quality. Demonstrations were given throughout the county in milking, straining and cooling the milk, and in washing and caring for the utensils. These demonstrations were arranged to cover all sections of the county, and were attended by all farmers who expected to produce milk for the new receiving stations. Meetings were held, with talks on production of clean milk and moving pictures dealing with the subject.

Cooperation of Philadelphia Department of Public Health

In January of 1924, a statement made by Dr. Wilmer Krusen, Director of Public Health of Philadelphia, announced an indorsement of the campaign to raise the standard of Philadelphia's milk supply. He was offered the support and cooperation of the Quality Control Department of the Dairy Council in checking up the milk at the source.

At that time the city had only 14 inspectors, who not only had to inspect milk, but also meats and other foods. In speaking of the work of the Quality Control Department, Doctor Krusen said:

"To check up on the milk at the source of supply, the Quality Control Department of the Inter-State Dairy Council has increased its staff from four to ten men, all of whom will visit the dairy farms throughout the territory of the Philadelphia milk shed to make inspections and tests, to study the farmer's method of dairying and aid him in improving methods and equipment at a minimum cost."

New Sanitary Regulations

In the spring of 1924, through the producer-dealer cooperation, it was possible to inaugurate regulations covering the production and handling of milk, adopted by the Inter-State Milk Producers' Association at its annual meeting in December, 1923. These regulations in detail provided standards for buildings, premises, light and ventilation, stable floors, ceilings, water supply, the milk house, cans, and other utensils, and for proper methods of milking and care of milk. The Inter-State Milk Producers' Association, the cooperating dealers and health authorities authorized the Quality Control Department to carry out these new regulations.

While not taking precedence on any regulation promulgated by State or local boards of health in the Philadelphia milk shed, it became necessary for a producer in the Philadelphia territory to obtain a Dairy Council permit before a cooperating buyer would purchase his product.

This entire field force of the Dairy Council is at the disposal of farmers and distributors for advice and help in improving their premises to meet the regulations. A plan frequently used has been to hold a community meeting on the premises of some farmer where considerable changes were necessary and where the Dairy Council representative could point out the needs of that particular producer.

Enforcing Sanitary Regulations

In some few instances farmers did not procure temporary permits and, in accordance with the plans advanced for the enforcing of the regulations, were stopped from shipping to the cooperating dealers. However, not more than 100 farmers had their milk rejected, at the time of the first enforcement of the regulations, because of lack of permits. In most cases those who had not procured their permits were very small shippers who felt that they would rather market their milk through other channels than to comply with the regulations. In some few sections of the territory a feeling existed that the sanitary regulations would not be enforced; that even though the first inspection had been made, subsequent inspections would not follow. Upon realizing that such was not the case, and that they were placed in a position where their milk market was endangered, such shippers complied with the standards.

Amount of Rejected Milk Decreases

A result of the sanitary regulations was to materially reduce the proportion of the milk rejected at receiving-station doors. It became evident that milk carefully prepared meant a larger percentage of marketable milk and therefore meant a return of more money to the producer throughout the year with a correspondingly larger milk check.

Something of what was accomplished by the cooperative method was summarized in the report made from the Quality Control Department in 1924. At one station, where at times from two to three thousand pounds of milk per day were rejected in former years because of sourness, after the enforcement of the sanitary regulations it was seldom necessary to reject more than two or three hundred pounds daily.

Country Plant Inspections

Dealers were requested to install can washers, with the result that approximately an additional fifty per cent of all the plants in the Philadelphia milk shed had can washers installed.

Many of the country plants needed improvement. In some cases drainage was unsatisfactory or surroundings were contaminating. Screens and shades were needed in many instances, while a general cleaning-up and painting was required in many plants.

A few plants were condemned and closed. One or two others were rebuilt. Systematic inspections of the plants are regularly made, and constant improvement is noted.

Improved Rating of Sediment Disks

When the Quality Control Department took up the problem of eliminating visible dirt in the Philadelphia milk supply, sediment tests were made of the milk of all producers. These were graded into four classes, A-B-C-D. Early records disclosed that approximately 21 per cent of the milk graded in the class known as D. Although the standard has been changed and made much more rigid than the standard used in 1921 and 1922, the quality of the milk has so improved from the standpoint of cleanliness that not more than three per cent of the producers receive the D grading. Milk corresponding to that regarded as good at the beginning of the sediment testing campaign is today because of the higher standards regarded as unsatisfactory.

Nutrition Department Work

The first city in which the Nutrition Department shared in general health activities was Trenton. Nutrition work was soon started in Chester, Reading, Altoona, Johnstown, Lancaster, and Harrisburg, Pennsylvania, with special development in parts of Dauphin and Delaware Counties; also in Atlantic City, Trenton, and Haddonfield, New Jersey.

Dauphin County Survey

A survey of the consumption of milk in Dauphin County, Pa., in 1922, in connection with extension work of Pennsylvania State College was conducted in cooperation with the Dairy Council. Every place where milk was sold, even in small quantities, was visited. It was found that the consumption per capita was about three tenths of a quart. It was no greater in the rural section than in the city of Harrisburg. In fact, it was discovered in the school survey that only about one fourth of all country children drank as much as a glass of milk per day, and one third of them did not drink milk at all. As a result of this and other surveys a complete nutrition program was developed by the Council.

Supper Clubs

A number of Supper Clubs for industrial girls were formed with groups of from 12 to 20 girls. The clubs meet for dinner once a week. The marketing and preparation of foods is done by the girls under the supervision of a member of the Nutrition Department. During the course of the meal the Dairy Council representative gives informal talks on the food values of the dishes being served. Attractive ways of utilizing milk are demonstrated.

Milk Service for Schools

Milk service in the public schools of Philadelphia increased rapidly after the first year of Dairy Council work. The daily half pint of milk became so popular, and so many problems surrounded its distribution, that Doctor Broome, Superintendent of the Philadelphia public schools, gave the Dairy Council the task of acting as a clearing house for information about milk service. It was found that more than half the public schools of the city were then having the daily milk service, and that others were adopting the plan in such great numbers that it was difficult to obtain a definite report. In one week during October, 1922, more than 14,500 half pints were distributed. This rapid growth of the milk service in the schools has been directly traceable to health education work.

Colored Groups

Early in the work it was found very desirable to reach the many colored people of Philadelphia with nutritional information. Mrs. Madeline Tillman, a graduate of Drexel Institute, was given charge of this work. Her activities have been very successful. She has a full knowledge of the habits and problems of the colored race and knows how to adapt her work to meet their needs. She speaks before colored churches, schools, and clubs and has contacts with all the various negro groups.

