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EIGHTEENTH ANNUAL REPORT

OF THE

International Association of Dairy and Milk Inspectors

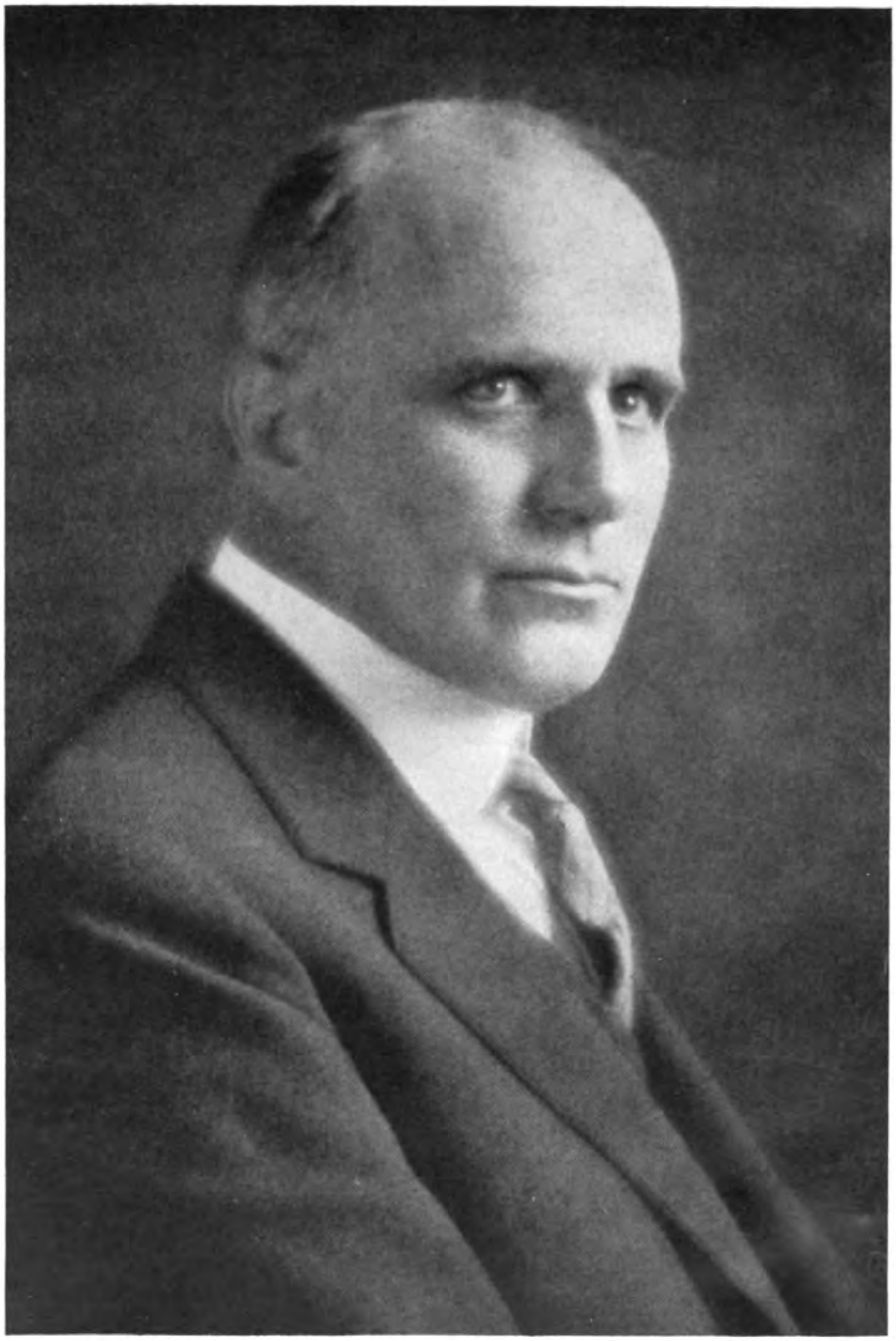
INCLUDING PAPERS READ AT THE ANNUAL
CONVENTION IN MEMPHIS, TENN.
OCTOBER 7, 8, AND 9, 1929 - 30

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

COMPILED BY

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

Price Two Dollars



Ivan C. Weld
Secretary-Treasurer of Association from its beginning to his death March 15, 1929.

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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

SECTION 4. Members of the Association may elect as honorary members, at any stated meeting, on the recommendation of the Membership Committee, those whose labors have substantially added to the scientific knowledge of milk supply betterment, or those who have been of pronounced practical influence in the improvement of the milk industry. From such members no dues shall be required. They shall have the privilege of attending the meetings of the Association, but they shall not be entitled to vote.

ARTICLE 2

OFFICERS

SECTION 1. The officers of this Association shall be a President, a First, Second, and Third Vice-President, a Secretary-Treasurer, and two Auditors, who shall be chosen by ballot at the annual meeting of the Association, and shall hold office for one year, or until their successors are duly elected.

SECTION 2. The Executive Board shall consist of the President, the three Vice-Presidents, and the Secretary-Treasurer.

SECTION 3. The Membership Committee shall consist of the President, the three Vice-Presidents, and the Secretary-Treasurer.

ARTICLE 3

DUTIES OF OFFICERS

SECTION 1. It shall be the duty of the President to preside at all meetings of the Association. He shall examine and approve all bills previous to their payment, appoint all committees unless otherwise directed by vote of the Association, and perform such other duties as usually devolve upon a presiding officer, or are required of him by the Association.

SECTION 2. The Vice-Presidents, in the order of their selection, shall perform the duties of the President in his absence.

SECTION 3. The Secretary-Treasurer shall record the proceedings of the Association. He shall keep a list of members, and collect all moneys due the Association, giving his receipt therefor. He shall record the amount of each payment, with the name and address of the person so paying. He shall faithfully care for all moneys entrusted to his keeping, paying out the same only with the approval of the President, and taking a receipt therefor. He shall, immediately after his election to office, file with the President of the Association a bond in the sum of five hundred dollars, the expense of which shall be borne by the Association. He shall, at the annual meeting, make a detailed statement of the financial condition of the Association.

It shall also be the duty of the Secretary-Treasurer to assist in making arrangements and preparing a program for the annual meeting, and to compile and prepare for publication all papers, addresses, discussions and other matter worthy of publication, as soon as possible after the annual meeting.

SECTION 4. The full management of the affairs of the Association when the Association is not in session shall be in the hands of the Executive Board, as provided in the Constitution.

SECTION 5. It shall be the duty of the Auditors to examine and audit the accounts of the Secretary-Treasurer and all other financial accounts of the Association, and to make a full report of the condition of the same at the annual meeting.

ARTICLE 4

MEETINGS

SECTION 1. The annual meeting of the Association shall be held at such time and place during the month of October of each year or at such other time as shall be designated by the Executive Board.

SECTION 2. Special meetings of the Association may be called by the Executive Board, of which due notice shall be given to the members by the Secretary.

SECTION 3. Quorum.—Twenty-five per cent of the membership shall constitute a quorum for transaction of business at any annual meeting. Voting by proxy shall not be permitted.

ARTICLE 5

These By-Laws may be altered or amended at any annual meeting of the Association. Any member proposing amendments must seasonably submit the same in writing to the Secretary-Treasurer, who shall then give notice of the proposed amendments by mail to each member of the Association at least thirty days previous to the date of the annual meeting.

International Association of Dairy and Milk Inspectors

OFFICERS, 1928—1929

President, Howard R. Estes .... Cleveland, Ohio
First Vice-President, Ralph E. Irwin.... Harrisburg, Pa.
Second Vice-President, A. R. B. Richmond, Toronto, Ont.
Third Vice-President, William B. Palmer.. Orange, N. J.
Acting Sec'y-Treas., Ralph E. Irwin........ Harrisburg, Pa.
Auditors: Thomas Holt............................ Hartford, Conn.
F. D. Holford............................ New York City

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Prof. James D. Brew........................ Ithaca, N. Y.
H. Carman........................ Newport, Ky.

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Prof. C. L. Roadhouse	Davis, Cal.
Dr. G. C. Supplee	Bainbridge, N. Y.

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Dr. James A. Tobey	New York City

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A. R. Tolland	Boston, Mass.

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Prof. R. M. Washburn	Chicago, Ill.

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Abele, C. A.	Director of Inspection, Alabama State Board of Health	519 Dexter Ave., Montgomery, Ala.
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Hulquist, J. A.	Dairy Inspector and Sanitary Inspector	Jamestown, N. Y.
Irvine, George	Dairy Bureau, State Department of Agriculture	Lansing, Mich.
Irwin, Ralph E.	Chief, Division of Milk Supply, State Department of Health	Harrisburg, Pa.
Jennings, J. R.	State Dairy Commissioner	Phoenix, Ariz.
Johnson, E. B.	Executive Officer, Board of Health	Framingham, Mass.
Johnson, W. Scott	Chief Public Health Engineer, State Board of Health	Jefferson City, Mo.
Johnston, John F.	Inspector of Milk	Health Department, Newport, R. I.
Kagey, Dr. J. F.	Food and Dairy Inspector	Kingsport, Tenn.
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Kelly, Ernest	Market Milk Specialist, Bureau of Dairy Industry, U. S. Department of Agriculture	Washington, D. C.
Kirchoff, Geo. F.	Dairy Inspector	1925 Ave. H., Birmingham, Ala.
Knobel, Dr. Ed.	Inspector of Milk	Dedham, Mass.
Krueger, Paul F.	Assistant Director, Bureau of Dairy Products, Department of Health	Chicago, Ill.
Langwell, C. F.	Dairy Inspector, State of Indiana	State Board of Health, Indianapolis, Ind.

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Lawton, Dr. H. C.	Secretary, Board of Health, and Milk Inspector	Camp Hill, Pa.
Layson, S. V.	Milk Sanitation, Illinois Department of Public Health	State House, Springfield, Ill.
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Le Fevre, Peter E.	Research Laboratory, National Dairy Products Co.	New Paltz, N. Y.
Leslie, Dr. Roy F.	Chief, Bureau of Food and Dairy Inspection	127 City Hall, Cleveland, O.
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Lockwood, Prof. W. P. B.	Managing Director, New England Dairy and Food Council, Inc.	51 Cornhill, Boston, Mass.
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McInerney, Prof. T. J.	Milk Inspector and Assistant Professor of Dairy Industry	Department of Dairy Industry, Cornell University, Ithaca, N. Y.
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Magee, D. J.	Dairy and Food Inspector	Box 658, Vicksburg, Miss.
Marcussen, W. H.	Vice-President, Borden's Farm Products Co.	110 Hudson St., New York City
Marquardt, O. R.	Milk Inspector, Board of Health	Detroit, Mich.
Master, Melvin, F.	Milk Inspector	City Hall, Lowell, Mass.
Matthews, C. B.	Chief, Bureau of Dairy Inspection	Miami, Fla.

Maughn, M. O.	Executive Secretary, The Milk Council, Inc.	Builders' Bldg., Wacker Drive at La Salle St., Chicago, Ill.
Melican, Geo. D.	Milk Inspector	Room 6, City Hall, Worcester, Mass.
Menary, Dr. A. R.	City Dairy Inspector	Cedar Rapids, Iowa
Meyer, Dr. E. F.	Chief Milk Inspector	1839 Union Ave., Grand Rapids, Mich.
Mickle, F. Lee	Director of Laboratories, State Department of Health	Hartford, Conn.
Miller, Dr. John F.	Supervisor of Milk Pasteurizing Plants, State Department of Health	Albany, N. Y.
Mitchell, Dr. H. B.	Milk Supervisor	City Hall, Lancaster, Pa.
Moore, Mrs. Edith L.	Bacteriologist and Chemist	City Hall, Houston, Texas
Morrow, Dr. A. C.	District Veterinarian, Butte District	Dillon, Montana
Mott, Frank E.	Chemist, Health Department, and Inspector of Milk	1104 City Hall Annex, Boston, Mass.
Mumford, Dr. J. E.	Veterinary Dairy Farm Inspector	62 Gothic Ave., Toronto, Ontario
Munro, Harold R.	Milk Inspector, City of Malden	8 Lovell Road, Watertown, Mass.
Neer, Lester C.	Meat and Dairy Inspector	328 Edgar Ave., Dayton, O.
Ocker, Harry A.	Meat and Dairy Inspector, Department of Health	Cleveland, O.
Oliver, John	Meat and Milk Inspector	Columbus, Miss.
Osborne, W. J. Earl	Dairy Inspector, Essex Border Municipalities	Windsor, Ontario
Osgood Clayton P.	Assistant State Dairy Inspector	Augusta, Maine
Palmer, Russell R.	Chief Milk Inspector, City of Detroit	1300 Beaubien St., Detroit, Mich.
Palmer, Wm. B.	Executive Officer, Milk Association of the Oranges, N. J.	City Hall, Orange, N. J.
Parker, Horatio N.	City Bacteriologist, Health Department	Jacksonville, Fla.
Parker, N. M.	Chief Inspector Milk Supervision, State Board of Health	Jackson, Miss.

Pattison, Edwin	Milk Inspector, Health Department	Bloomington, Ill.
Pearce, Dr. C. D.	Chief Veterinarian, The Borden Company	350 Madison Ave., New York, N. Y.
Pease, Dr. Herbert D.	Director of Pease Laboratories	39 W. 38th St., New York City
Pierson, John	Health Inspector	629 N. Parramara St., Orlando, Fla.
Pilgrim, Dr. S. L.	Chief, Division of Food	Milwaukee, Wis.
Plimpton, Geo. E.	Chemist, Francis S. Cummings Co.	534 Boston Ave., West Somerville, Mass.
Possien, S. G.	Chief Milk and Dairy Inspector, Board of Health	Mobile, Ala.
Posson, R. J.	Sec'y-Mgr. Wash. Dairy Council	502 Hill Bldg., Washington, D. C.
Prentiss, Russell I.	Milk Inspector, Town of Lexington	Lexington, Mass.
Price, J. M.	Dairy Inspector	Greenville, Miss.
Price, Dr. Wm. H.	Detroit Creamery Co.	Detroit, Mich.
Putnam, Geo. W.	Research Engineer, The Creamery Package Mfg. Co.	1243 W. Washington Blvd., Chicago, Ill.
Rath, Dr. Floyd C.	Assitant Health Officer, Dairy and Food Inspector	Madison, Wis.
Redfield, Dr. H. W.		Mendham, N. J. R. F. D. 1
Regan, Dr. J. J.	Chief Veterinarian and Director of Labs., Dairymen's League	11 W. 42d St., New York City
Rice, Dr. John L.	Health Officer	City Hall, New Haven, Conn.
Richmond, Dr. A. R. B.	Chief of Division of Food Control, Department of Public Health	Room 300, City Hall, Toronto, Ontario
Roadhouse, Prof. C. L.	Professor of Dairy Industry, University of California	University Farm, Davis, Cal.
Robertson, Dr. T. R	Sanitary Inspector	Dyersburg, Tenn.
Romberger, Dr. E. E.	Milk and Meat Inspector	340 N. 6th St., Reading, Pa.

Rosenberger, Dr. M.	Superintendent, Adohr Stock Farm	R. 2, Box 105, Van Nuys, Cal.
Russell, C. C.	Dairy Inspector	City Health Department, Birmingham, Ala.
Schlegel, John M.	Dairy Inspector, Chicago Health Department	Doleville, Ind.
Schofield, Dr. Earle F.	Milk and Food Inspector, Department of Health	Greenwich, Conn.
Schmeing, J. B.	Sanitary Inspector of Dairies	Covington, Ky.
Secoy, Chas. W.	Meat and Dairy Inspector	Bellevue, O.
Shain, Dr. Chas.	Chief Food Inspector	Health Department, Hamilton, Ontario
Shere, Lewis	c/o Diversey Mfg. Co.	53 W. Jackson Blvd., Chicago, Ill.
Shoults, Dr. W. A.	Director of Food Division, Provincial Board of Health	Winnipeg, Manitoba
Shrader, Dr. J. H.	Director, Research Laboratories, National Dairy Products Corporation	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.
Shutt, Donald B.	Dept. of Bacteriology, Ontario Agr. College	Guelph, Ont.
Sibbald, A. D.	Assistant Dairy and Food Commissioner	Old Capitol, St. Paul, Minn.
Slater, J. P.	Sanitary Inspector, Union County Health Unit	Eldorado, Ark.
Smith, D. R.	Hampton Roads Creamery, Inc.	Newport News, Va.
Smith, E. J.	Gabel-Risdon Creamery Co.	Detroit, Mich.
Smith, Howell A.		Denver, Colo.
Smith, Russell S.	Director, Dairy Division, State Board of Health, and Milk Specialist, U. S. Public Health Service	New Orleans, La.
Snyder, R. D.	Inspector and Chemist, Snyder's Dairy	Bloomsburg, Pa.
Spafford, H. A.	Sanitary Engineer for Logan County	Logan, W. Va.
Steiger, L. T.	Dairy Inspector, City Health Department	Memphis, Tenn.

Stevenson, A. F.	The Borden Company	350 Madison Ave., New York City
Stovall, Roy S.	Sanitary and Milk Inspector	New Albany, Miss.
Strauch, Thos. J.	Chief Dairy Inspector, Bureau of Health	Richmond, Va.
Stricklen, Owen E.	Milk Inspector	Ann Arbor, Mich.
Supplee, Dr. G. C.	Director of Research Laboratory, The Dry Milk Company	Bainbridge, N. Y.
Swanner, R. O.	State Dairy Inspector	Selma, Ala.
Switzer, H. B.	Chief, Rouses Point Import Milk Station	Rouses Point, N. Y.
Testerman, H. L.	Inspector of Milk and Foods	Colorado Springs, Colo.
Thomas, R. C.	Asst. Milk Specialist, U. S. Public Health Service	Washington, D. C.
Thomson, James E.	Chief, Bureau of Sanitary Control, Borden's Farm Products Company	New York City
Thrasher, H. J.	Assistant Director of Inspection, Alabama State Board of Health	Huntsville, Ala.
Tiedeman, Walter D.	Assistant Sanitarian, Division of Sanitation, State Department of Health	Elsmere, N. Y.
Tobey, Dr. James A.	Scientific Consultant, The Borden Company	350 Madison Ave., New York City
Tobias, James H.	Dairy Inspector, Chicago Health Department	307 Bent St., Elgin, Ill.
Tobin, Michael F.	Inspector of Pasteurization	245 Canal St., Providence, R. I.
Tolland, A. R.	Dairy Inspector, Health Department	Room 1102, City Hall Annex Boston, Mass.
Trish, Dr. Karl A.	Food and Dairy Inspector, Health Department	City Hall, Kenosha, Wis.
Trotter, Dr. A. M.	Chief Veterinary Inspector, Corporation of Glasgow	60 Hill St. (East) Glasgow, Scotland
Vener, Benj.		2738 E. 19th St., Brooklyn, N. Y.
Von Achen, S. O.	Milk Inspector, State Board of Health	Jefferson City, Mo.
Voorhees, Dr. L. A.	Chemist, Department of Health	New Brunswick, N. J.

Walker, Dr. W. F.	Director, Committee on Administrative Practice, American Public Health Association	370 Seventh Ave., New York City
Walmsley, Dr. F. D.	Borden's Farm Products Company of Illinois	326 W. Madison St., Chicago, Ill.
Ward, Dr. Augusta R.	Assistant Chief, Dairy Research Division, Matthews Industries, Inc.	Detroit, Mich.
Ward, Willard E.	Agent, Board of Health, for Milk and Food Inspection	14 Town Hall, Brookline, Mass.
Warner, W. J.	Deputy State Dairy and Food Commissioner	Hartford, Conn.
Washburn, R. M.	Director, Miss. County Health Unit	Blytheville, Ark.
Washburn, Prof. R. M.	Technologist, Liquid Dehydration Corporation	4750 Sheridan Road Chicago, Ill.
Way, H. O.	Director, The Agricultural Laboratory	508 Blackstone Bldg., Cleveland, O.
Weaver, B. F.	County Sanitary Inspector	Moulton, Ala.
Wheeler, Ralph J.	Milk Inspector, City of Pasadena	547 Padilla St., San Gabriel, Cal.
White, G. T.	Milk Inspector	1130 Seward Ave., Detroit, Mich.
Widmayer, Fred J.	Food and Milk Inspector	Scranton, Pa.
Wilcox, Dr. F. P.	Director, Division of Dairy Products, Los Angeles County Health Department	Hall of Justice, Los Angeles, Cal.
Williams, Dr. R. W.	Milk and Food Inspector	P. O. Box 923, Eldorado, Ark.
Wilson, Frank C.	In charge Milk Laboratory, Food and Drug Department, State Board of Health	152 State House, Indianapolis, Ind.
Yale, Maurice W.	Chief of Sanitation Department, Pittsburgh District Dairy Council	451 Century Bldg., Pittsburgh, Pa.

Yates, J. W.	General Laboratories, Inc.	124 S. Dickenson St., 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.
Hastings, Dr. C. J.	Medical Officer of Health	Toronto, Ontario
Pearson, Dr. R. A.	President, University of Maryland	College Park, Md.
Van Norman, Dr. H. E.	The Borden Co.	350 Madison Ave., New York City
Woodward, Dr. W. C.	American Medical Association, Bureau of Legal Medicine and Legislation	535 N. Dearborn St., Chicago, Ill.

Eighteenth Annual Convention

HOTEL PEABODY

MEMPHIS, TENN.

MONDAY, TUESDAY, WEDNESDAY, OCT. 7, 8, 9, 1929

Tuesday, October 8
5.00 P.M.

BUSINESS SESSION

The report of the Secretary-Treasurer was presented by Mr. Irwin. Moved and seconded that it be accepted. Motion carried.

Mr. Holt reported that the auditors had examined the financial records of the Secretary-Treasurer and found them correct and in satisfactory condition. Moved and seconded that the report be accepted. Motion carried.

Dr. Price presented the report of the Committee on Resolutions. Moved and seconded that the report be accepted.

The following officers were unanimously elected for 1930:

President, Ralph E. Irwin
First Vice-President, A. R. B. Richmond
Second Vice-President, William B. Palmer
Third Vice-President, Horatio N. Parker
Secretary-Treasurer, Paul B. Brooks
Auditors, F. D. Holford, Thomas Holt

NEW BUSINESS

The Secretary-Treasurer read telegrams or letters of invitation for the 1930 convention from several cities.

It was moved and seconded that a committee of five be appointed by the President, the members to be located in different parts of the country, to study the advisability of revising the constitution and to report at the next meeting. Motion carried.

It was moved and seconded that the Executive Committee consider the desirability of bringing about the establishment of branch organizations or sections and report at the next meeting. Motion carried.

Mr. Abele, on behalf of the southern members, thanked the Executive Committee for having selected Memphis as a meeting place and reported that 21 applications for membership had already been received from Alabama. He suggested that the committee give serious consideration in selecting the meeting place for next year to the selection of a city located centrally and not too far from the South.

Mr. Ehlers, of Texas, extended an invitation to the Association to hold its next meeting in Texas, calling attention to the fact that the next meeting of the American Public Health Association would be held at Fort Worth.

Mr. Frank moved that the Committee on Ordinances continue to study the standard milk ordinance of the U. S. Public Health Service and that a reasonable minority of membership of the committee be from states where this ordinance is in effect. Motion seconded and carried.

Mr. Estes read a letter addressed to the late Mr. Weld from a German Commission, with the membership of which Mr. Weld evidently had been in contact when in Germany. It indicated that members of this Commission planned to visit the United States and had reference to its program while here. It was moved and seconded that the Secretary be instructed to invite the Commission to attend the next annual meeting of the Association, stating that at that time the Association would be pleased to extend to the visitors any courtesies within its power. Motion carried.

There being no further business the business session was adjourned.

REPORT OF COMMITTEE ON RESOLUTIONS

WHEREAS, In His infinite wisdom, Almighty God has seen fit to remove from our midst our dearly beloved friend and associate, Ivan C. Weld, a charter member, founder, first and only Secretary-Treasurer of this organization, a man of science whose contributions have added materially to our knowledge, an efficient and broad-minded executive, a man of noble character and high ideals, who gave generously of his time to activities designed for the improvement of human welfare and public service; be it

Resolved, That the International Association of Dairy and Milk Inspectors spread upon its records its belief that the science of milk inspection has suffered a distinct loss; and be it further

Resolved, That this Association dedicate a page in its records to his memory, and that his picture be placed therein; and be it further

Resolved, That a copy of these resolutions be forwarded to his family.

WHEREAS, This Association has been enlightened and benefited by contributions of papers by friends of our organization; therefore be it

Resolved, That the International Association of Dairy and Milk Inspectors express its appreciation and thanks to those friends, not members, who have contributed to our program.

Resolved, That this Association express its thanks to Hon. Watkins Overton and other officials for hospitality extended to us while in Memphis.

IN MEMORY OF IVAN C. WELD

WILLIAM H. PRICE

Prof. Ivan C. Weld, widely known for his contributions to civic betterment and the advancement of the dairy industry, died on March 15, 1929, at the Montgomery County General Hospital, Sandy Springs, Md. He had been ill less than a week, and had enjoyed his usual robust health up to the time of his final illness. An attack of influenza was complicated by a blood infection so virulent that heroic measures such as blood transfusions were of no avail. His funeral was largely attended by a host of friends and the civic organizations of Washington. This Association was represented by Past-president Ernest Kelly, First Vice-president Ralph E. Irwin, and Mr. C. Sidney Leete.

Professor Weld was connected for many years with the Chestnut Farms Dairy of Washington, D. C. At the time of his death he was serving his second term as President of the Washington Chamber of Commerce. He was Secretary-Treasurer of the International Association of Dairy and Milk Inspectors from the time of its organization. He was a member of the American Dairy Science Association, the Kiwanis Club, the Washington City Club, the Masonic fraternity, and the Congregational Church. He is survived by his widow, Mrs. Lena R. Weld and a daughter and a son.

Professor Weld was fifty-six years old. He was a native of Cornish, New Hampshire, and descended through a long line of New England stock from pioneers who had settled in that section in the early part of the seventeenth century. He was born and brought up on a farm, and it was there that he became thoroughly grounded in the first principles of practical dairying.

His association with the local Grange, as a member and later as Master, marked the beginning of a lifetime of generous co-operation with all with whom he came in contact. He concentrated on the practical problems of dairying with a firmness of purpose well known in later life, was a consistent winner in local and state exhibits and contests of dairy products, and was called to the chair of Dairy Husbandry at the New Hampshire College of Agriculture. His success as an instructor and developer of principles and men at that institution laid the foundations for his national activities and fame.

In 1906, Professor Weld entered the service of the Dairy Division of the United States Department of Agriculture. In company with the late Doctor Whitaker and the late Professor C. B. Lane, both former members of this Association and well known to our older members, he formulated the original Score Cards for Dairy Farms and Market Milk Contests used by the National Dairy Division, and traveled widely on request throughout the country introducing the systems of milk betterment which those cards contemplated and summarized. It was while acting in that capacity that Professor Weld participated with Whitaker, Lane, Steffens, Henderson, Jordan and others in the organization of the International Association of Dairy and Milk Inspectors.

In 1910, Professor Weld resigned his position with the Government and associated himself with the late Mr. George M. Oyster, Jr., of Washington, who had organized the Chestnut Farms Dairy some fourteen years before and built it by slow degrees on the firm basis of quality in milk and milk products. Mr. Oyster held very advanced views, for that time, of the responsibility of the city milk dealer to the public. He was prepared to support with all his resources the theory of clean and perfectly safeguarded milk, and to that end he installed the most modern dairy equipment and sought the services of Professor Weld to develop a model and practical system of country production and of city laboratory control.

To Professor Weld, this meant an opportunity for the fulfillment of his ideals in quality milk production and processing on a large scale. His practical experience with both men and methods, his tact and kindliness, patience, thoroughness, and tenacity of purpose were built into the Oyster enterprise, which prospered and has come to be known as the model institution of its kind.

The whole world is indebted to Professor Weld for his direction, also with Mr. Oyster's support, of those studies on the relative nutritive values of pasteurized milk as compared with raw milk produced under the most exemplary conditions. These are the classical studies of the subject. They confirmed the at least equal utility of pasteurized milk. The published report ran through several editions and into hundreds of thousands of copies.

In the summer of 1928, at the invitation and with the financing of the German Government, Professor Weld served as a member of a commission of ten American dairy experts who toured Germany for three months and made an exhaustive study of the possibilities and requirements of the dairy industry in that country.

Few of us of the dairy industry realized the extent of the activities of importance carried on by Professor Weld in the civic affairs of his home city. He had but recently been elected by unanimous vote to his second term as president of the Washington Chamber of Commerce. Previously he had served as Vice-president, and as chairman of the committees on national representation, on municipal finance and taxation, and on membership. Out of our own experience with him we realize the quality of the service he put into those activities.

Professor Weld's contributions to the dairy industry were of the first order of their kind and of a permanent and continuing nature. It is but natural that we of this Association should think of him as particularly ours. As first and continuing secretary he came into intimate contact with every individual member. His compilations of our Annual Reports have been eagerly sought by colleges, libraries, and individuals, interested in the betterment of milk supplies. The influence of his high character has been carried by these contacts the length and breadth of the land. He was the soul of this organization. It is useless for me to attempt to voice our regard which approaches reverence for Ivan C. Weld. How we can get along without him we do not know; but it would be his wish that we should carry on. We are fortunate to have had him; we appreciated him while we had him. He will always be with us, and continue to influence us, with his infinite wisdom, and generosity, and love without end.

MR. ERNEST KELLEY: Friends of the Association, we stand under a shadow at this meeting without the presence of one who was instrumental in organizing and successfully carrying on the work of this Association, and yet not under a shadow, but more in a reflected light of the setting sun of his presence.

Years ago, it stands out very vividly in my mind, I was going through one of the old cemeteries in Boston. It seems that the sea-faring folks up in New England had a great many traditions. One of them was that the pelican, if food were scarce, would pierce her own breast and feed her young with her own blood. There was a tomb stone at the burial place of a woman with this inscription: "Pelican like, she cheerfully gave her blood and fed her children." To Mr. Weld, we owe in a large part, the success of this organization. He was a man who expended much effort and time to better us. This Association is the child of his brain.