Summary of Nutrition Work

Tremendous strides have been made, both in the scope of nutrition work, and in the methods of presenting it. Not only has the Nutrition Department kept pace with the growing interest of the public in health education, but no opportunity has been lost to keep in the forefront in adopting the most advanced methods of presenting nutritional information. The effort made by the Dairy Council Nutrition Staff to adapt its health program to the actual and individual needs of schools has resulted in entire confidence from school authorities and the general public in the ideals and methods employed by the Dairy Council.

Health Dramatic Department

During the first few months of the Philadelphia Inter-State Dairy Council, the dramatic program offered by the Council was given a thorough trial in the public schools. After seeing the presentations, school authorities acknowledged they presented a most delightful and valuable lesson in inspiring children to develop health habits. A play for school children called "The Milk Fairies," portraying the importance of milk in the diet, was obtained through the National Dairy Council.

Dramatic Organization

In October, 1921, a complete department was organized to meet the increasing demands. New plays were written and rehearsed during the summer of 1922. A demonstration of this material in the Botanical Gardens of the University of Pennsylvania in the early part of September to a representative group of educators, Dairy Council contributors, and members of health and social organizations, was received by them with enthusiasm.

The new dramatic material included "How Milk is Made," "Following the Milk Can," "Eating Milk," and "Milk for the Whole World," ten-minute plays for third- and fourth-grade school children; "Making the World Fit," a twenty-minute play for seventh- and eighth-grade boys and girls as well as high-school girls, which teaches a lesson in nutrition; "Happy's Vanity Case," a monologue on "Inside Paint"; "The Garden of Hours," a play portraying the "Rules of Health" in pageant form for girls of high-school age.

Object talks emphasized by the use of dolls, toy furniture, toy foods, masks, and other objects have proved effective in teaching children, especially those very young. Teachers frequently used them as a basis for the regular health lessons.

In connection with the rural meetings of the Inter-State Milk Producers' Association and the Interstate Dairy Council, the Dramatic Department was first called upon in 1922 to furnish plays and monologues.

A performance of the "Garden of Hours," given in the auditorium of the Germantown High School in February, 1923, marked the entry of the Dairy Council dramatics into the high schools.

During the sessions of the Pennsylvania State Dental Society held at the Bellevue-Stratford, Philadelphia, May 17 and 18, 1923, the Dramatic Department staged a performance on two successive days of a new play adapted by the Dairy Council from a play by the Colgate Company, "Who Said Six-Year Molars?"

The addition of the "Health Circus" to the plays offered by the Department resulted in its becoming one of the most popular. The play was given in city and country by all kinds of groups. It was found equally satisfactory in other Dairy Council units. Prior to this there was no health play for boys of junior high school age.

Other plays have been prepared and put into general use. A playlet called "Health in Toyland" furnishes a lesson for the very small children; "The Scarecrow," a play for high- and junior-high-school girls, filled the same needs with girls as the "Health Circus" with boys.

Demonstrations for Teacher-Training Institutions

Regular programs, demonstrating the work of the Dairy Council and the dramatic and nutritional material which it offers to teachers, have been conducted in a number of normal schools, universities, and teacher-training schools. The Dramatic and Nutrition Departments united in presenting the message of the work of the Dairy Council to these educational groups. Training teachers in the presentation methods of the dramatic material became one of the most important means of extending the message.

The value of the work of the Dramatic Department was best illustrated in the spring of 1926 with a presentation of the "Masque of Beauty Through the Ages" by the Harding Junior High School, Philadelphia. This was developed as a project by the school, every department cooperating in the preparation of material, the training of the cast, and its presentation to the community on four successive evenings. The Dairy Council cooperated in the preparation of this, the first health pageant or masque yet produced for high and junior high-school use. It was written by Charles Sommer, the author of the "Health Circus," "The Scarecrow," "The Garden of Hours," and other Dairy Council plays.

Motion Pictures

As a part of the educational program for city and country, the motion picture occupies a distinct and important place. Films have been shown to a wide group:

1. Dairy farmers at country meetings are shown films on such subjects as better feeding, better breeding, clean milk production, cow-testing associations, and cooperative marketing.

2. Manufacturers are shown better methods.

3. College and high-school students are helped in the discussion of every important dairy question.

4. City consumers and city children learn how milk is produced and its importance in nutrition.

5. Motion-picture theater audiences see entertaining films which carry a nutrition moral.

The first work of the Dairy Council was that presenting a motion picture in 80 theaters in Philadelphia. The availability of this avenue for publicity was immediately recognized. The Dairy Council has since developed its own pictures.

There was evident need of a film to tell the story of milk from the cow to the consumer. A film called "Highland Lassie" was developed and has proved to be in every way the most popular film of the Dairy Council, being shown to over one million people in Philadelphia and neighboring cities during one winter alone.

A film was needed for use with country audiences, and "The Turn in the Road" was produced, which, because of its human interest and popular appeal, was the means of helping to popularize the Dairy Council meetings throughout the territory.

Gradually other films have been added to the Dairy Council library, and pictures have been continuously shown in theaters and educational channels, until this work at the present time is considered one of the most important of all our publicity media.

Exhibits

The preparation of exhibit material and the placing of it in position has been one of the Dairy Council's activities most difficult to standardize. It has not been a simple matter to prepare standard material to be used repeatedly, due to the varied nature of the groups to be reached.

A number of mechanical devices have been used in window displays and booths. These have aided in calling attention to the visualized program of the Dairy Council presented to the public through framed photographs, posters, and demonstrations.

Advertising

During the first year it was felt necessary to make an announcement to the public of the Dairy Council message, and paid advertising space was used for one or two insertions in all the leading newspapers, as well as in a number of foreign-language and local newspapers in Philadelphia and other cities. During the summer of 1921, the billboards of Philadelphia and other cities were used, for which copy was furnished through the National Dairy Council. As the other work of the Dairy Council increased in volume and importance, it was not felt that these forms of publicity work could be continued as profitably, so they have been discontinued.

Newspaper Publicity

Newspapers have shown a willingness to use Dairy Council material. The news and human interest value of the health work of the Dairy Council has been reorganized, and a generous use made of the material released in the territory.

A constantly increasing number of newspapers scattered throughout the territory carry a column of nutrition material prepared by staff members of the Nutrition Department and released each week by the publicity department. This material is so released that it is exclusive in the circulation of the receiving newspaper. The "Nutrition Talks" cover the varied field of nutrition subjects, with a practical application in suggested menus and recipes which will furnish assistance to the housewife in preparing well-balanced and nourishing meals.

The power of the printed word is tremendous, especially in the case of rural newspapers, and the identification of the Dairy Council with the newspaper field reinforces the spoken message of its representatives in the territory.