Those of us who really knew him have grief so deep that it can not be expressed in words. We are here to catch up from his hands the flaming torch of knowledge and carry it back to our communities, beyond state lines, beyond national boundaries; to take up the work which he so dearly loved and to carry it on with all the industry we can and in that way we can carry on the memory of one who loved us and one whom we loved, Ivan C. Weld.

HORATIO N. PARKER: My remarks must be brief. I well remember the first time I met Dr. Weld. I was teaching at the University of Illinois and at that time the Association met in Milwaukee. There was a man on the program who could not appear and I was asked to take his place. I did not know them and they did not know me but as soon as I stepped into the room, Mr. Weld stepped forward and greeted me in such a hearty way that I knew there was a man of honor and that I was in a crowd of men with whom I might be proud to be associated.

I feel that this Association is one of the best of those to which I belong and I believe that it is because the Association has high standards. That it has high standards is due to Dr. Weld. He insisted upon everyone connected with the Association standing for something. The chief thing he did was to insist that those who were not milk inspectors be kept out of the Association. They were welcome to the meetings but in the governing of the society and the running of its business, only the milk inspectors were included. The next thing he did was to insist on a high standard for membership. No man who makes application for membership in this Association is rushed in. Time is taken to look him up and find out that he is what he claims to be. That has been a good thing for the Association and it is a good thing for the man who makes application and for the members, because if you are a member of the society, if applicants are examined closely everybody knows it and you benefit accordingly.

Dr. Weld had his ideas in relation of the Association to the commercial man. They have contributed a great deal to the success of our organization but at no time were they permitted to take the reins from the hands of the inspectors and do the driving.

It takes a man to do these things and Dr. Weld was a man and we are going to miss him. The only way we can keep the Association up to Dr. Weld's standard is to stand shoulder to shoulder and to work as a uniform body. We have been working in a rather limited area but still it has been an association that is rather limited to the northeast. The time has come for it to grow and it has got to grow properly. It is up to us to project this international society all over the country. How it is best to be done remains to be determined.

Here we are in this southland meeting for the first time and I think it is a good omen. I think it is what Dr. Weld desired. I sincerely hope that Southerners will come forward and build up this Association and then carry it west and southwest. If we can do that, we will be worthy of our leader's praise, Dr. Ivan C. Weld.

PROGRAM

MONDAY, OCTOBER 7

11.00 A.M.

Address of Welcome

HON. WATKINS OVERTON
Mayor of Memphis

Response to Address of Welcome

MR. RALPH E. IRWIN
First Vice-president, International Association of Dairy and Milk Inspectors

Presidential Address

HOWARD R. ESTES
President, International Association of Dairy and Milk Inspectors

MONDAY, OCTOBER 7

2.00 P.M.

Paper

"Fundamentals of Dairy Inspection"
PROF. A. D. BURKE
Department of Dairying, Alabama Polytechnic Institute, Auburn, Alabama

Report of Committee on Score Cards and the Score Card System of Rating Dairies and Dairy Products

MR. C. SIDNEY LEETE
Bureau of Dairy Industry, U. S. Department of Agriculture, Washington, D. C., *Chairman*

Paper

"Chicago's Program for Securing a Satisfactory Quality of Raw Milk for Pasteurization"
MR. PAUL F. KRUEGER
Assistant Director, Bureau of Dairy Products, Department of Health, Chicago, Illinois.

Report of Committee on Dairy Farm Methods

MR. THOMAS J. STRAUCH
Chief Dairy Inspector, Bureau of Health, Richmond, Virginia *Chairman*

Report of Committee on Dairy and Milk Plant Equipment

MR. GEORGE W. PUTNAM
1243 West Washington Blvd., Chicago, Illinois, *Chairman*

MONDAY, OCTOBER 7

8.00 P.M.

Paper

"Milk Plant Design and Equipment"
MR. G. E. MATTER
The Pfaudler Company, Rochester, N. Y.

Paper

"The Sediment Test for Visible Dirt in Milk—Its History"
MR. F. LEE MICKLE
Director of Laboratories, State Department of Health, Hartford, Connecticut

Report of Committee on Milk Plant Practice

DR. H. A. HARDING
Mathews Industries, Inc., Detroit, Michigan, *Chairman*

Paper

"Developing Effective Milk Supervision in a Small Oregon Municipality"
MR. J. E. BLINKHORN
Chief Milk Inspector, Salem, Oregon

Report of Committee on Methods of Bacterial Analysis of Milk and Milk Products

DR. GEORGE E. BOLLING
Director of Laboratory and Inspector of Milk, Brockton, Mass., *Chairman*

Report of Committee on Educational Aspects of Dairy and Milk Inspection

JAMES D. BREW
Professor of Dairy Extension, Cornell University, Ithaca, New York, *Chairman*

TUESDAY, OCTOBER 8

10.00 A.M.

Paper

"Effect of Holding Milk at Low Temperatures on Bacterial Plate Count"
MR. RUSSELL R. PALMER
Chief Milk Inspector, Department of Health, Detroit,
and
MR. E. T. MCCUTCHEON
Bacteriologist, Department of Health, Detroit, Mich.

Report of Committee on Food Value of Milk and Milk Products

PROF. IRA V. HISCOCK
Assistant Professor of Public Health, School of Medicine, Yale University, New Haven, Connecticut, *Chairman*

Report of Committee on Serving Milk in Schools, Factories, and Office Buildings

MR. M. O. MAUGHAN
Executive Secretary, The Milk Council, Inc., Builders' Building, Chicago, Illinois. *Chairman*

Paper

"The Pitfalls Connected with Dairy and Milk Inspection"
DR. W. G. HOLLINGWORTH
City Veterinarian, Utica, New York.

Paper

"'Safety First' in Milk Sanitation."
DR. PAUL B. BROOKS
Deputy Commissioner, State Department of Health, Albany, New York.

Report of Committee on Dry Milk

DR. HORATIO N. PARKER
City Bacteriologist, Health Department, Jacksonville, Florida, *Chairman*

The First Spray Dried Milk

R. M. WASHBURN

TUESDAY, OCTOBER 8

2.00 P.M.

Paper

"Possibilities of 'Certified Milk' in Memphis"
DR. GILBERT J. LEVY
Chairman of Shelby County Medical Milk Commission, Memphis, Tennessee

Paper

"Progress in the Control of the Production of Certified Milk"
DR. C. I. CORBIN
Sheffield Farms Company, Inc., New York City

Paper

"Laboratory Control of Certified Milk at the Source"
DR. J. G. HARDENBERGH
Director of Laboratories, Walker-Gordon Laboratories, Plainsboro, New Jersey

Report of Committee on Bovine Diseases—Their Relation to the Milk Supply and to the Public Health

DR. A. R. B. RICHMOND
Director, Division of Food Control, Department of Public Health, Toronto, Ontario.

Paper

"San Francisco's Milk Supply and Its Problems"
DR. ALEXANDER F. EAGLE
Dairy Veterinarian, San Francisco, California

TUESDAY, OCTOBER 8

5.00 P.M.

Business Session

TUESDAY, OCTOBER 8

8.00 P.M.

Paper

"Proper Application of Direct Ammonia Refrigeration to Milk Cooling Equipment"
MR. W. L. HUTTON
St. Louis, Manager, Western Division, York Ice Machinery Corporation, York, Penn.

Paper

"Import Milk Control"
MR. H. B. SWITZER
Chief of the Rouses Point Inspection of the Food, Drug and Insecticide Administration, U. S. Department of Agriculture

Paper

"Legal Phases of Milk Control"
DR. JAMES A. TOBEY
Director, Health Service, The Borden Company, 350 Madison Ave., New York City

Report of Committee on the Sanitary Control of Ice Cream

RALPH E. IRWIN

Chief Division of Milk Control, State Department of Health, Harrisburg, Penn., *Chairman*

WEDNESDAY, OCTOBER 9

10.00 A.M.

Report of Committee on Milk Ordinances

MR. WILLIAM B. PALMER

Executive Officer, Milk Association of the Oranges, New Jersey, City Hall, Orange, New Jersey, *Chairman*

Paper

"Using the Direct Count to Improve Philadelphia's Milk Supply."

MR. FLOYD R. EALY

Quality Control Department, Philadelphia Inter-State Dairy Council, 219 N. Broad Street, Philadelphia, Penna.

Paper

"The Use of the Methylene Blue Test in Alabama as a Basis for Classification of Milk Supplies for Manufacturing Purposes"

MR. J. W. GARRETT and MR. F. H. DOWNS, JR.

District Milk Inspectors, Bureau of Inspection, State Board of Health, Montgomery, Alabama

Paper

"Local Milk Control."

DR. L. M. GRAVES

Superintendent of Health, Memphis, Tennessee

Announcement Concerning Plans for Wednesday Afternoon

WEDNESDAY, OCTOBER 9

2.00 P.M.

A Study of Milk Control in Memphis by Visiting Points of Interest

WEDNESDAY, OCTOBER 9

8.00 P.M.

Paper

"Co-ordinating Municipal Meat and Milk Inspection in Alabama Communities"

MR. H. J. THRASHER

Assistant Director, Bureau of Inspection, State Board of Health, Montgomery, Alabama

Report of Committee on Communicable Diseases Affecting Man

DR. HORATIO N. PARKER

City Bacteriologist, Health Department, Jacksonville, Florida, *Chairman*

Paper

"The Relation of Udder Infection to Human Health"

DR. F. D. HOLFORD

Chief Veterinarian, Borden's Farm Products Company, Inc., 110 Hudson Street, New York City

Monday, October 7
11.00 A.M.

ADDRESS OF WELCOME

MAYOR WATKINS OVERTON

Memphis, Tenn.

The trouble I have when introducing myself as Mayor is that half the people don't think I am the Mayor. They expect some fat, rotund gentleman.

A lot of people come down here and expect the Mayor to give them the keys to Memphis but, people, we don't have any keys to this city of ours. The doors are open and we are glad to have you come in and stay as long as you want to. You can't welcome anybody with a lot of words. We want to welcome you by our smile and the shake of your hand. We appreciate the fact that you have come down South and are holding your convention in Memphis—"Down in Dixie."

We have a lot of fine dairy herds in and around Memphis and we want you to look us over and see what we have.

Everybody thinks that all business men close their stores at noon and sit out in front with a palm leaf fan and drink mint juleps but we really don't do that at all. We do a lot of work and we work hard, too.

As you see Memphis, I think it will mean more to you. When this city was being established here on the bluffs of the Mississippi, it was looked upon as a place which could be inhabited by Indians but the white people overcame the Indians; they overcame the yellow fever; and they have had to overcome having their territory swept with terrible floods every year. I do not believe that any people in the country have been taxed more and have overcome more difficulties than the people who built Memphis. It has its defects. Milk is not the worst thing we have to deal with down here in the way of beverages, but we are doing the best we can to build an American city.

My idea of a convention covers two things, each of these counting fifty per cent. One is real association, a good time and fellowship. I think that is one of the greatest things in a convention and I hope that you won't hold up that fifty per cent. Of course, the other thing is gaining new ideas and a new vision of the great work in which you are engaged.

I want to say that I attend some conventions because it is a duty but I am really glad to be here. I say that frankly and I mean it. The work that a health department is doing in this line of work, while it does not have a lot of publicity, is an honest work and can be looked back upon with pride and with the thought that you have done your part in giving health and happiness to children, women and men, and that you have helped to give them a better opportunity under which to live. Memphis, frankly, is proud of its health department. We have much to do. There is always much to do. When they came to me with the Standard Milk Ordinance, I thought we would have an awful fight but those men stuck with me and they were able to sell the idea to the dairymen of this community, and to this day not a protest has come to the Mayor's office. The credit does not go to the Administration. The real credit goes to Dr. Haskell, Dr. Graves and Dr. Bishop. I want to say that they deserve credit because they did not hurt our milk supply. They went to the dairymen with a business proposition; presented it to them with tact and determination; and put over a remarkable program which has resulted in raising our standards and giving us a good milk supply with no damage to the milk industry.

In looking over our little city, if you find anything bad, we would appreciate your telling us and if you find anything good, we would appreciate your telling someone else.

I congratulate you men for the progress you have made in the great work which you are doing. I know that you have to do a lot of hard work without much pay but the greatest credit that comes to any man is to know that he is doing something worthwhile.

Memphis is proud to have you here and we hope you will not fail to call on us if you need help in any way.

RESPONSE TO ADDRESS OF WELCOME

RALPH E. IRWIN, *First Vice-President*

Harrisburg, Pa.

The International Association of Dairy and Milk Inspectors has held seventeen annual conventions in eleven cities; namely, Springfield, Massachusetts, New York City, Philadelphia, Washington, Detroit, Chicago, St. Paul, Milwaukee, Indianapolis, St. Louis and Toronto, and in no place have we received more hearty welcome than here in Memphis today. We feel already, on the first day of our Convention, the beauty and warmth of southern skies, the gracious welcome and traditional hospitality for which Dixie is noted, and a sympathetic understanding of the purpose for which we gather as an International Organization.

You Honored Sir, as Mayor of Memphis, have shown that you are a worthy representative of the milk consumers of this city. In your words of welcome you have indicated that you appreciate the fact that the health and happiness of your people depend in no small degree on the quality of the milk and milk products distributed within your municipality.

Reports from all parts of the country announce an increase in the use of milk and milk products. This, we believe, is a reasonable result of our efforts to secure a safe, clean, sweet and rich milk at a fair price to all concerned. Increased consumption makes efficient supervision a civic duty. Untrained, inexperienced inspectors are expensive at any price. On coming here we are encouraged when we learn that those in charge of municipal expenditures appreciate the value of school training and field experience and are willing to provide adequate compensation. May not this be the result of a proper guidance of public opinion on your part as a representative of your community? In school we are taught that the aim of the public health official is to "Render growth more perfect, decay less rapid, death more remote and life more vigorous and successful." To accomplish this aim it is necessary that public sentiment precede, or at least follow closely the laws and expenditure necessary. We are often reminded that, "Public sentiment is everything. With public sentiment, nothing can fail; without it, nothing can succeed. They who mold public sentiment go deeper than they who enact legislation or pronounce decrees."

Our coming here was preceded and in fact determined by invitations from over sixty health officials and a host of individuals interested in our Association. We come not as missionaries, but rather as pupils ready to learn from our southern brethren, and to form a friendship for mutual development.

The one who has largely guided our destiny in the past, is gone. We shall endeavor to honor his memory in the further development of our International Organization, seeking to reveal the treasures of science, the blessings of rational living and the satisfaction of service well rendered.

The papers and reports presented here will be published in a volume going to every part of the world. Those considering milk control or interested in the development of laws and personnel connected therewith, look to us for guidance. May our deliberation here meet their needs. Nor should we forget our debt to our foster mother, the Dairy Cow, that has given her freedom of plains and woodlands for those who need her in the pursuit of their own health and happiness.

PRESIDENTIAL ADDRESS

HOWARD R. ESTES, *President*
International Association of Dairy and Milk Inspectors

For the eighteenth year in succession, the members and friends of the International Association of Dairy and Milk Inspectors have seen fit to meet in convention to further the object of the Association which is, as stated in the constitution, "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."

If these meetings served only to broaden the minds of those who have attended them in the past they have been well worth while. But we know that much more has been accomplished. We have, year after year, seen members and non-members return to their regular duties enthused with the contacts which they have made and the thoughts which they have heard expressed.

We know that as a result of the existence of this organization for the past seventeen years, human health and happiness have been more prevalent throughout this and many other nations, for our organization knows no boundary lines. Its influence is felt, either directly or indirectly, wherever dairy products are consumed.

These thoughts are uttered in no spirit of idle boasting. We should realize that this influence should be even more prevalent, and I would have you consider this thought briefly.

We should, and I believe we can, give the records and papers of these annual meetings a much wider circulation. Relatively speaking, only a limited percentage of those persons who are interested in dairy improvement attend these meetings. Distance, cost, time and other factors tend to limit attendance. But, as Mohammed stated, if the mountain won't come to Mohammed, Mohammed will go to the mountain. So should we, I believe, attempt to carry our message. One of our members who has never been able to attend a meeting in person has stated that "within its scope as a milk improvement agency, nothing surpasses our annual reports." I believe his statement is correct. Such being the case every library in English speaking countries should contain copies of our annual reports. And these should not be left to collect dust upon the shelves.

There exist, in this country alone, many cities where only a minimum of milk improvement work has been done. Most of these places have libraries. If the latest information on milk improvement such as is contained in our reports was available in these libraries, and word to that effect was circulated, the good influence of the Association would be felt more than it is at present. The following suggestions are offered to help bring this about:

First. Every member here present should see that his home town library has a copy of the annual report every year. Libraries have funds for such acquisitions. Such funds could be used to no better advantage.

Second. Our members should see that local milk companies know of the availability of these annual reports. The reports are for sale to private individuals and organizations at the usual reasonable charge.

Third. Colleges and scientific schools and high schools should have the information contained in these reports available to their students. It is my belief that if this suggestion were made to the proper authorities of these institutions they would be glad to order copies. Our members should approach these authorities. We will endeavor to make such efforts convenient.

During the past year your president has been privileged to represent the Association at meetings of the Pennsylvania and Massachusetts State Milk Inspectors' Associations. I return to you from them with most cordial greetings and wishes. During the past year it has been my privilege to attend, as a representative of the Association, a joint meeting of the committees on the Sanitary Control of Ice Cream of the International Ice Cream Manufacturers Association and the International Association of Dairy and Milk Inspectors. The results of this meeting were most gratifying. Good will and a broad-minded interpretation of the problems of the other fellow have more firmly cemented the friendship which has existed between the two organizations. The concrete results of the work of these committees will be given in detail during this meeting.

The assistance of the Association has been offered to the White House Conference on Child Health and Protection and has been gratefully accepted. It is certain that many of our members, as individuals and our Association as a unit, will be called upon and will render much help in this most worthy effort.

An instance of undoubtedly well intended, but unfortunately deplorably worded publicity in connection with milk consumption has recently been noted. Every startling headline and every printed line of unfortunate publicity of this nature is a destructive force which time and great effort only can eliminate. The truth is the aim of every sincere scientist but the truth may and should be printed in a constructive manner whenever it is possible.

The membership of this organization, due to the wisdom of its founders, is composed of individuals who look upon dairy problems from different points of view, but who are united in the common thought of better and more dairy products to an ever increasing number of consumers. We should always bear in mind the fact that in our work no problem has only one method of solution. This Association has cherished and held the respect of various associated interests far and wide because of its broad and balanced interpretations of the problems which it has endeavored to solve. During our deliberations now and in the future we should endeavor to maintain our liberal attitude so that the weight of our conclusions may never be diminished in the minds of those who look to us as a unit for guidance.

The passing of Ivan C. Weld has removed from our midst the father of this Association. For seventeen years his spirit of kindness and his unerring wisdom have helped to mould the thoughts and actions of this membership. Expressions of our great loss have continued to come. We have increasingly seen revealed, evidences of the effort and devotion which Mr. Weld has contributed to the Association. To know Ivan Weld was to respect him. His life has been and will continue to be an inspiration to all of us. Before the close of this meeting a tribute in keeping with the respect in which he is held will be formulated.

Never has an annual meeting of this organization closed but that many constructive contributions have been brought into existence. I would direct your thought for a moment to a problem which continues to exist as such, and which is prevalent throughout the domains which contribute to our membership, namely the milk supply of the smaller cities and towns. Such improvement has been evidenced in the milk supplies of the larger cities that the contrast with the supplies of smaller communities is the more marked. No individual formula will ever be devised which is applicable to the entire situation as a remedy. Careful, deliberate thought has been and must continue to be directed toward the solution of this problem. It is desirable that more attention be given to it than is in evidence at the present time. To further that end I would, with your permission, formulate a new committee whose sole aim would be directed toward the solution of this problem. I know of no group from which to select such a committee whose members are better fitted to direct the thoughts along these lines, than our own.

Former meetings of this Association have always been marked with broad vision and thought. A glance at the program indicates that this meeting will be no exception. Members who will contribute to it come from Canada in the far north, from Florida in the far south, from states bordered by the Atlantic and from states washed by the Pacific. Ideas generated in these widely scattered areas are poured into the melting pot at this convention; digested, moulded and crystallized by the discussion of all, to issue forth as products which materially aid in promoting the health and happiness of thousands who look in this direction for guidance.

Monday, October 7
2.00 P.M.

FUNDAMENTALS OF DAIRY INSPECTION

PROF. A. D. BURKE, *Head of Dairy Department,*
Alabama Polytechnic Institute

Successful dairy inspection is the outgrowth of necessity—the direct result of a demand for safe milk. We think of it as a rather recent innovation—a child of the past thirty years—but history tells us that as early as the thirteenth century certain standards for dairy products were adopted in parts of Europe. Even then it was a crime to adulterate milk and thus it has been ever since.

But why dwell on antiquity. We must keep abreast of the times and in these days speed seems to be the watchword. The old adages of "make haste slowly" and "look before you leap" have as certainly been replaced by the more or less futuristic—"he who hesitates is lost." Where once we were hesitant in establishing milk inspection systems now public opinion and thorough specialization have demanded and permitted prompt action. Thus we are often brought up squarely with the problem of establishing effective inspection within an almost inconceivably short period. That such can be done has been amply demonstrated by the cities of Birmingham, Alabama, and Tulsa, Oklahoma, where most excellent and successful operative plans were installed within a comparatively short time.

What makes this possible? There must be a background; a foundation on which to work—to build—and that foundation as I see it, is established around

1 A capable inspector
2 A well equipped laboratory
3 Adequate financial support
4 A sympathetic populace

5 A reasonable ordinance
6 Cooperation on the part of the producers
7 Eternal vigilance on the part of those engaged in the work
8 Unification of ideas.

The dairy inspector is a guardian of public health. It is his duty to prevent rather than correct the outbreak and spread of disease through dairy products but once an outbreak occurs, then correction becomes all the more important and the value of any inspector to his community depends upon his ability to control both problems. Seldom does the consumer consider these points seriously. His attitude is well expressed in the following paragraph taken from the still classical work, "The Milk Question" by Dr. Rosenau. He says

> It is much more theatrical to cure a disease than to prevent its occurrence. To stamp out an epidemic seems to some flamboyant minds a more notable achievement than to prevent its occurrence. When disease is prevented, nothing happens. There is a lack of action. There is nothing to fill the eye, but the ounce of prevention is still worth much more than the proverbial pound of cure. It is so with milk. Good, clean, safe milk gratifies the palate, satisfies thirst and hunger, and produces no untoward effects. Infected milk may cause disease and death a week, a month, even a year or more afterwards. The connection is not clear to persons who have not given the matter careful consideration, and is therefore shrouded in mystery and no little skepticism.

Since an inspector must control both problems of correction and of prevention he must be a superior type of man for only as such will he succeed. In this way the inspector is peculiar,—peculiar in a sense that he must be a composite of all those attributes that combine to make the superior type of man I mention. You as members of this organization have admitted as much for did you not say in a recent report that an inspector must meet on equal footing representatives of almost every profession—he must speak the language of the farm, the city, the school, the courts and so on to near infinity.

He must be conscious of the task before him, honest, tactful, persevering, punctilious, impartial and progressive.

Then there is the presence or absence of courtesy that brands one either a gentleman or a prude and the moral character that should at least characterize the guardian of public health and infant welfare. Little more could be asked except that one possess common sense and be fundamentally trained for his work.

You say I have sought out an angel! I have but given you the predetermined characteristics of that man heading a successful dairy inspection system in any community.

The Man for the Position

Who is this man? Veterinarian or dairyman—which? Three years ago I gave you my answer. Times have changed—dairy inspection has changed—is continually changing. My views are altered. With the present increased interest in dairying, in health, in newly discovered transmissible diseases, in processing dairy products,—it becomes almost a necessity that the inspector of the future be at once a combination veterinarian—dairyman, thoroughly grounded in bacteriology, chemistry and certain engineering technique.

Specialization may lead us to that consideration in the future preparation of college curricula and the training of the inspector—for the inspector is no longer a civil officer. His place is not to make arrests; not to antagonize with unjust demands but rather to act in an advisory capacity for those whom he must serve and for those to whom he is directly responsible. To use a common phrase—the inspector must "know his stuff." He, above all, even more than the county agent is the community specialist on dairying.

Essentials for Success in Dairy Inspection

Education, then, is the foundation on which effective inspection rests. The inspector who teaches his community why certain requirements are necessary and not simply that they are; who assists dairymen in overcoming difficulties and is not too proud to don overalls—as some of us have done—to verify a questionable point—will be rewarded by substantial results in his work.

As some one has said, a successful inspector educates the ignorant, eliminates the dishonest and protects the progressive.

Indications of Successful Inspection System

When these things are accomplished, we may expect to find a healthy community with a low infant mortality and an effective control of bovine and human diseases that may be spread through milk.

Advantages of Inspection

Four parties contribute directly to a successful inspection system—the inspector, the producer, the dealer and the consumer. Each plays his part in the order named and success comes only when each has received his allotment of benefits and the community as a whole is given safe milk; is protected against unfair practices; and continues to advance in its dairy program, for each community must have a program else the whole inspection system stagnates.

Disadvantages of Inspection

I have seen this occur and when it comes the result is more far reaching than the stagnation due to changes of personnel. The one may be permanent because it means the lethargy of disinterest—the latter is more or less temporary and may be rectified if the right man steps in. Even then certain hindrances may arise. You know them as well as I—low salaries; poor equipment; public service in all kinds of weather; interference of politics; public criticism; and a new one recently brought to my attention through one of my surveys—the attitude of the farmers themselves. One might assume that such were possible but hardly probable for unmistakably the real trouble as with each of those mentioned, especially the latter, is due to misunderstanding of the real value of milk inspection and the purpose of an inspector in a community.

And now I have brought you face to face with the college professor's problem. There is but one. To teach the fundamentals of dairy inspection and send out the kind of men pictured above. Have we a problem? I leave that for you to decide.

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

Mr. C. Sidney Leete, *Chairman*

During the past year there has been made available a revised score card for the scoring of milk and cream. This card finds its greatest use in connection with various milk and cream contests. These contests may be used to advantage in milk-improvement programs and also as a part of the regular inspection systems. Milk and cream contests have proven to be of great assistance in improving milk supplies in many western cities. This method of education and control has been in successful operation for about 15 years and is in use in many of the principal cities of California, Oregon, Washington, Idaho, Montana, Wyoming, Nevada, Utah, and Colorado. In connection with this work a score card for judging milk and cream is employed. This card takes into consideration such factors as bacterial count, sediment, flavor and odor, acidity, temperature, package, fat, and solids-not-fat. There were several factors appearing on the old card to which widespread exception was taken in the method of scoring. It was argued that there were no available data as to the exact percentage of fat and solids-not-fat at which milk becomes "perfect." A careful study of these criticisms was made by the United States Department of Agriculture Bureau of Dairy Industry and as a result a revised milk and cream card has been drawn up.

The new or revised card contains the provision that all milk and cream which fails to comply with the legal standard for fat, solids-not-fat, and bacteria shall be barred from competition. The 30 points previously allotted to fat and solids-not-fat were distributed to other factors, which have a bearing on strictly sanitary features.

UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF DAIRY INDUSTRY

SCORE CARD FOR MILK AND CREAM

(APPROVED BY THE AMERICAN DAIRY SCIENCE ASSOCIATION)

Place ....

Class .... *Exhibit No*......................

	Perfect Score	Score Allowed	Remarks
Bacteria ________	45	______	Bacteria found per cubic centimeter ______
Flavor and odor______	25	______	Cowy, bitter, feed, flat, strong, cooked ______
Sediment ________	10	______	________________
Temperature, (street samples) ______ *or* Acidity, (prepared samples) ______	15	______	Degrees ______ *or* Per cent ______
Bottle and cap______	5	______	Bottle ______ Cap ______
Total	100	....	

Exhibitor ....

Address ....

(Signed) ....

....

....

Judges

Date ....

DIRECTIONS FOR SCORING

BACTERIA PER CUBIC CENTIMETER—PERFECT SCORE, 45

	Points		Points
500 and under	45.0	18,001- 19,000	40.0
501- 1,000	44.9	19,001- 20,000	39.6
1,001- 1,500	44.8	20,001- 21,000	39.1
1,501- 2,000	44.7	21,001- 22,000	38.6
2,001- 2,500	44.6	22,001- 23,000	38.1
2,501- 3,000	44.5	23,001- 24,000	37.6
3,001- 3,500	44.4	24,001- 25,000	37.1
3,501- 4,000	44.3	25,001- 30,000	36.1
4,001- 4,500	44.2	30,001- 35,000	35.1
4,501- 5,000	44.1	35,001- 40,000	34.1
5,001- 6,000	43.9	40,001- 45,000	33.1
6,001- 7,000	43.7	45,001- 50,000	32.1
7,001- 8,000	43.5	50,001- 55,000	30.1
8,001- 9,000	43.3	55,001- 60,000	28.1
9,001-10,000	43.1	60,001- 65,000	26.1
10,001-11,000	42.8	65,001- 70,000	23.1
11,001-12,000	42.5	70,001- 75,000	20.1
12,001-13,000	42.2	75,001- 80,000	17.1
13,001-14,000	41.9	80,001- 85,000	13.1
14,001-15,000	41.6	85,001- 90,000	9.1
15,001-16,000	41.2	90,001- 95,000	5.1
16,001-17,000	40.8	95,001-100,000	1.1
17,001-18,000	40.4	Over 100,000	0

FLAVOR AND ODOR—PERFECT SCORE, 25

Deduct for disagreeable or foreign odor or flavor according to conditions found. When possible to recognize the cause, describe it under "Remarks."