Articles dealing with various new and interesting phases of the Dairy Council work are constantly being prepared. They have appeared in a widely differing number of magazines.

Literature

Distribution of literature by the Philadelphia Inter-State Dairy Council is very closely related to all the work which is done. Each Department depends on booklets and posters to use in connection with lectures and talks, motion pictures and plays. It is understood that any school program will include distribution of certain pieces of literature, some of which is distributed one piece to every child and others one piece to a room. As visits are made by representatives to the schools, the teachers are given an opportunity of ordering such Dairy Council material as will be appropriate to the subject which has been discussed.

The production of Dairy Council literature at the present time is on a national basis. Material is prepared by those particularly qualified for this kind of work. It is carefully checked by Dairy Council managers at quarterly conferences and much of it is rechecked at the annual conference of Dairy Council workers. It is then published through an inter-council agreement and distributed by the National Dairy Council in such quantities as the various Councils may want.

Accomplishments

The Philadelphia Inter-State Dairy Council can point to definite accomplishments in health improvement. Its work with the nutrition classes in the Philadelphia public schools improves the health standards of approximately 1200 children each year.

The Dairy Council itself does not claim any credit except that of a cooperating agency, one among many which have done effective work in health education and one among several which have specialized in the field of nutrition.

Through the mothers' meetings in Philadelphia, particularly in the poor sections, and also with supper clubs of girls, the importance of a well-balanced diet has been emphasized to the point of securing permanent dietary improvements in families and even whole neighborhoods.

The health importance of the accomplishments of the Quality Control Department is certainly very great.

Social Significance

The people of Philadelphia have enjoyed for a decade a milk supply which was as cheap or cheaper than that of the average large American consuming center, but at the same time the price ,to the farmer has been as high or higher than that in the same centers. This has not been a circumstance of fate. It has been due to the good understanding and mutual confidence between producer, dealer, and consumer.

The staff of the Dairy Council has been able to explain to consumers, to educators, and to social workers alike many of the problems of the producer and distributor, thus stimulating in the public at large an intelligent, sympathetic interest in the industry which is responsible for such a large and important item in the diet of the people.

Economic Importance

Nothing except "enlightened self-interest" has prompted the farmers and dealers to put money into Dairy Council activities. It was only because of the expectation of greater business and better public relations that the Dairy Council was started. The public knew of this fact and accepted it.

The Dairy Council early set itself the task of assisting in putting milk service in the Philadelphia public schools and in smoothing out difficulties which, it knew, would develop in this pioneer work on the part of the school system. There is now a fairly smooth-running system of milk distribution in a very large majority of the schools in Philadelphia. Similar activity in other centers has been equally, if not more satisfactory, as, for instance, in suburban districts, Camden, Atlantic City, and Trenton in New Jersey.

Increased Consumption

As indications of successful Dairy Council work, definite statistics of the increased consumption of dairy products are not as important as some other things. Nevertheless the increase has been tremendous.

In this connection it can point to the survey of the United States Department of Agriculture made in 1923, which showed that the per capita consumption of milk in Philadelphia had increased from 0.54 pints to 0.69 pints per day. Four successive years of Dairy Council work brought about an increase in the consumption of milk of something over 30 per cent in this territory. The same survey showed that Philadelphia was using about 23 pounds of butter per year per capita, as compared with the average consumption in the United States of less than 17 pounds.

However, the historian must evaluate the first six years of Dairy Council activity. A large majority of the Dairy Council work very properly has been conducted with young people. The future habits of these young people will not be fully indicated in terms of total milk consumption until they establish their own homes in the years that are to come.

"All that is good in man comes through work; and civilization is its product."

STANDARDS FOR SEDIMENT TESTS

DR. H. A. HARDING, Mathews Industries, Inc.,
Detroit, Mich.

If the movement toward paying for raw milk on the basis of its cleanliness as delivered at the milk plant is to become a fixed part of the financial plan, it will be necessary to develop accurate standards for determining the amount of dirt present. Agreements as to the sliding scale of payment must ultimately be based upon a mutually understood and easily applied scale.

HISTORICAL

Probably the first attempt to make the price of the milk as delivered depend upon the showing of the sediment was in connection with a creamery in New Hampshire, but the earliest attempts to create fixed standards against which to judge the cleanliness of the milk probably were those made at Chicago about 1910. Photographs were prepared of actual sediment pads, and such sediments were used in grading sediments shown by samples brought in by the inspectors or tested in connection with their work. At about the same time, arbitrary sample pads were prepared by Dr. H. W. Conn in connection with his work at the State Laboratory of the Connecticut Department of Health. The date of preparation of these standard pads and the amounts of dirt used in their preparation have not been determined, but the pads are still extant in the laboratory.

In the third edition of the Standard Methods of the American Public Health Association, published in 1921, there was introduced material on sediment testing and reproductions of sediment pads purporting to indicate the limits of suggested grades of cleanliness. Similar material has been shown in later editions of these Standard Methods.

When the Philadelphia Inter-State Dairy Council undertook a campaign for reducing the amount of dirt in the raw milk, they prepared photographs of sediment pads to be used as guides to their field men. Recent improvements in the photographs have resulted in what is probably the most serviceable standard for comparing sediment pads which is now available. However, the glossy surface of the photograph presents a surface which does not lend itself well to close comparisons with the cotton sediment pads obtained from the actual testing of the milk.

Making Standard Sediment Pads

Some nine years ago, Professor J. D. Brew was doing some graduate work at the University of Illinois, and in this connection he made a study of the possible preparation of standard sediment pads. He tested the practicability of barn dirt, phosphate rock, ground feed, dried manure, and carbon. Of all of the substances tried, the carbon gave a sediment pad which most closely resembled those obtained when samples of milk are tested.

It is not practicable to make the desired standards through the use of milk because the milk remaining on the cotton turns yellow on standing, thus destroying the sharp contrast between the white cotton and the dirt. On this account milk cannot well be utilized in making these standards.

The work of Brew was stopped before the required pads were worked out, and recently it has fallen to my lot to undertake the completion of this study.

The first problem is to select a sample of carbon and bring it to the desired fineness. The work thus far has been done with carbon so fine that it would pass through a sieve having 100 meshes to the inch. It is not certain that this is the most suitable degree of fineness.

The next problem is to get the desired weight of carbon. Scales are available with a theoretical sensitiveness of 1/20 milligram. However, it was found more satisfactory for this purpose to weigh out 10 milligrams of the carbon and then suspend this in a measured amount of fluid.

While carbon can be wetted with water by transferring the powdered carbon to an Erlenmeyer flask and shaking vigorously in water, the wetting of the carbon can be accomplished more easily if glycerin (about 2 per cent) is added to the water. When 10 milligrams of carbon are shaken for some time with 100 cubic centimeters of glycerin solution, the carbon becomes distributed uniformly throughout the fluid. With the carbon dispersed in this manner, it is evident that if ten cubic centimeters of this fluid was drawn off, it should contain one milligram of the carbon.

The experiment in preparing standard sediment pads was carried out with the so-called Wisconsin sediment tester. The cotton pad was inserted as in making an ordinary test. The measured amount of fluid containing a known amount of carbon was poured into the tester, taking care that it should strike the side of the tester so as to provide for the more uniform distribution of the material over the pad. Additional small amounts of clean water were poured down the sides of the tester so as to insure the deposition of all of the carbon on the cotton pad.

Manipulated in this way, it was found possible to prepare from a single flask containing ten milligrams of carbon, ten standard sediment pads each containing one milligram of carbon, and have the appearance of all of them uniform.

In a similar way it was found possible to prepare a series of sediment pads representing one half milligram per pad by proceeding in the same way, except that only five cubic centimeters of the carbon suspension was used for each pad.

It was likewise found practicable to prepare similar standard pads representing one fourth milligram by adding two and one half cubic centimeters of the carbon suspension to each pad.

Importance of Density of Carbon

The studies up to this point had been made with a sample of wood charcoal, which is comparatively light. In order to determine what would be the effect upon the standard pads of using carbon of distinctly different density, a second sample of carbon was prepared, using as dense a carbon as could be obtained. This latter was obtained by grinding up some of the carbon used in lightning arresters.

It was found that following the same plan as used with the other sample of carbon, it was practicable to prepare a series of sediment pads which would present a common showing. However, the showing was far from that presented by equivalent weights of the lighter carbon. With these two samples of carbon it required roughly three milligrams of the dense carbon to give the same appearance on the sediment pads as that shown by one milligram of the lighter carbon.

Steps in Developing Standard Sediment Pads

From these observations it is plain that several matters must be settled before we will be able to provide standard sediment pads which can be duplicated at will in any laboratory. These must be settled in the following order:

1. It will be necessary to decide upon the substance to be used as a standard. Carbon seems best adapted to this purpose for the country at large, but in regions where the soil is red or is pale clay, it may be desirable to have some other substance having more nearly the color of the soil and of the dirt found on the actual sediment pads.

2. It will be necessary to decide upon a standard density of the standard substance and a standard fineness. When these matters have been settled, it will then be practicable to make these standard sediment pads, unless the standard substance selected has qualities considerably different from that of the carbon which has been studied.

Importance of This Matter

There is a real need for such standards, both in the matter of basis for payment for cleaner milk and in formulation of ordinances and regulations. All milk contains some foreign matter, but the amount under proper conditions is very small. With a properly constructed dirt standard it will be practicable to establish the permitted limits and make them as small as is practicable.

"Few things are impossible to diligence and skill."

RESULTS FROM BONUS ON SEDIMENT AND REDUCTASE TESTS

DR. H. A. HARDING, Dairy Research Division,
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There is fairly complete agreement that the principle of paying for an article on the basis of its quality is sound. In practice perhaps the most outstanding exception to the application of this principle is in connection with the purchase of milk, and this is the more surprising because of the importance of the milk traffic both from the financial and the health standpoint.

Even here the exception is not complete, since for more than a decade it has been common practice in the city milk trade to modify the price paid the producer on the basis of the fat content of the product. The failure to provide for a modification of the price on the basis of the cleanliness and of the keeping quality of the milk results mainly from the apparent lack of a satisfactory basis for such modification. The experiences here presented were the result of an attempt to develop such a basis.

PREVIOUS ATTEMPTS AT DEVELOPING A BASIS

One of the very early extensive attempts to improve the cleanliness of the milk supply was made by the Bowman Dairy Company, of Chicago, about 1910. In this attempt they offered a bonus of ten cents per hundred pounds for all milk which would come up to the desired standard of cleanliness as indicated by the sediment test of the milk as delivered at the receiving station. As the result of this offer practically all of the milk fairly promptly received the bonus. Later this bonus was withdrawn.

Various attempts have been made to stimulate the production of a milk supply with better keeping quality. The early attempts in this connection largely took the form of paying a bonus for milk which had a low bacterial count. This count has been determined in most cases by means of the standard plates, but in some cases, notably in the case of the Borden Farm Products Company at New York City, much of the supervision has been through the application of the direct microscopic count. These efforts have proved successful in the case of the milk which could be sold at an advance of some cents per quart, but the expense connected with such supervision has thus far prevented the application of these counts in any large way to the ordinary grade of milk.

With the growing recognition of the desirability of the methylene blue reductase test as a means of measuring keeping quality of milk, there has been a growing tendency to try it as a basis for bonus payment. Such attempts have been made in many places, but thus far most of them have been in a very tentative way. The Crescent Creamery Company, of Winnipeg, and the Union Dairy Company, of Calgary, both in Canada, have been experimenting with this for some time.

In 1925 the City Consumers Company, Paducah, Ky., offered a bonus for the production of a milk of better keeping quality. This was applied during the warmer months and resulted in a marked improvement of the supply. During 1926 the application of this bonus was again made during the hot season with continued good effect upon the milk supply.

Results Obtained at Altoona, Pa.

In the experiments conducted at Altoona, Pa., in connection with the Harshbarger Dairy, the problems of cleanliness and of keeping quality were kept entirely separate and the bonus for each computed as though it alone was being studied.

Results Regarding Effect of Bonus on Cleanliness

In order to have a basis for estimating the improvement which would result from the payment of a bonus, measurements were made of the cleanliness of the milk supply both before anything was done to improve it and also after moral suasion had been applied to the producers who were careless in this particular.

These tests were made by passing a pint sample of the milk through a sediment pad. The sample was collected from the weighing can at the plant. The pads were divided into four classes: Class 1 representing very clean, Class 2 acceptably clean, Class 3 dirty, and Class 4 very dirty milk. As an aid in this grading, consideration was given to photographic standards provided by the Philadelphia Inter-State Dairy Council.

The results of these observations are given in Table 1.

TABLE 1

Proportionate Cleanliness of Raw Milk Supply Before Bonus

	1924	1925			
Class	Oct. 7	Mar. 4	May 21	Aug. 13	Nov. 29
	%	%	%	%	%
1	8	5	5	15	15
2	87	65	77	69	48
Total of 1 and 2	95	70	82	84	63
3	5	28	18	14	29
4	0	2	0	2	8
Total of 3 and 4	5	30	18	16	37

Beginning January, 1926, an agreement was made between the milk producers and the Harshbarger Dairy whereby the milk was to be sampled and graded four times per month; and each time the grading was in Class 1, the producer was to have two and one half cents per hundred pounds added to his milk price for that month. Under this plan the producer who uniformly delivered a very clean milk would receive a bonus of ten cents per hundred pounds.