SEDIMENT—PERFECT SCORE, 10

Examination for sediment may be made by means of a sediment tester, and the resulting cotton disks compared with standards; or the sediment may be determined by examination of the bottom of the milk or cream in the bottle. In the latter case allow the milk or cream to stand undisturbed for at least an hour before the examination. Raise the bottle carefully in its natural upright position until higher than the head. Tip slightly and observe the bottom of the milk or cream with the naked eye or with the aid of a reading glass. The presence of the slightest movable speck makes a perfect score impossible. Make further deductions according to the quantity of sediment found. When possible describe the nature of the sediment under "Remarks."

TEMPERATURE (STREET SAMPLES)—PERFECT SCORE, 15

°F.	Points	°F.	Points
40 and below	15.0	51	11.0
41	14.8	52	10.0
42	14.6	53	9.0
43	14.4	54	8.0
44	14.2	55	7.0
45	14.0	56	6.0
46	13.6	57	5.0
47	13.2	58	3.0
48	12.8	59	1.0
49	12.4	60 and over	0
50	12.0		

—OR—

ACIDITY (PREPARED SAMPLES)—PERFECT SCORE, 15

	Points		Points
0.18 per cent and less	15	0.22 per cent	5
0.19 per cent	14	0.23 per cent	1
0.20 per cent	12	Over 0.23 per cent	0
0.21 per cent	9		

BOTTLE AND CAP—PERFECT SCORE, 5

Make deductions in score for dirty or chipped bottle; and for caps which do not cover the lips of the bottles, or do not fit properly in the cap seats.

NOTE.—Any sample failing to comply with the legal standard for bacteria, fat, or solids not fat, shall be barred from competition.

The committee suggests that members interested in score cards and scoring methods send to members of this committee suggestions as to changes which they believe are needed in any of the score cards now in general use. If a sufficient number of different cards are placed in the committee's hands, it is believed that a comprehensive review and report of this subject could be submitted at our next meeting.

CHICAGO'S PROGRAM FOR SECURING A SATISFACTORY QUALITY OF RAW MILK FOR PASTEURIZATION

PAUL F. KRUEGER, *Assistant Director*

Bureau of Dairy Products, Chicago Department of Health

Pasteurization is the milk sanitarian's greatest weapon in insuring a safe supply of milk, but a good quality of raw milk is essential in any plan for proper milk control, forming as it does, a factor of safety in addition to pasteurizaton.

Pasteurization will not make milk of good quality from poor quality milk, and safety, extremely important as it is, is only one factor entering into milk quality.

A good quality of raw milk is produced from healthy cows, and is handled by healthy workers on farms properly constructed and operated for handling the milk in a sanitary manner. The milk itself is clean, unaltered in composition as produced by the cow, free from bad odors and flavors, is of normal appearance, and is free from excessive numbers of bacteria and germs of harmful character.

Chicago's first milk pasteurization ordinance was passed in 1908, and compulsory pasteurization was put into effect in 1916 but before this, viz., since 1904, Chicago has inspected the sanitary conditions of the farms on which its milk is produced, and the country stations in which milk is received.

This work is done by a field organization of 39 men, under the direction of supervisors; 33 of these men spend their entire time visiting farms, and 6 men visit the country receiving, and pasteurizing plants.

All farms producing milk for Chicago are required to meet the same standards and are visited regularly by our dairy inspectors, at which time a score card rating is given to insure compliance with the Department's twenty dairy requirements essential for the production of clean milk with low bacteria count and satisfactory keeping quality. These requirements are printed on the reverse side of the copy of the score card given to the producer at the time of the visit, and relate to the health and cleanliness of the cows, construction and cleanliness of the barn and milk house, care and sterilization of milk containers and utensils, and proper milk handling methods.

Orders necessary for improving farm conditions are given verbally, and like written orders are sent by the Department to both farm owners and tenants, a time limit being granted for compliance with them. A reinspection is made following the initial inspection, and if the farm has not met the major requirements, the product is barred from the market.

During the year 1928, a total of 55,983 individual farm visits were made, and 74,229 notices were issued to producers for the improvement of their farm equipment, and methods. During the first eight months of 1929 a total of 34,849 farm inspections were made, and 75,291 notices were issued.

The necessity for farm inspection work is shown very forcibly in the fact that of the 35,731 farms under inspection, 1423 were excluded in 1928 because of insanitary conditions, and 1217 for the same reason during the first eight months of 1929.

Certificates from state and federal authorities showing all cattle on farms under inspection to be free from tuberculosis, are on file at the Chicago Department of Health. Individual herd certificates for each herd are required to be filed in the Department office before milk delivery is made, and a record of each succeeding retest must follow.

These records are carefully checked for completeness. If the result of the retest is not received upon the expiration of the previous certificate, a notice to that effect is sent to the milk dealer. If the certificate is not received within 10 days, the producer is notified and failure on his part to have the approved form sent to the office within five days results in the farm being barred from the Chicago market.

Each milk dealer is required periodically to furnish a list of his patrons to the Department. Our inspectors obtain lists of the producers and amounts of milk delivered by each one from plant weigh-sheets, and also from similar lists submitted with test results, or with samples collected for testing.

Checking these lists against herd certificates on file, insures milk from only tested sources. Comparing the amount of milk with the number of cows listed on the certificate, insures the testing of all cows in the herd.

This detailed checking, which requires the entire time of four men, is fundamentally essential. During 1928, 1203 producers were barred from the Chicago market because herd certificates were incomplete or had expired, and during the first eight months of 1929, 797 were excluded for the same reason.

Farms where contagious disease exists are barred until the quarantine has been terminated. Information concerning the existence of communicable disease on farms is obtained from the milk plant owners, and from the local health officers. A certificate, to the effect that the Illinois state laws concerning communicable disease (which are more strict than those of the surrounding states) have been complied with, shall be in our files before the embargo placed against the farm may be raised. During 1928, 166 farms were shut off because of contagious disease existing on the premises.

Milk, as it arrives at the country or city receiving stations and at pasteurizing plants, is inspected by the city and country plant inspectors working in cooperation with the country dairy inspectors. Milk is inspected for odor and appearance; the temperature of the milk is determined; a sediment test is made; and samples are secured for chemical and bacterial examination.

The city ordinance requires a butterfat content of not less than 3.0 per cent in milk delivered to the city, not less than 8.5 per cent solids not fat, and not less than 12.0 per cent total solids.

Samples are collected regularly of milk delivered from the individual farms and country plants, and those that do not meet our chemical and bacteriological standards are barred from the market.

The Chicago Department of Health issues no temporary or special permits to plants for the sale of milk in Chicago for short periods of the year. All plants are under the same inspection, which is maintained throughout the year. Department regulation permits of but one grade of milk other than certified.

Permits are issued to milk plants to sell milk in Chicago, only if at the time of application, the farms supplying the plant meet a high level of general excellence. After a permit is granted to sell milk in the city the plant must, in the absence of inspectors, cooperate in carrying out Department requirements. For example, the plant operator must inspect the milk for temperature and odor as it arrives at the plant, and at least twice each month samples of milk must be collected for sediment and reductase tests. The plant field men are expected to take the same action as would the inspector. The results of these tests, along with action taken, are kept at all times as a permanent record on file at the plant for examination by the Department's representative. This cooperation on the part of the plant insures that milk delivered to the plant will be of the same uniform quality, whether or not the Department's inspector is present. The plants in general cooperate very well, although during 1928 the permits of 42 plants were withdrawn for failure to comply with our requirements, and in the first eight months of 1929, 28 plant permits were cancelled.

No farm-separated cream may be received by any plant holding a Chicago permit. All milk must be delivered to plants daily.

Producers whose milk is shown to be only fairly clean are warned that it will be necessary for them to improve their methods. Milk found dirty is rejected, and the dairyman is warned that a repetition of the offense will result in placing an embargo against the farm. During 1928, 38,522 sediment tests were made, of which 53.8 per cent were good, 38.3 per cent were fair, and 7.9 per cent were bad. During the year 366 farms were shut off for failure to produce clean milk.

Milk delivered in the city as raw milk from individual farms and country plants, is sampled, and analyzed bacteriologically by the plate count. Farms and plants whose milk contains more than 1,000,000 bacteria colonies per c.c. in summer, or 750,000 colonies per c.c. in winter, are warned that improvement is necessary or the milk will be barred. During 1928, the average count of all samples of raw milk collected, 4600, was 180,000 bacteria colonies per c.c., while during the first eight months of 1929, the average count on 4065 samples was 140,000 bacteria colonies per c.c.

Although it is possible to examine the raw milk delivered to plants in the city by means of the bacterial plate count, it is very difficult to do so at the various country plants. For this reason the methylene blue test is used. During 1928 a total of 23,184 reductase tests were made of milk received at the country plants, and during the first eight months of 1929, a total of 34,070 such tests were made.

The milk is grouped thus:—Groups I and II comprise milk that remains blue for at least three and one-half hours; Group IIIa comprises milk decolorized within three and one-half hours, but requiring more than two hours; Group III, milk decolorized within two hours, but requiring more than one-half hour, and Group IV, milk decolorized in less than one-half hour. Of the milk analyzed during the first eight months of 1929, 84 per cent fell in groups I and II, 8 per cent in Group IIIa, 6 per cent in Group III, and 2 per cent in Group IV. This represents an improvement of 22 per cent over the same period of the previous year.

Producers whose milk decolorized within three and one-half hours were notified that immediate improvement would be necessary or the milk would be barred from the Chicago market. Retests were made within a week of the original test, when it was found that usually the necessary improvement had been made.

As a means of improving the bacterial content of the milk a standard of 65° F. was adopted as the practical maximum temperature for milk delivered to the plants, although the city ordinance requires 55° F. Milk above 65° F. is returned to the dairyman. During 1928 a total of 63,687 temperature readings were made, of which 44 per cent were above 65° F., and during the first eight months of this year, 85,519 temperature readings were made, of which 20.8 per cent showed milk above the legal limit; this milk was returned.

Carrying out Chicago's definite program for securing a satisfactory quality of raw milk resulted, during the first eight months of 1929, in the condemnation of 1,500,000 pounds of milk and the barring of 2,739 farms from the Chicago market. The result, however, was well worth the effort for there was an improvement of almost 25 per cent in the bacterial quality of the city's milk, as compared with that supplied the year before, when the milk was considered good.

REPORT OF COMMITTEE ON DAIRY FARM METHODS

T. J. Strauch, *Chairman*

The opinion of your committee is that the production of milk of a high sanitary quality, of a low bacterial content and free from visible dirt, is a matter of proper methods at the source of production. It therefore recommends certain things that should be done in order to obtain the desired results.

We have taken the different factors governing the production and handling of milk on the farm in the order of the influence which they have on the production of the sanitary quality of milk.

We feel that the most important thing is the proper cleaning of all utensils used in the handling and storing or transportation of milk, and recommend the following method: All utensils should be rinsed in cold water immediately after use. This is to remove the greater part of the milk which sticks to the utensils. The washing must be done immediately, without waiting, as milk will dry rapidly on the utensils and dry milk is difficult to remove. The utensils should then be washed in warm water containing a washing powder, and then sterilized with steam or heat or should be scalded. It is very important to wash and sterilize the utensils every time they are used.

The use of small top milking pails of proper design and construction is recommended.

All utensils or containers should be of such construction that they may be easily cleaned and must be in good repair.

As there has been a large increase in the use of milking machines, and as many milking machines have been condemned because of the supposed difficulty in cleaning them, and as there seems to be a great difference of opinion regarding the best method, your committee thought it best not to make and definite recommendation for cleaning milking machines at this time. It, however, thought it highly desirable to have this matter thoroughly discussed by the members of the association in order that your committee may get all the information possible before it makes a report on this very important matter.

The flanks of all milking cows should be kept free of visible dirt at the time of milking, the udders and teats should be washed and wiped with a clean dry cloth immediately before milking.

Your committee therefore considers that the principal factors in the production of a clean milk with a low bacteria count at the time it is milked are: clean, sterilized utensils; clean cows with clean udders and teats; the small top milking pail; clean healthy milkers; and clean methods and conditions.

In order to keep the bacteria count low, milk must be properly cooled. Your committee therefore recommends that milk from each cow, as soon as drawn, shall be removed to a milk house and cooled to a temperature not over fifty (50) degrees F., and if held over on the farm and delivered to a distributing plant once a day, that it be kept in covered cans placed in insulated tanks of ice water or in approved refrigerators, and the temperature of the milk in such container or refrigerator shall not be allowed to rise over fifty (50) degrees F. and shall be delivered to the milk plant properly protected.

In this report, your committee has only considered the simple factors necessary for the production of a clean milk of a low bacteria count.

The other factors such as clean, healthy milkers, healthy cattle, properly constructed, well lighted and well ventilated barns and milk houses, clean barns and clean surroundings, manure disposal, safe water supply, proper disposal of wastes from the human body, bedding used in barns and the feeding of cattle, are all factors having some influence on the quality and safety of milk, and should be considered in future reports of this committee.

Monday, October 7
8.00 P.M.

REPORT OF COMMITTEE ON DAIRY AND MILK PLANT EQUIPMENT

GEORGE W. PUTNAM, *Chairman*

IMPROVED MILK METALS

The past year has seen the introduction of an important metal for milk plant equipment. This is an alloy of iron, chromium and nickel, marketed by different steel manufacturers as Allegheny Metal (Super-Ascoloy) and Enduro KA2. This is one of a group of alloys loosely classed as "stainless steels" which are extensively used for knives, table and counter tops. Ordinary stainless steels like Enduro and Ascoloy consist of iron containing 12 to 18 per cent chromium. The important difference with the improved metal is that it contains in addition to chromium about 10 per cent of nickel which imparts to it valuable properties for use in connection with milk. These improved metals are hard alloys of the same composition throughout with a highly polished surface which experience indicates do not become stained, discolored, pitted or corroded with use. Independent metal investigations by Prof. O. F. Hunziker, Prof. M. J. Prucha, (University of Illinois) and Prof. E. S. Guthrie (Cornell University) with Prof. C. L. Roadhouse (University of California) have all shown the remarkable resistance of these metals to corrosion and tarnishing.

Pure nickel has been used in increased amounts with continued success particularly on cold milk. It is apparently unsuited for use with hot milk flowing over surface coolers, due to its slight solubility in milk with resulting corrosion. It is subject to some tarnishing with high acid milk products.

LOW TEMPERATURE HEATING MEDIUMS FOR PASTEURIZING

A comparatively new aid for heating and holding during pasteurizing is the water heating and circulating unit.

This consists of a small, closed heating chamber with a silent steam nozzle at one end, and a steam controller bulb at the other to maintain a uniform water temperature. A centrifugal water pump sucks the heating water through the heating chamber and forces it through the milk heater or holder jacket. This water heating and circulating unit is used on barrel and internal tubular heaters and coil vats to replace the less rapid steam jet circulation and may also be connected to the jackets of tanks or vats used simply as holders. When used in this way on a jacketed tank, it tends to insure against a drop in the temperature of the milk during holding due to radiation heat losses.

When used to furnish hot water heating medium for the barrel heater or coil in a coil vat, it permits heating with a lower temperature heating water such as 155° to 160° and reduces serious baking of milk on the tubes or coils with consequent increased difficulty in cleaning and injury to the flavor of the milk.