TABLE 2

Proportionate Cleanliness of Raw Milk Supply Under Bonus

Class	Jan.				Feb.				March				April				May				June			
	6	16	25	31	7	14	18	23	2	15	20	30	20	23	27	30	3	11	20	29	10	21	26	30
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
1	37	45	36	50	52	58	56	70	60	53	48	61	60	48	29	31	56	63	59	70	58	65	58	68
2	45	42	48	38	40	32	40	28	34	43	48	32	33	42	68	67	40	34	37	26	39	32	41	32
Total 1 and 2..	82	87	84	88	92	90	96	98	94	96	96	93	93	90	97	98	96	97	97	96	97	97	99	100
3	16	11	13	8	8	9	2	2	6	4	4	7	7	6	3	2	4	3	4	3	3	3	1	0
4	2	2	3	4	0	1	2	0	0	0	0	0	0	4	0	0	0	0	0	1	0	0	0	0
Total 3 and 4..	18	13	16	12	8	10	4	2	6	4	4	7	7	10	3	2	4	3	4	4	3	3	1	0

The effect of this bonus plan upon the cleanliness of the raw milk supply is shown by the results obtained during the first six months of the year 1926, which are given in Table 2.

It will be observed from Table 1 that even under the influence of moral suasion it did not seem practicable to get much more than 80 per cent of the milk supply in an acceptably clean condition, and during the period in which the cows were in the barn the proportion of dirty milk tended to increase.

On the other hand, under the influence of the bonus there was a rapid improvement as the producers became convinced of the genuineness of the opportunity to get more money for clean milk; and the proportion of clean milk rose promptly, although it was the season at which the production of clean milk was most difficult because of the fact that the cows were continuously in the barn and the supply of bedding was becoming limited. As the pasture season appeared, the proportion of clean milk approached 100 per cent.

Results Regarding Effect of Bonus on Keeping Quality

During 1924 and 1925 observations had been made upon the keeping quality of the raw milk supply. Samples were tested with the methylene blue test and moral suasion was applied to those producers who were furnishing milk of undesirable quality. The results of these tests were grouped according to the classification offered by the Standard Methods of the American Public Health Association, and are given in Table 3.

Beginning in January, 1926, a bonus was given for all milk grading in Class 1, four tests being made each month and two and one half cents per hundred pounds being added to the wholesale price for each time Class 1 was attained during the month. Accordingly, the producer whose product was Class 1 at each test received an additional ten cents per hundred pounds in addition to any bonus which might be earned because of the cleanliness of the product.

TABLE 3

Keeping Quality of Raw Milk Supply Before Bonus

Class	1924 July 12	1924 Aug. 1	1925 Mar. 4	1925 May 21	1925 Aug. 13	1925 Nov. 29
	%	%	%	%	%	%
1	19	6	49	12	7	93
2	15	29	25	54	46	6
Total of 1 and 2	34	35	74	66	53	99
3	26	28	13	25	27	0
4	40	37	13	9	20	1
Total of 3 and 4	66	65	26	34	47	1

The results from the application of this bonus for keeping quality are given in Table 4.

It will be observed that from the beginning, the milk was practically all in Classes 1 and 2, which gave a supply of acceptable keeping quality, and that a considerable proportion of the milk was in Class 1, which was a milk of excellent keeping quality. It will also be observed that with the coming of hot weather the proportion of milk of excellent quality declined. This was largely due to the fact that at this time of year the cooling of the milk is an important factor in connection with its keeping quality. Good cooling is the result of provision for accomplishing this, together with its careful use. In many cases these provisions had not been made in advance. However, with the loss of bonus resulting from the lack of cooling before them, provisions for improving the cooling were made. The bonus money offers a substantial basis for incurring expense in connection with the improvement of the quality of the milk.

Conclusions from the Altoona Experiment

From the data here presented it is evident that the payment of a bonus for milk of greater cleanliness and better

TABLE 4

Proportionate Keeping Quality of Raw Milk Supply Under Bonus

Class	Jan.				Feb.				March				April				May				June			
	6	16	25	31	7	14	18	23	2	15	20	30	20	23	27	30	3	11	20	29	10	21	26	30
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
1	55	87	86	79	77	75	76	73	68	86	56	76	89	44	85	76	29	65	46	64	43	42	31	33
2	36	12	13	18	20	20	20	25	28	14	38	19	11	39	14	21	47	31	50	33	43	50	51	48
Total 1 and 2..	91	99	99	97	97	95	96	98	96	100	94	95	100	83	99	97	76	96	96	97	86	92	82	81
3	6	1	0	2	3	5	3	2	4	0	4	5	0	13	1	2	18	4	2	2	12	7	15	12
4	3	0	1	1	0	0	1	0	0	0	2	0	0	4	0	1	6	0	2	1	2	1	3	7
Total 3 and 4..	9	1	1	3	3	5	4	2	4	0	6	5	0	17	1	3	24	4	4	3	14	8	18	19

keeping quality produces modification in the quality of the supply. However, there is here not sufficient data to suggest the right amount of bonus required to produce the best results.

From the data at hand it would seem that the payment of a bonus of ten cents per hundred pounds for clean milk is about the amount necessary to produce the desired improvement. On the other hand, it seems evident that a like sum is not quite sufficient to bring about the desired improvement in the keeping quality in this community.

In considering the application of these results to any other community it should be remembered that a number of factors will enter into the situation.

Relative Merits of Variable and Uniform Application of Bonus

In the Altoona experiment the bonus of 10 cents per hundred pounds was applied during the entire six months. In the Paducah experiment the bonus was applied only during the summer months. The experiment in neither place has progressed sufficiently to decide the relative merits of these two plans. As a matter of fact, the bonus for keeping quality was increased at Altoona during the latter portion of the season and the results from this will be supplied later.

It is clear that during the summer months, when the cows are on clean upland pasture, it is relatively easy to obtain a fine score for cleanliness. Accordingly, any bonus given at that time will be earned rather easily. In a similar manner, it is easy to produce milk of the highest keeping quality during the cold months, while the difficulty in this particular is very real during the hot ones. There are many reasons for attempting to make the bonus proportionate to the effort required to produce a fine product, but any attempt to introduce a fluctuating scale complicates the problem of making the payment fair in all particulars.