A water temperature of 155 to 160 degrees can be used with a water heating and pump circulating unit as compared to 170 to 190 degrees when using steam jet circulation, which occasionally admits live steam. This unit is used in connection with one or a battery of coil vats, barrels and internal tube heaters, glass and metal lined tanks, etc. The advantages favoring low temperature heating water, are more complete preservation of the natural milk flavor and easier cleaning of the equipment.

Carrying the idea of lower heating water temperatures to its conclusion, there has been developed equipment having approximately double the amount of heating surface ordinarily provided, and providing rapid circulation of the hot water heating medium over this surface. With such equipment it has proven possible to heat milk with a differential of not over one degree; that is, the initial or highest temperature of the heating water will not exceed the milk outlet temperature by more than one degree. When heating milk to 145° with water at 146°, it is apparent that not even a part of the milk at the heating surface can be heated more than one degree higher than the pasteurizing temperature. In contrast to a heater using such a high temperature heating medium, it is claimed that a heater of this type more nearly recovers the original raw milk cream line when it has been injured by agitation, transportation, pumping, and handling of the untreated milk. An advantage claimed from a health point of view is that the excess of heating surface and heating water provides such a margin of safety that it is possible to control the temperature of the heated milk within 1° limits.

New Positive Holders

A large number of new positive holders have been advanced in the past two years. Some are of the multiple pocket type, others consist of a group of four or more glass or metal lined tanks with special methods of filling and emptying, one filling by vacuum and emptying by compressed air, another filling by pump pressure and emptying by pump suction. Many are so-called valveless holders. All are claimed by the manufacturers to eliminate dead ends, leakage of raw and partially pasteurized milk into the pasteurized product, and to be capable of being operated so as to hold the temperature of every portion of the milk within one degree of the indicating thermometer during the holding period. One new holder combines the continuous flow and pocket features in a single machine.

New Accurate Thermometers

Standards for thermometers have been tentatively settled upon, with the result that more accurate and easily read indicating and recording thermometers are available from a number of instrument manufacturers. These can be read to one degree without having to estimate from a two or five degree scale division. The tentative standard for indicating thermometers is at least 1/16″ per degree and scale divisions for each degree; thermometer to be guaranteed accurate to one half degree. For recording thermometers, it is similarly 1/16″ per degree, scale lines for each degree, a twelve-hour chart, and the thermometer to be guaranteed accurate to one degree.

Most instrument manufacturers also have variable scale thermometers which not only give an open single degree scale through the pasteurizing range but also condensed scales above and below which permit the recording of cooling and sterilizing temperatures. The intervals on these cooling and sterilizing portions of the chart are usually five degrees per division. This is in contrast to the 100 to 150 or 160° range ordinarily provided.

One difficulty with indicating thermometers has been that they were often located in a position so awkward to read that the operator would not use them when provided. Means have been provided for eliminating this difficulty by designing the thermometer in right and left side angle types, which can be readily tilted to a position easily read without the operating getting down on his hands and knees on a wet floor, standing on tiptoe or on a small ladder, according to the thermometer position.

Plug Type Safety Outlet Valve

The application of a flush type plug valve to vat outlets has been developed as an alternate to flush type leak protector outlet valves of the double disc type. The insulation is cut away for a small space at the outlet and a special plug valve so attached to the vat as to seat approximately flush with the inside lining. Grooves in the plug provide leak drains like those in leak protector inlet valve of the grooved plug type.

The simplicity of this new plug type safety outlet valve for operation and cleaning will undoubtedly make it a popular valve in the future for new vats and tanks. It should be noted, however, that the seating surface of this new valve is considerably greater than that of the double disc valve, and increased care must be taken to prevent injury to this larger seating surface.

Improvements to Protect Sanitary Quality of Pasteurized Milk

In response to suggested specifications, manufacturers are providing for improved construction on new surface coolers to prevent possible contamination of milk with brine or condensation from the headers. This is accomplished by shortening the trough and by projecting fins or special slopes at the bottom of the header.

The proper soldering of surface coolers to eliminate insanitary cracks and provide smooth filletted surfaces has received increased attention. The use of solder with different melting points for the two sides of the cooler and the use of concave metal strips fitting between the tubes has apparently provided a satisfactory solution to the problem.

New vat and filler covers are made completely self-draining by means of over-lapping edges which prevent any condensation or other contaminating material from getting into the milk. A large dairy repaired their old fillers to prevent condensation draining into the filler on account of occasional complaints of ropy milk. Organisms on the bottle cases were transferred to the filler pipe by the operator's hands in adjusting it. When taken off with sterile swab, organisms on cases and piping caused milk to become ropy in laboratory tests. Usually three or four days were required for the milk to become ropy, but occasionally these contaminating organisms will cause ropiness in bottled milk within 48 hours and be noticed by the consumer.

MILK PLANT DESIGN AND EQUIPMENT OR THE FOUR SQUARE INDUSTRY

G. E. Matter

The Pfaudler Co., Rochester, N. Y.

On your program you have this period allotted to a representative of a concern which furnishes equipment for handling dairy products. Since equipment represents less than four per cent of the total business of the dairy industry, this allotment is quite liberal. But in allowing someone who has something to sell to present a paper before this body, I feel that a spirit of tolerance mingled with liberality on your part is exhibited. The confidence so placed in me, I shall reciprocate by pledging that I shall not attempt to sell you anything in the nature of goods that I have for sale. In fact, my discussion will be just as "square" as I can make it, and you will have to remember that I said square, and I will add at this time that a square has four sides.

The dairy industry has *four* main divisions, market milk, butter, cheese and ice-cream.

Roughly speaking, our milk comes from *four* million farms, and there is one cow in this country for every *four* people. Even a good dairy cow has her mammary apparatus divided into *four* quarters, and since the tuberculin test has finally taken hold in this country, we may reasonably expect that eventually all four of her quarters will be good.

The number *four* has a deep significance in the dairy industry. This is true in a fundamental sense, as well as a practical and symbolical sense. The dairy industry indeed deserves the title, "The Four Square Industry," and no service to civilization can excel the efforts to maintain that position unblemished. Founded in that age when it seems that sympathy in the mind of man first took intelligent form, and it was first understood that future progress of the human race depended upon the relief of the human mother. This was centuries before any other industries started; it was a fundamental prerequisite, and today if you will trace the most progressive nations of the globe you will find, without exception that, wherever man has gone and flourished he has taken this foster mother of the human race with him. As he advanced in other things, the methods of handling dairy products likewise had to be changed to suit his requirements.

The subject "Milk Plant Design and Equipment," on its surface may not seem so important, but ever since Noah led the first cow out of the Ark, the style of milk plants and milk handling equipment has constantly changed. Right now, in this country, unusual interest is being exhibited in this subject, which, I believe, is the reason for Mr. Irwin asking that I discuss this subject in a general way at this meeting.

My object, however, will not be to discuss changes, but rather to discuss that which is, was, and always will be in milk plant design and equipment. In other words not things and their changes, but principles and forces, and I will remind you occasionally that these more permanent things in the dairy industry are related to the number four, or to the square of four.

If you could build a milk plant to handle anywhere from two thousand to ten thousand quarts of milk per day, and if in this plant you could handle your milk more satisfactorily and more economically than you could in any other building, it would be reasonable to conclude that it was the design that gave you the advantage.

If this building embraced all the requirements of the law, and lodged all the up-to-date necessary equipment to prepare milk for the market, I venture that in outline your building will be square or nearly so. The refrigeration machinery, and the boiler would not be included in this square.

On the paper before you I have drawn a square, which is the outline of the building we will now plan. This building has four sides, each one straight (as every milk man may very well be). A straight line is the shortest distance between two points, which is the way we will run the pipe lines, because it is more economical from the standpoint of first cost, upkeep, and pressure condensation.

We will locate practically all the heavy consumers of steam and water in a straight line from the boiler. Here's the can-washer, the heater and pasteurizers, pumps and possibly the separator. This is the side of the building where we will receive the milk, the rear end of which houses the boiler, the well-pump and compressor; and it is along this wall that most of the pipes run, water, steam, and milk. The sizes of these pipes will be discussed later.

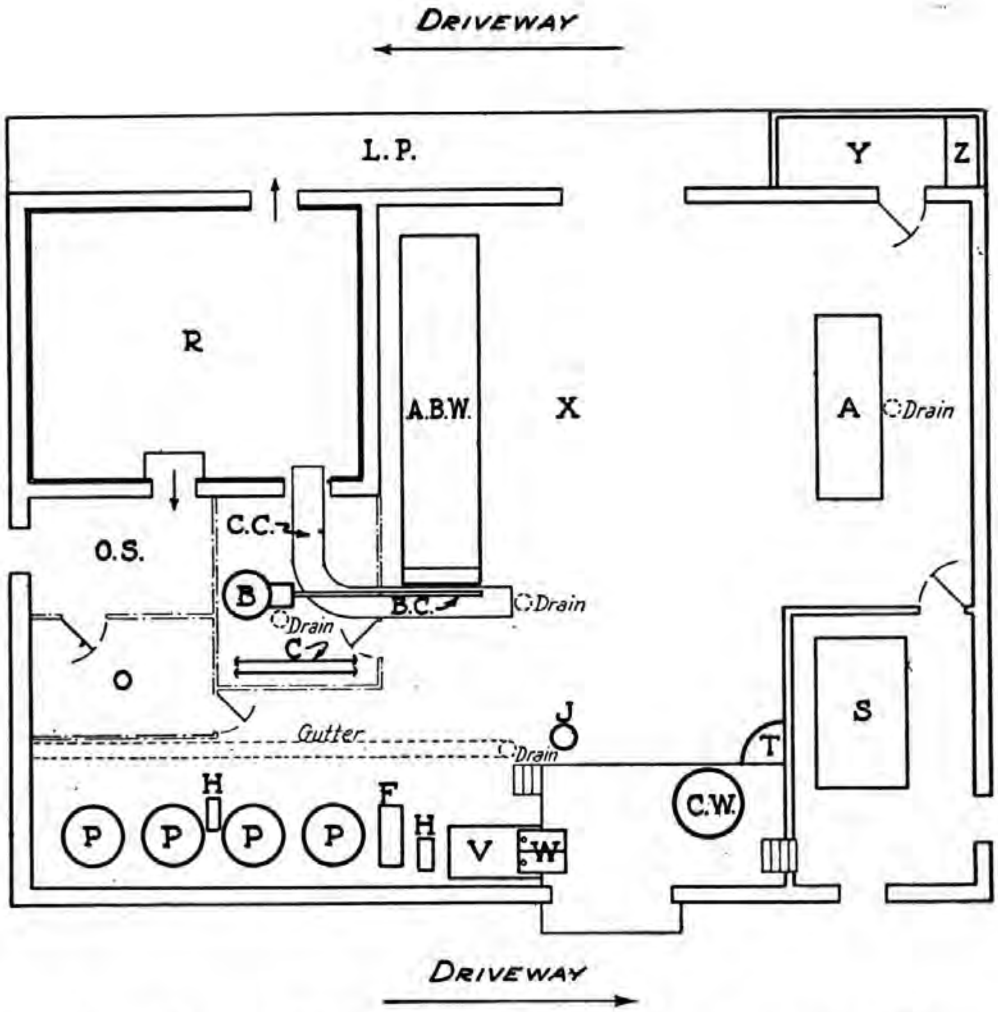
The location of the refrigerator will be in the corner of the building diagonally opposite the boiler and receiving department, for then there is no lost motion of the milk on its way to the refrigerator. Your refrigerator may occupy one-*fourth* of your total floor space. If you sell butter, a section may be partitioned off in which a lower temperature can be maintained. You will observe that one side of the building represents the receiving of the product, and the other side discharges the finished product; also you will observe that the front of the building may be clean at all times, while the rear has to do with the return cases, cans, etc.

Your building will be well lighted, well ventilated, and well drained, each of which is too large a subject to include in this paper. The center of your building will be practically open, and purposely so, because there is no other part of the room traversed more frequently by foot, by can or truck. Also by lining all the stationary pieces of equipment along the walls you not only improve the appearance, but it is more economical of floor space and labor.

Outside of the partitions for the refrigerator, the office and sales room, there will be little reason for having partitions. A room where the cooling operation takes place over a surface cooler is very desirable, but where internal coolers are used this is not necessary. The bottling operation is preferably in a separate room. From your office or salesroom you will be able to serve a customer directly out of a shelf of the main refrigerator, and at the same time you can have your eye on every vital operation going on in the plant.

With such a plant you need have no fear that a competitor can operate his plant with more economy and satisfaction. In every sense of the word you should be proud of your possession, and IN KEEPING IT SANITARY THERE IS GREAT REWARD.

But you will fall far short of the success that awaits you if your plant alone is kept sanitary. The equipment is even more vital. Very often the only reason that is given for equipment not being clean is that it is difficult to clean. That is the best reason for getting rid of it, for such an argument cannot be accepted as an excuse. More than ever before must the milk handling equipment of our modern plants be free from rough sur-



faces, inaccessible parts, square corners, questionable seams, insanitary joints, and submerged stuffing boxes, especially where there is a fluctuating hydrostatic pressure, which forces the product in and out of the stuffing boxes. Of all that may be said for and against dairy equipment, there is nothing that distinguishes one piece from the other so much as its sanitary features.

There is nothing fundamentally new in the mechanics of machinery. All machinery is built on six principles, which are the wheel and axle, the lever, the inclined plane, the pulley, the screw, and the wedge. These principles are so old that no one seems to know just when they were first apprehended by the mind of man. Yet in the dairy industry their application has been relatively new. It has only been during the last thirty years that extreme effort has been expended to improve by mechanical means the equipment used for handling this food product, milk. Think of it, from a milk can and dipper, to our present highly developed milk machinery in approximately thirty years.

The efforts of J. Willman, L. S. Pfonts, H. Feldeier, S. Skidd, Coburn, Engholm, Behringer, Stock, Meyer, Stroudt have certainly left the dairy industry richer, and I wish that I might complete the list of all who contributed in a practical mechanical sense to advance the industry to its present position. In respecting their courageous efforts we might well keep in mind that no prompting influences such as boards of health were then in vogue. From what they initiated, the dairy industry has advanced in its equipment until at this time we may truthfully say that it surpasses any other nation in the whole world. This grand result of general accomplishment meant the cooperation of labors in all the fields of dairying. We omit praise of the other fields of dairying, simply because they do not properly come under this subject.

Did you ever know how simple it is to determine the boiler horsepower required to pasteurize milk? Think of the number *four*. Assuming that we will raise the temperature of the milk from 40 to 145 degrees F. If you heat 2000 lbs. per hour, multiply 2 by 4, or 8 H.Ps. If you raise the temperature of 10,000 lbs. per hour it will be 4 times 10 or 40 H.Ps. If can washers or hydraulic bottle washers are used at the same time, this B. H. P. of course would have to be enlarged. But where these operations take place when the pasteurization is not in progress, the same capacity will be adequate for the plant.

If you do not choose to use my "rule of thumb" method of determining B. H. P., you may use the following accurate formula,

$$\frac{\text{Lbs. milk times degrees raise}}{29{,}000} \text{ equals Boiler H.P. required}$$

Can you tell if a man has enough refrigeration, without resorting to pencil and paper, and excluding snap judgment? Of course.