Suggestions

We have made an interesting beginning in the problem of paying for milk on the basis of its quality, but this is after all only a beginning. When the plan is worked out it should be such that the production of first-quality milk is accompanied by a substantial profit, while the production of bad milk is made unprofitable. This means that there must be a system of cuts as well as bonuses. However, we should be patient in the matter of working out the desirable bonus system first, and then develop the system of cuts as the producers become more familiar with the most economical methods of producing milk of high quality.

"The best evidence of merit is a cordial recognition of it whenever and wherever it may be found."

SOME DANGERS OF RAW MILK

DR. FLOYD C. RATH, *Assistant Health Officer,*
Madison, Wis.

For some time there has been a decided movement toward pasteurization of our city milk supply, until today 92 per cent of it is pasteurized. The transition from raw to certified or pasteurized milk has taken certain clearly definable steps, which have been greatly augmented in their progress by epidemics and "misfortunes" to raw milk supplies.

In 1920 only 55 per cent of our milk supply was pasteurized. In 1923 a scarlet-fever epidemic in one of our best raw milk supplies was the cause of a decided step in the advancement of pasteurization. The milk supply was stopped immediately when the epidemic was brought to our attention and consequently only a few cases of scarlet fever resulted. Situations of this nature impressed upon our authorities the necessity of definite steps to safeguard our raw milk supply during such epidemics. A stricter ordinance and a greater percentage of pasteurization were answers to this need.

By 1925 our percentage of pasteurized and certified milk had reached 75 per cent of our milk supply. However, in the spring we had the misfortune of having hemolytic streptococcus occur in several families at the same time. All used milk from the same dairy, which caused our department to make an investigation. For years the bacterial count of this dairy had been below 10,000 per c. c., and upon this particular examination we found it to be about 150,000 per c. c. The dairyman was called in and questioned. At this conference he stated that he had three cows with mammitis.

The milk was ordered pasteurized and the cows ordered examined by a licensed veterinarian. The veterinarian, upon his visit to the farm, collected samples of milk from these cows and sent them to the Agricultural Bacteriology Department at the University of Wisconsin. According to a report compiled by Dr. W. D. Frost, of this Department, the following are the quoted results:

"The milk was plated on blood agar, and the next day No. 1 showed only 200 bacteria per c. c., while No. 3 showed 600,000 bacteria per c. c., but in neither case were there any hemolytic colonies present. The plates made from the milk of cow No. 2, however, revealed the enormous number of 36,000,000 bacteria per c. c., and furthermore these bacteria were apparently all hemolytic streptococci of the *beta* type. This organism was isolated in pure culture, found to strongly hemolyze in the test tube and to possess a capsule. These characteristics were regarded as strongly presumptive evidence that this organism was *Streptococcus epidemicus* Davis, which subsequent tests confirmed.

Contemporaneous with the work on the milk, an attempt was made to locate the source of infection in the cows. From the work of Smith and Brown, 1915, Davis, 1912, W. H. Frost, 1912, and others, it seems probable that milk-borne septic sore throat is caused by the infection of the cows from a human source; hence swabs were made and examined from the nose and throat of all persons on the dairy in question. Out of the ten persons examined, two yielded culture of *Streptococcus epidemicus*. One of these two persons was one of the women in the house. She had never had any part in the handling of the milk and, no doubt, became infected from drinking the milk as other persons on the route did. She had very slight clinical symptoms but carried the organism for a little over two months. The other person was the hired man, whose chief duties were the care of the cows and the milk. He had come quite recently from army service to this dairy a little over a month before the cases on this milk route were recognized. So far as sore throat is concerned, his previous history is undetermined. He himself declares that he has not had sore throat within his memory. The nurse who swabbed his throat reported it inflamed, although he said it was not sore. While on the farm, the particular cows reported above as being infected were among those regularly cared for and stripped by him after using the milking machine. After he left the dairy, *Str. epidemicus* was never found in the milk."

The publicity given to the 68 cases of hemolytic streptococci which resulted from this epidemic, together with three other tuberculin-infected herds enumerated below, brought our percentage of pasteurized milk up to 92 per cent of our entire supply.

The first of these herds, which two years previously had had no reactors, now showed 30 reactors out of 52 cows. In 90 days, 18 cows reacted, and again in another 90 days the remaining cows were condemned.

The second herd, consisting of 29 cows, was supplying raw milk to a local hospital, and upon a two-year retest 15 cows reacted to tuberculosis.

The third herd, consisting of 14 cows, and supplying raw milk to a retail trade, upon a retest had eight out of the 14 cows react to tuberculosis.

These three herds were cut off because of our policy whereby the milk supply from such herds is automatically cut off if 50 per cent of the cows react to tuberculosis.

Our ordinance requires "a test every two years unless any test discloses tuberculosis in any member of the herd tested, in which case tests of such herds must be made semiannually thereafter so long as said tests shall disclose tuberculosis."

From the cases cited above, one can readily see the danger of waiting two years to retest herds supplying raw milk. The test should be required every six months wherever possible, but at least once a year in every herd. The herds should also at all times be under the close supervision of a good local veterinarian and be examined by him every month. Conditions being equal, a healthy herd of cattle will produce more milk at a lower cost than a diseased herd, which should prove advantageous to both producer and consumer. It has been said that the eradication of tuberculosis from dairy herds is in part a health measure, and since pasteurization is admittedly not one hundred per cent perfect at all times, it is clear that a very valuable precaution has been added to the milk supply if all cows supplying milk have passed the tuberculin test and, in the case of raw milk, if they have passed a semiannual retest.

"Vigilance is not only the price of liberty but of success of any sort."

THE COLORIMETRIC DETERMINATION OF THE HYDROGEN ION CONCENTRATION OF MILK

PROF. T. J. MCINERNEY, Cornell University, Ithaca, N. Y., and PAUL FRANCIS SHARP

The hydrogen ion concentration of milk is an expression of the intensity factor of acidity in the milk. Bacteria which produce acids increase not only the titratable or quantity factor of acidity but also the intensity factor, that is, the hydrogen ion concentration, as well. Thus by determining either the titratable acidity or the hydrogen ion concentration, an idea may be gained as to whether or not acid-producing bacteria may have grown in the milk, which growth, of course, affects the keeping qualities of the milk.

Fresh normal milk usually has a pH between 6.5 and 7. As the milk begins to develop acidity the pH decreases. Milk usually curdles when a pH of 4.8-4.6 is reached, according to Van Slyke and Baker.