Think of the number, *four.*

Assuming that artificial cooling starts at 85 to 95 degrees F., and is used to reduce the temperature to 38 degrees F. Now note the capacity of his cooler. Let us say that it is a 5000# cooler. Multiply 5 by *4*, which means 20 tons capacity. Suppose that he is cooling 12,000 lbs. then 12 times *4* equals 48 T. of refrigeration.

The capacities thus obtained are very reasonable to work with and they take into consideration the heat of summer, cooling water for the condensers that may be warmer than was originally figured upon, as well as the more or less perfect condition of valves and pistons in the compressor, and also normal radiation and conduction losses. The unit for figuring tons of refrigeration is 11,833 B. T. U. per hr. and is useful, at least, to check up my "rule of thumb" method.

Size of Pipes

One never need be in doubt of the proper size of pipe to use in the dairy industry if he can reflect upon "The Four Square" symbol of this industry.

First start with a one-inch pipe. A square has four-sides, all right, square four and you have 16. Well, 16 is the number of gallons that will flow through a one-inch pipe, ten feet long with a head pressure of one foot.

Just remember how you got that 16 and from it you can figure the approximate capacity of any of the larger sizes. Take for example, a two inch pipe. Square its diameter, which is four, and multiply by 16, or 64 gals. per minute.

Take a three inch pipe, 3 times 3 is nine; then nine times 16, or 144 gals. per minute.

It so happens that a one-inch pipe has about eight times the frictional head of a 1½ in. pipe. Therefore, use no less than a 1½ in. pipe in dairy work. Both economically and from a sanitary standpoint 1″ pipe is impractical, and no milk plant is too small to use 1½ inch size pipe for their milk lines.

Use 1½ in. pipe up to 10,000 lb. per hour.
Use 2 in. pipe from 10,000 lb. to 20,000 lb. per hour.
Use 2½ in. pipe from 20,000 lb. to 35,000 lb. per hour.
Use 3 in. pipe from 35,000 lb. to 70,000 lb. per hour.
Use 4 in. pipe from 70,000 lb. to 200,000 lb. per hour.

Size of pipe required for steam at 80 lbs. or more of pressure

Distance	20 ft.	40 ft.	60 ft.	100 ft.
16 H.P.	1 in.	1¼ in.	1½ in.	2 in.
25	1¼	1½	1½	2
35	1¼	1½	2	2½
50	1½	2	2½	3

If low pressure steam is used, i. e. 12 lbs. or less, double the size of pipe.

Milk Pumps

Deciding the type of pump to use depends upon where you are, what you want to do, and with what you have to do it. The piston or suction type of pump is one of the oldest pumps used in the dairy industry. Its special value lies in its capacity to lift, and may be depended to do this kind of work to about 30 feet. Where steam operated it lends itself to great changes of capacity, and therefore does very well in country stations where steam is the only source of power, and where great changes of capacity are required. It is always well to put an air chamber in the line, otherwise it may pulsate to the point of loosening the lines. Its positive action when hooked up with other equipment, not provided with relief valves, may result in damage, because of the excessive pressure built up, and this must be watched with this type of pump. The Burrell and the Burham are pumps of this type.

The rotary pump contains two or more revolving blades or cylinders which move in eccentric or reciprocal action with one another. It is quite noisy; does not lift as well as the piston pump, but comes into its own when a steady flow of viscous product is to be lifted a considerable distance or height. It works very well with cold sour cream, or buttermilk. The Viking and Lobee are types of this kind.

The direct motor driven centrifugal pump is rapidly gaining favor for pumping milk. Its name describes it. The pressure of centrifugal force is created inside the housing by the impellor which whirls at speeds varying from 1150 to 3200 revolutions per minute.

It is very quiet; discharges so that there are no pulsations to the pipe lines; its capacity exceeds that of any other type of pump, and may be very easily varied and controlled by manipulating a valve on its discharge end, in which case there is no chance of building up excessive pressure that may damage other equipment that is in the line. It has one moving part, is simple, accessible, and I dare say, the most sanitary pump made, providing it is made accessible.

There is a lot of prejudice against this type of pump for use on milk or light cream. For milk, they say, it is hard on the cream line, in which connection I want to add that the viscolizer, the emulsifier and the centrifugal pump, in fact a lot of the other dairy equipment may be said to injure the cream line, and at the same time I would like to say that all of these pieces of equipment may be used to modify the cream line, providing you employ the major factors that set into motion the formation of the cream line. Under certain conditions I feel satisfied that a better cream line may be obtained with the use of a centrifugal pump, than without it. As Shakespeare once said, "There is nothing either good or bad, but thinking makes it so." And I think this is a case of a thing being condemned, for the reason that some people made it so by "thinking," and not by truly scientific demonstration.

The size of a pump is decided by the capacity it is expected to discharge through a known resistance of pipe, the number of elbows, and the actual lift. If you order a pump you should be able to specify the size of pipe, the height you expect to lift a given volume per minute and the number of bends in the pipe. To arrive at a result one must refer to tables, which may be obtained from any supply house of dairy equipment.

Regenerative Coolers

In plants that run steadily for any considerable length of time advantage may be taken of the regenerative principle in cooling. Regeneration is seldom used in plants of less than 5000 pounds capacity per hour, or where the run is less than 2½ hours. The heated milk from the pasteurizer enters the inside of the single tube regenerative cooler, and gives up its heat to the cold (unpasteurized) milk which trickles down the outside surface on its way to the pasteurizer and holder. The direction of flow may be reversed, but it is best to have the finished product under pressure, in case of any leaks, as well as for reasons that I shall mention when I come to coolers in general.

If the flow of milk is approximately equal in each direction of a regenerative cooler, the hot milk will be cooled from 145 degrees F. to from 90 to 70 degrees; and the cold milk at 40 degrees will be heated to from 100 to 120 degrees F., all depending on the amount of surface brought into play.

Now to determine the saving thus effected per hour, we have as a minimum 55 plus 60 or 115 degrees, times 10,000 lbs. per hour, or 1,150,000 B. T. U. saving, of which 600,000 is on the heating side, and 550,000 on the cooling side. Divide 600,000 by 29,000 and it roughly equals 20 Boiler Horse Power. Divide 550,000 B. T. U. by 11,833 and it roughly equals 46 tons of refrigeration capacity. This refrigeration capacity is equivalent to the melting of two tons of ice per hour or the pumping of 40 gallons of average well water, per minute. To determine the amount of surface that may be safely used for cooling pasteurized milk, think of the number "four" and multiply the number of pounds per hour by four which gives you the number of square inches required.

Coolers In General

There is no piece of equipment in the milk plant of today that is more out of step with the progress of our sanitary code, and which threatens "The Four Square" reputation of the industry more than the conventional surface cooler.

What I say on this subject, I trust no one here will interpret as an ambitious move on my part to win honorary membership in some union of wrecking crews. On the other hand I prefer to belong to a construction gang.

But before we go on the cooler subject let me say that I heartily favor all the criticisms made on holders during the past few years, and I feel that all of them can be rectified. The formation of pellicle, the formation of froth, and its contamination by air from uncontrolled sources, the film that is left in draw-off valves, which is exposed between runs, and the absolute holding of every drop of the milk to insure that the consumer is perfectly protected; all of these and more I am sure can be realized, in fact are right now being realized; I subscribe to all of these and more.

Once upon a time there was a milker who knew how to milk a cow. He scalded his pail, which had a small opening in its covered top; he cleaned his cow and washed her udder and flank. He even discarded some of the fore-milk that his final bacteria count might be reduced, and he milked until he had a pailful, after which he raised himself with satisfaction, at the same time removing his milking stool, and just then the cow stuck her foot in the pail.

MORAL: You are not done with milk until it is delivered in its final container.

In the milk plant, one is not done with a perfect pasteurization holding process. No, not until you retain that which you have already accomplished.

The idea of flagrant exposure of milk after the heat treatment is so repugnant to my sense of sanitation that I honestly welcome the opportunity to state before this body my opinion that it is the weakest link in the whole pasteurization procedure, and one that holds promise of speedy rectification.

Where surface coolers are used fully 60 per cent of the total exposure of the milk takes place *after* the heat treatment; just before it goes to its final container. If this exposure took place before the heat treatment, when it might be used as a heater and aerator, I would have no fault to find.

Here is a problem in mathematics, with a milk inspection flavor.

If 60 per cent of the total exposure of milk takes place after the heat treatment, and the heat treatment was employed to remove the damaging effects of the original

40 per cent exposure, how in the operation, and to what extent can heat treatment be employed to correct the damaging effects of the last 60 per cent exposure?

This subject is a big one, in fact it is proportionate to the exposure. Flies on an open type cooler are not a perennial problem, but they get in the milk after the heat treatment, in spite of screened doors and in spite of the so-called vertical covers. The air laden with dust and organisms that gets in is the same as that which helps to form the froth in the holder, only it comes from a lower level of atmosphere as it passes over the cooler, and there is much more of it, due to the hot milk expanding the air at the top of the cooler, causing it to rise, thus setting up a decided air current over this recently treated milk. And the covers, if they should perchance be used, indeed act as a chimney, by furnishing a path of travel to further hasten the flow of air. Hold a lighted match at the bottom of one of these covers and see which way the flame tries to go. Did you ever notice the dark accumulation on the ceiling, where the cooler is hung reasonably close to it? There is no question where this dark accumulation came from. But, if you noticed the dark accumulation you also noticed the beads that form from the rising vapor from the cooler. Sometimes they drop, yes, on the recently treated milk.

It has been said that air passing over a cooler does not touch the milk passing over it because the radiating heat of the warm milk drives the air away. That may be true of the top portion where the milk is warmer than the air, but how about the lower section, where the air is warmer than the milk.

It has been pionted out that the bacterial count on the bottom of such a cooler often is lower than at the top, which would indicate to the non-suspecting mind that, therefore, no organisms could have been taken on by the milk as it flowed over the cooler. But this is indeed misleading, and I might add is no criterion at all, for there is no means of telling how many organisms, weakened by the heat treatment, were oxidized out of existence by being thus exposed. Or who knows but that some chemical change added to the above influence invariably reduces the count more rapidly than this swift flowing milk might, under certain more favorable conditions of atmosphere, be expected to take on in count due to fresh contamination. Personally, I have run into counts at the bottom of the cooler that were several hundred per cent higher than they were at the top of the cooler. Of course, in such cases we attribute some of this contamination to physical condition of the cooler; or structurally, it may have some open solder seams, or the solder may have blistered. Nevertheless this is exposure, just what I am talking about as being typical of this type of cooler.

My main thought is that this exposure is dangerous, especially when practiced after the heat treatment. Nor can I see how medical inspection of our milk handlers, however frequent, can be expected to make up for the fallacy of flagrant exposure at this stage of the operation. Even without reasoning it out our wives know better than to expose the canned goods they put up for the winter. And think of how Nature puts up Her food packages without any exposure at all. In fact She seals the apple and all Her fruits before she fills them.

The internal cooler is the only answer, and the milkman who decides to reduce milk exposure to a minimum by this means, needs have less fear of having an epidemic traced to his plant, I dare say, than the man with an open cooler, even though the latter exercised every care in having medical inspection of his men. Besides the former will be able to sterilize the entire cooling system under pressure. In which connection let me add that the sterilizing of a surface cooler is one of those things that can't be done.

But the cry often rings out, "The milk must be aerated." The answer is aerate before the heat treatment, and as for the absolute need for aeration of good milk, let me say for the benefit of those disciples of aeration not fully familiar with the subject, that the finest bottle of milk that has ever been pasteurized, according to the judgment of competent and unprejudiced judges, yes, from the standpoint of flavor and all the other points of quality, never received the beneficent advantages of aeration. It was heated, held, and cooled in a glass bottle, its final container. I am not arguing for in-the-bottle pasteurization. That would be too expensive and impracticable. But there is something in it which we might well copy, so far as exposure is concerned.

Indeed this matter of reducing exposure, after the heat treatment, or closing the lines in our milk plants is as important as it is to close the lines in the army when the battle is on. Closing the lines in the one case may save armed combatants, whereas in the other it may save innocent citizens of peace. If we don't close these lines, you know what may happen. The enemy may boldly step in, and I recommend it to you as from one in whom it is a deep-rooted conviction, that the surface cooler threatens more than anything else the reputation of "The Four Square Industry."

Next in importance to the absolute protection of milk after the heat treatment, I would call your attention to the protection of all the milk during every moment of the holding period, which I feel is not being accomplished, where uninsulated covers for holders are used. Aside from what these uninsulated covers contribute toward run-off in temperature, they function as condensers for the rapidly rising vapors from the milk beneath them, and as this accumulation takes place, the beads that form lose temperature rapidly by conduction. These beads drop into the milk twenty or more minutes after the holding period has started, and they drop from a surface that certainly has not been sterilized, in fact from a surface that has not been maintained at pasteurization temperature, for otherwise it would not condense the vapor.

It has been my good fortune to know and work with some of the foremost manufacturers of acidophilus milk, including Dr. Cheplin the discoverer of b. acidophilus. In the production of this dairy product, the uninsulated cover is absolutely out of the question because of the contamination afforded. In fact for their work they must be sure that no beads form on surfaces that have not been subjected to steam under pressure, and with the type of equipment that allows them to do this, they are also able to control such factors as froth contamination, pellicle, etc. I mention this for the interest of those who would make this industry of ours "squarer" and safer than it has ever been before.

So far as I have been able I have discussed things in the dairy industry that are, were and always will be. Any burdensome thoughts of change that I have suggested, are offered for your consideration, as we all work to make this industry increasingly deserving of title, "The Four Square Industry." But in a very special way you are the ones of whom it is expected to keep this ship in her true course. No greater satisfaction can come to you than to strive toward the accomplishment of this feat. That you are alert to the task, there is no question. In the past few years I have observed that it was from the inspection branch of this great industry that the greatest stimulus for progress was derived. I believe that from your ranks must be initiated that grand balance that gives stability and yet advancement for the future. What could be more fitting than to have this organization radiate that standard which makes our dairy industry neither a patron of change nor one of tradition. In the successful undertakings of your unusual duties, I pray that you may, with courage, tempered with tolerance, continue to honorably meet all obstacles.

THE SEDIMENT TEST FOR VISIBLE DIRT IN MILK—ITS HISTORY

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A study of the origin and development of the sediment test for visible or undissolved foreign material in milk reveals that, commencing twenty-five or thirty years ago, numerous experimenters began rather definitely to search for ways of determining, recording and reporting the comparative amounts of sediment in samples of milk. For a long time the presence of considerable sediment, coming chiefly from the stable, had been recognized as almost inevitable in market milk because of the rather general existence of insanitary stable conditions and the distribution of much milk by dipping or pouring from cans or other receptacles. The changes brought about in recent years, through the use of improved apparatus for the production, clarification and filtration of milk, from numerous scientific studies and out of the keen competition that has developed in the milk industry, render it difficult for us today to clearly picture the situation of only a quarter of a century ago. Then the bacterial content of milk was very generally believed to be proportionate to the amount of sediment or stable dirt it contained and more than one worker apparently further confused this supposed relationship of stable dirt and high bacterial content with the specific production of disease among users of milk. Subsequent study clarified much of this confusion. The early studies of dirt in milk quite naturally were concerned with the soluble as well as insoluble dirt that might find its its way into milk and the methods dealt with straining, centrifugalization, and filtration by gravity and under pressure or suction.