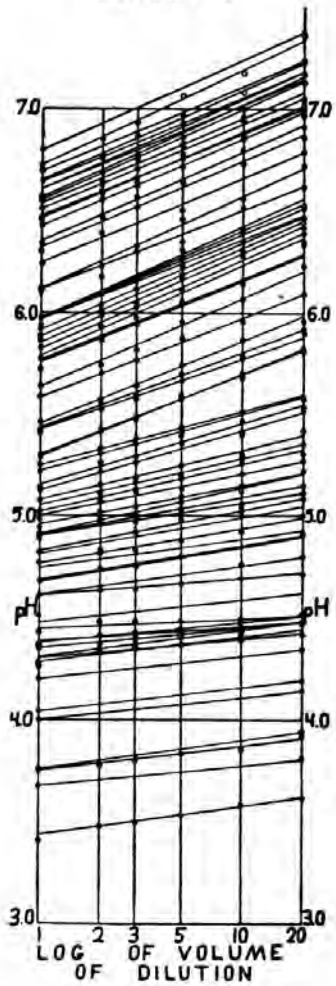
The determination of the hydrogen ion concentration of milk by the colorimetric method offers considerable difficulty, supposedly due to the marked turbidity of the milk itself. Several methods have been proposed to overcome this difficulty.

Baker and Van Slyke added the indicator, brom cresol purple, directly to the milk contained in test tubes and compared the unknown samples with the color obtained with standard samples of normal milk.

The main difficulties in this method are the lack of definite color standards and the opaqueness of the milk.

Several investigators dialyzed milk and determined the hydrogen ion concentration of the diffusate colorimetrically. This method gives satisfactory results but requires time and special technique. Brown diluted the milk with water to decrease the turbidity and stated that the dilution of milk with water did not change the pH. We found, however, that the dilution of milk with water increases the pH. Taylor found that if the pH of milk diluted with various amounts of water was plotted against the logarithm of the

FIGURE I



dilution that the data fell on a straight line. Taylor's results indicate that the hydrogen ion concentration of milk changes in a uniform manner as it is diluted with water. This led us to study the constancy of this dilution factor with different samples of milk and with the hydrogen ion concentration of the milk diluted.

We first diluted several samples of milk with various amounts of distilled water and determined the hydrogen ion concentration of the different dilutions. The results fell on a straight line up through dilutions of 1 to 29 but a bending was indicated with dilutions of 1 to 49. Because of the possibility that dilutions higher than twenty volumes might give results that would not fall on a straight line, we restricted ourselves in the main part of this investigation to dilutions of one part of milk to nineteen parts of water. Such dilutions are called dilutions 1 to 20 volumes. In studying the dilution factors, dilutions were made of one part of milk to a total of 2, 3, 5, 10, and 20 volumes. The results were plotted against the logarithm of the volume to which the milk was diluted. A line was drawn through the points and the difference in pH of the original milk and of the 20-volume dilution as indicated by the line was taken as the dilution factor. Some of the data are shown in Figure I.

This is also expressed in the form of a table.

This table gives the hydrogen ion concentration of the original milk and of the dilution of the milk to 20 volumes, together with the difference. This difference is the correction factor for dilution.

Experiments were tried with fresh milk, artificially soured milk, and naturally soured milk. The samples included mixed whole and skimmed milk from the Cornell dairy herd, milk from individual cows in the herd, and patrons' milk brought in by the dairymen in the vicinity.

It will be noticed that a dilution to 20 volumes caused a decrease in the hydrogen ion concentration of fresh milk of about 0.54 pH units. As the milk sours, and after reaching a pH of about 5.6, the decrease in acidity on dilution becomes less. The data obtained indicate that the dilution factor is a function of the hydrogen ion concentration of the orginal milk.

The dilution factors for 158 samples of milk were obtained by plotting a curve as shown in Figure I. These dilution

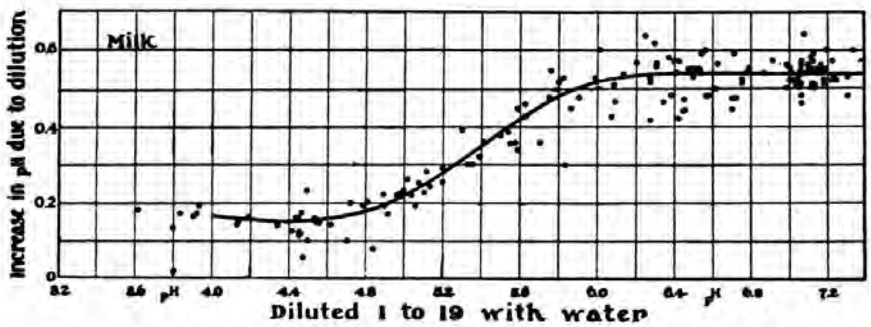
TABLE I

Table of correction factors for the colorimetric determination of the hydrogen ion concentration of milk by the dilution method. The product is diluted 1 to 19 with distilled water and the colorimetric determination made in the conventional way with turbidity blank. The colorimetric pH reading is located in column 1, then the pH of the undiluted milk is found in the corresponding row.

	Whole Milk and Skim Milk		
Colorimetric reading	Correction factor	Original undiluted	Indicator
pH	pH	pH	
7.4	0.54	6.86	
7.3	0.54	6.76	Phenol
7.2	0.54	6.66	
7.1	0.54	6.56	
7.0	0.54	6.46	red
6.9	0.54	6.36	
6.8	0.54	6.26	
6.7	0.54	6.16	
6.6	0.54	6.06	
6.5	0.54	5.96	Brom
6.4	0.54	5.86	cresol
6.3	0.54	5.76	purple
6.2	0.54	5.66	
6.1	0.53	5.57	
6.0	0.52	5.48	Chlor
5.9	0.50	5.40	
5.8	0.48	5.32	phenol
5.7	0.46	5.24	
5.6	0.43	5.17	red
5.5	0.39	5.11	
5.4	0.35	5.05	
5.3	0.31	4.99	
5.2	0.28	4.92	
5.1	0.24	4.86	
5.0	0.22	4.78	
4.9	0.19	4.71	Brom
4.8	0.18	4.62	cresol
4.7	0.17	4.53	green
4.6	0.16	4.44	
4.5	0.16	4.34	
4.4	0.15	4.25	
4.3	0.15	4.15	Brom
4.2	0.15	4.05	phenol
4.1	0.16	3.94	blue
4.0	0.16	3.84	

factors were then plotted against the hydrogen ion concentration of the diluted milk as shown in Figure II. The

FIGURE II



results were plotted in this way, so that one could determine the hydrogen ion concentration of a sample of milk diluted to 20 volumes and then read from the curve the fraction of a pH unit to be subtracted from the reading obtained with the 20-volume dilution to give the pH of the original undiluted sample.

It will be observed that in some instances the data for milk plotted in Figure II do not fall very close to the line, but in about 82 per cent of the samples the error in the correction factor is not greater than 0.05 pH, and in 98 per cent of the cases it is not greater than 0.10 pH.

The fact that the points in Figure II do not all fall exactly on the lines was to be expected and is probably due to differences in the composition of the milk and especially in casein content.

All of the preceding work on dilution was done electrometrically. It remained to be shown how accurately the colorimetric determination of the hydrogen ion concentration of the diluted milk indicated the hydrogen ion concentration of the original undiluted milk after applying the dilution factors given in Table I.

The colorimetric determinations were made with standard buffer solutions, using a test tube comparator and a turbidity blank. The test tubes used had an internal diameter of 13 mm. In such test tubes a 20-volume dilution of milk permitted considerable light to pass through when the tubes were held before a strong light. Most of the color comparisons were made with artificial light produced by an electric light held behind a sheet of thin white paper.

Artificial light was used because on cloudy days the natural light was not intense enough to penetrate the turbidity of the solution.

A large number of samples of milk of various hydrogen ion concentrations were diluted to 20 volumes and the hydrogen ion concentration of the diluted milk was determined both electrometrically and colorimetrically. The hydrogen ion concentration of the original milk was determined electrometrically. Some of the results obtained after eliminating those which did not conform to the indicators and range indicated in Table I are given in Table II.

In using Table I it is important to use the indicators only in the range given in this table, for although the indicators may give color changes outside of the range given in the table for ordinary colorimetric determinations, yet we found that with diluted milk it frequently happened the true pH value was not indicated.

In Table II are listed 44 samples of milk. The hydrogen ion concentration of the dilutions was corrected back to the hydrogen ion concentration of the original milk by the use of the factors given in Table I, and these values were compared with the actual hydrogen ion concentration of the undiluted milk. The error in terms of pH made in determining the hydrogen ion of the original milk from the 20-volume dilution are given in the last two columns.

It will be noticed that the maximum error made in the electrometric determinations was 0.15 pH, the average error disregarding signs was 0.047 pH, and the average error, taking into account the signs, was —0.002 pH. The maximum error in the colorimetric determinations was 0.18 pH,

TABLE II.

Whole milk. Showing the accuracy with which the colorimetric and electrometric determination of the hydrogen ion concentration of milk diluted to 20 volumes indicates, after correction, the hydrogen ion concentration of the undiluted milk.

Original milk	Milk diluted to 20 volumes		Corrected for dilution should give pH of undiluted milk			
					Error	
	Electrometric	Colorimetric	Electrometric	Colorimetric	Electrometric	Colorimetric
pH	pH	pH	pH	pH	pH	pH
6.63	7.13	7.1	6.59	6.56	—0.04	—0.07
6.62	7.13	7.2	6.59	6.66	—0.03	+0.04
6.59	7.19	7.2	6.65	6.66	+0.06	+0.07
6.58	7.06	7.0	6.52	6.46	—0.06	—0.12
6.57	7.12	7.1	6.58	6.56	+0.01	—0.01
6.56	6.95	7.1	6.41	6.56	—0.15	0.00
6.53	7.08	6.95	6.54	6.41	+0.01	—0.12
6.53	7.11	7.1	6.57	6.56	+0.04	+0.03
6.52	7.03	6.9	6.49	6.36	—0.03	—0.16
6.52	7.04	7.1	6.50	6.56	—0.02	+0.04
6.50	7.06	7.1	6.52	6.56	+0.02	+0.06
6.49	7.06	7.1	6.52	6.56	+0.03	+0.07
6.48	6.98	7.0	6.44	6.46	—0.04	—0.02
6.48	7.05	7.0	6.51	6.46	+0.03	—0.02
6.48	7.00	7.0	6.46	6.46	—0.02	—0.02
6.43	7.07	6.9	6.53	6.36	+0.10	—0.07
6.26	6.70	6.75	6.16	6.21	—0.10	—0.05
6.25	6.72	6.9	6.18	6.36	—0.07	+0.11
6.24	6.79	6.7	6.25	6.16	+0.01	—0.08
6.23	6.75	6.8	6.21	6.26	—0.02	+0.03
6.23	6.70	6.8	6.16	6.26	—0.07	+0.03
6.21	6.75	6.7	6.21	6.16	0.00	—0.05
6.10	6.58	6.6	6.04	6.06	—0.06	—0.04
6.10	6.58	6.7	6.04	6.16	—0.06	+0.06
6.06	6.62	6.6	6.08	6.06	+0.02	0.00
5.97	6.50	6.5	5.96	5.96	—0.01	—0.01
5.95	6.54	6.5	6.00	5.96	+0.03	+0.01
5.95	6.50	6.5	5.96	5.96	+0.01	+0.01
5.90	6.36	6.4	5.82	5.86	—0.08	—0.04
5.90	6.38	6.35	5.84	5.81	—0.06	—0.09
5.87	6.41	6.5	5.87	5.96	0.00	+0.09
5.68	6.30	6.4	5.76	5.86	+0.08	+0.18
5.63	6.10	6.0	5.57	5.48	—0.06	—0.15
5.46	5.99	5.9	5.47	5.40	+0.01	—0.06
5.41	6.01	5.7	5 49	5.24	+0.08	—0.17
5.35	5.71	5.7	5.25	5.24	—0.10	—0.11
5.28	5.76	5.7	5.30	5.24	+0.02	—0.04
5.22	5.77	5.7	5.31	5.24	+0.09	+0.02
5.17	5.63	5.5	5.20	5.11	+0.03	—0.06
4.90	5.29	5.2	4.98	4.92	+0.08	+0.02
4.84	5.12	5.1	4.88	4.86	+0.04	+0.02
4.80	5.06	5.1	4.84	4.86	+0.04	+0.06
4.76	5.02	5.0	4.82	4.78	+0.06	+0.02
4.27	4.50	4.5	4.34	4.34	+0.07	+0.07
Average error taking into account the signs...					—0.002	—0.012
Average error disregarding the signs.........					0.047	0.059

the average error disregarding signs was 0.059 pH, and the average error taking into account the signs was —0.012 pH. The average error taking into account the signs indicates that the average correction factors given in Table I, as obtained in the line in Figure II, are approximately correct. The agreement between the average values for the electrometric and colorimetric determinations differs only by approximately 0.01 pH. This agreement seems particularly good in view of the fact that the buffer standards were prepared only for 0.2 pH intervals and most of the color determinations were read only to even tenths of pH.

Summary

This method gives results which are usually correct factors for the effect on the hydrogen ion concentration of diluting the product with 19 volumes of distilled water in order to reduce the turbidity and to make it possible for light to pass through the solution.

This method gives results which are usually correct within 0.1 pH, the average error being about ±0.06 pH.

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(Applicant)

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