THE EARLY STUDIES

The sediment test for dirt in milk seems to have originated in Europe as a result of attempts to find a means of grading milk as it arrived at milk receiving stations. The use by Klein (1905)[1] of Fliegel's apparatus for that purpose was cited by Campbell (1916) with the comment that in this early use of the test the cotton discs, after the milk had passed through them, were cut into halves, one filed for reference and the other mailed to the farmer who was induced thereby to deliver cleaner milk. The Gerber is another testing device that seems to have been developed abroad at a relatively early date.

Recently Harding (1928) has called attention that Tonney (1907-10) utilized about 20 years ago, apparently for the first time in this country, the amount of dirt in samples of milk as a basis for their classification, and that he prepared standard pads by suspending weighed amounts of dirt in milk. He seems to have used a Gooch crucible, a suction flask and a water-suction pump. To Tonney seemingly belongs the additional distinction of first attempting to photograph sediment discs but the photographs obtained did not serve as very satisfactory standards.

The technique of milk-sediment testing as developed in Wisconsin was published by Babcock and Farrington (1910). They reproduced a drawing of an early model of the Wisconsin or Lorenz tester—constructed by E. H. J. Lorenz and apparently the first to be put on the market in this country at least—after suggestions of the authors and an illustration (Figure 1) of four discs of "absorbent

[1] Dates inside parentheses refer to references to the literature cited at the end of the article.

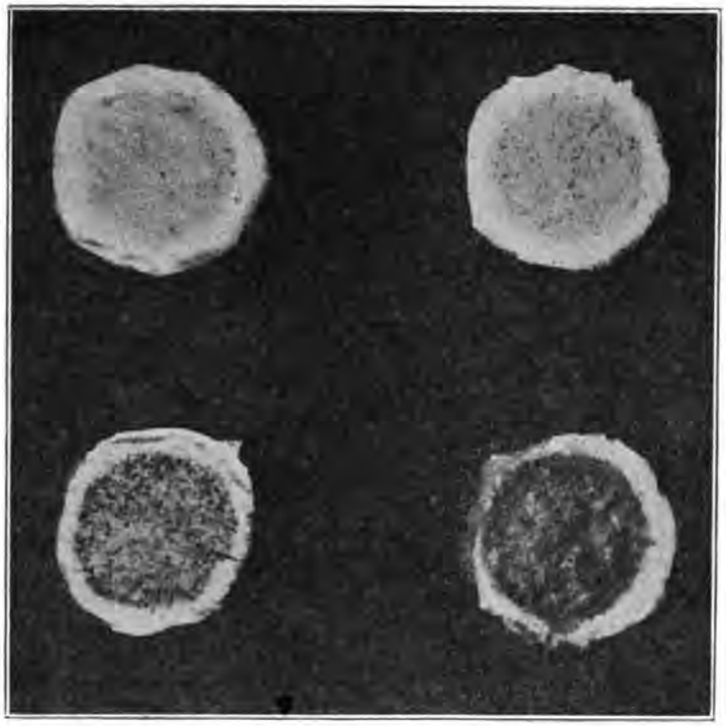

Figure 1. Four grades of milk in 1910: perfectly clean, slightly dirty, dirty, very dirty. (Taken from Babcock and Farrington.)

cotton" each made by "pouring through" the disc a pint of milk of a different grade, and stated "the records obtained from this test might be agreed upon as a basis for paying for milk according to the standards: Perfectly clean, slightly dirty, dirty and very dirty." The use of the test in Wisconsin was further discussed by Baer (1912) who stated that routine testing of all milk "delivered at the creamery" was started in 1911. He reported studies designed to show the amount of dirt removed from milk by straining or clarifying and that kept out by the use of the small-top pail; the relation between sediment and bacterial colonies in milk; the amount of sediment in market milk and cream, and the detection of gargety and colostrum milk. Baer also gave descriptions of several types of sediment testers and illustrations of sediment discs, some of which are of sufficient interest to be reproduced here as showing amounts of dirt (Figure 2) in pints of strained and unstrained milk

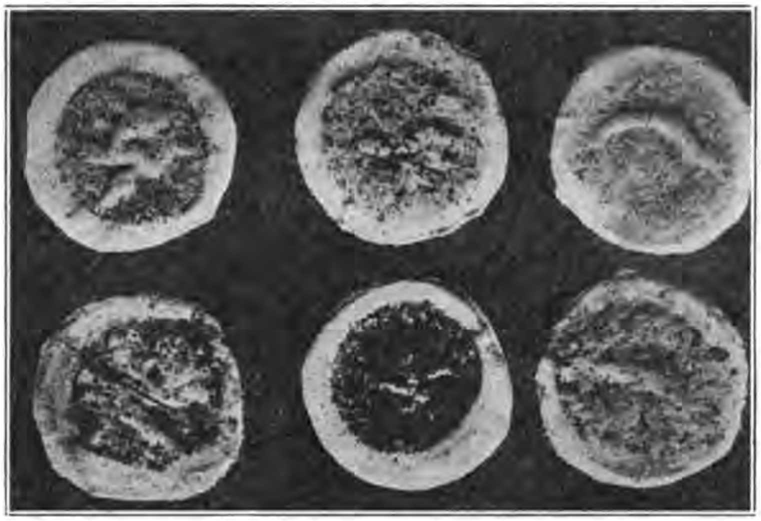

Figure 2. Sediment in pints of milk at the farm in 1912. Three upper discs are of strained and three lower of unstrained milk. (Taken from Baer.)

at the farm, and differences in the amount of sediment from clarified and unclarified milk (Figure 3). One of his illustrations (Figure 4) is of especial interest in connection with the present paper as calling attention to the amount of sediment apparently quite generally expected to be found in a pint of market milk at that period. In fact, in this early literature several references are made to market milk having an accumulation of sediment in the bottom of a pint bottle.

The writer recalls his experiences in examining milk as sold in Connecticut in 1910 and 1911 when the procedure for recording sediment was to observe the dirt that had collected on the bottom of a half-pint bottle after the milk had remained undisturbed for a short period. Sediments as heavy as those shown in Figure 4 were not infrequently seen in the half-pint samples and most of the milk contained visible sediment. A considerable portion of the milk sold in Connecticut at that time was dipped from cans. It was recognized by Conn (1913) that this method did not give quantitative results but only served to distinguish between "milk *without dirt,* that with

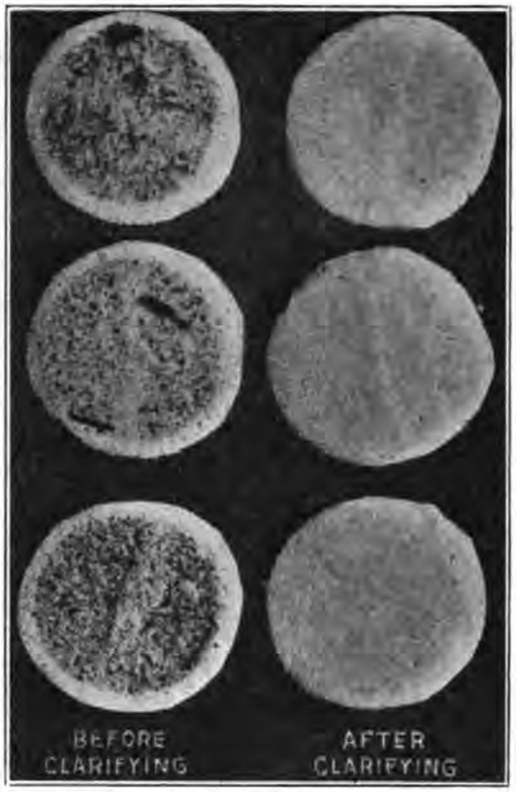

Figure 3. Sediment in milk before and after clarifying, in 1912. (Taken from Baer.)

slight dirt and that with *much dirt.*" The amount of dirt then considered slight would be very noticeable indeed to the housewife of today. In 1912 the practice of filtering the milk through a cotton disc with the Wizard sediment tester was adopted and the disc dried and returned to the local health official attached to the report. Later the practice was adopted of comparing the discs with others made in the laboratory by similarly filtering milk samples to which arbitrarily chosen amounts of dirt had been added. The standard method of the American Public Health Association was adopted in 1927 coincident with the examination of pint samples of milk collected in the bottles intended for delivery to the consumer. The results following this change in procedure are discussed below.

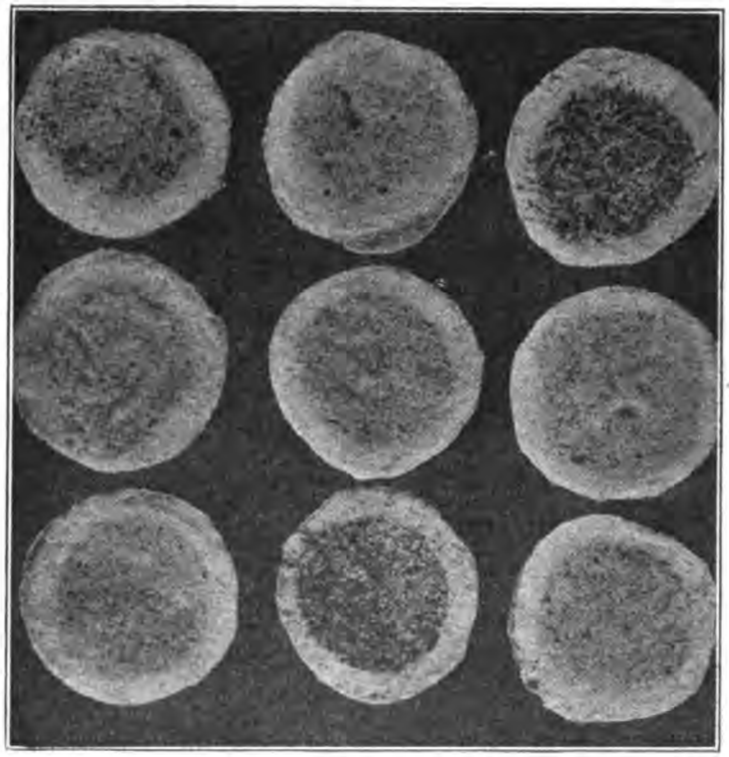

Figure 4. Sediment in pints of milk bought on the streets of Madison, Wis., in 1912. (Taken from Baer.)

Schroeder (1914) described the test as developed in the New York City Department of Health and gave photographs and descriptions of various types of sediment testing equipment, including Conn's filter-paper method, the Wisconsin, Stewart, Gerber, Schroeder, Wizard and Gooch gravity testers using either pressure or suction and the Babcock, Gerber, Stewart-Slack, and Conn centrifugal methods. Schroeder reproduced a photograph of a gauge devised by her to solve the difficulty of making comparative readings of the sediment obtained from filtering milk samples. This gauge represented the amount of dirt obtained by filtering liter lots of milk to which had been added, respectively $2\frac{1}{2}$, 5, 7 and 10 milligrams "of the material which usually finds its way into milk." She stated these gauges represented, in turn, the cotton filter after the passage of (one liter of) clean milk, and the sediment from fairly clean, moderately clean, dirty, and excessively dirty milk, and added that in some cities of Europe milk containing over five milligrams of sediment per liter is considered unfit for food and confiscated. She described her technique which is not further discussed here because it is essentially that incorporated into the third edition (1921) of *Standard Methods of Milk Analysis of the American Public Health Association* and retained with only slight modifications throughout subsequent editions. She used liter samples rather than pints, as most of the earlier workers had done, but the amounts of sediment on the discs pictured is not markedly heavier than in the earlier illustrations of pint samples referred to above. She appears to have graded directly against gauges she prepared rather than against a photographic standard. In fact, no mention has been found anywhere in these early articles of grading otherwise than by direct comparison of the discs against others considered as standards, with the exception of the work of Tonney already mentioned.

Campbell (1916) reported some experiments with various testers by the United States Department of Agriculture to determine whether the test could be relied upon to determine "insanitary milk" and gave a photograph (Figure 5) of standards "represented by the words: 'good', 'fair', 'medium' and 'bad'." He concluded that the Lorenz apparatus was the most practical; that the quantity of sediment was no criterion of bacterial content, and that sediment tests were of little value if the milk had been strained.

The methods cited seem to comprise most of those in use today. There now appears to be a tendency among

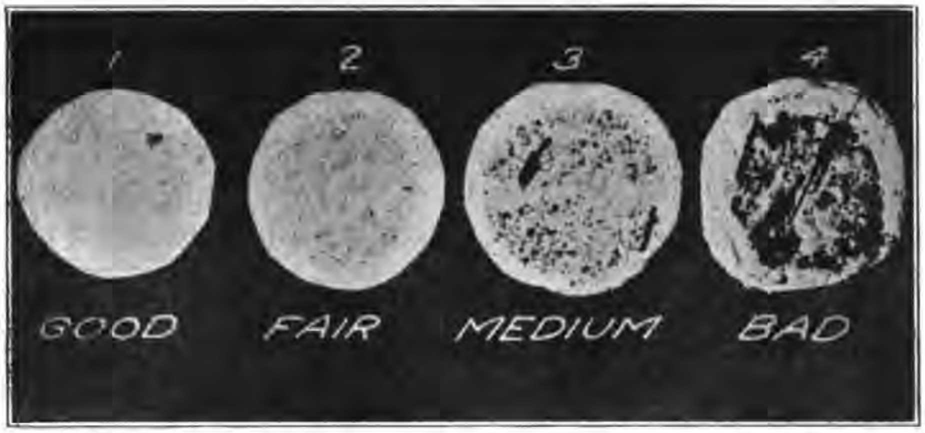

Figure 5. Milk sediment standards suggested by U. S. Department of Agriculture in 1916. (Taken from Campbell.)

workers to attempt to follow the standard method although uniform results are probably not secured in many instances because of carelessness in technique. Common faults, particularly in milk plants, appear to be inaccuracy in measuring the sample and collecting samples from the bottoms of cans. Several new testers have appeared on the market and may be found described in catalogs of dairy equipment. Some of these testers are particularly adapted to field testing and some types, the Kendall for example, make use of a plunger or piston for rapid filtration of the milk. The author has not observed any variation in the results secured with different varieties of testers, provided identical amounts of milk are filtered through cotton discs of the same thickness and texture (and preferably of the same brand of manufacture). Very divergent results may be secured from the use of discs that are not uniform.

From a study of the literature it appears the earlier workers were interested in the test chiefly for fixing fairer prices at milk-receiving stations, although also as a means of determining the "sanitary quality" of market milk. The earlier writers on the subject were pretty well agreed on the close relationship between filth and bacterial contamination in milk. That a fairly clean milk after a few hours may have a high bacterial content unless kept at a temperature unfavorable for rapid bacterial growth, appears not to have been always clearly borne in mind. As a result of the experiments carried out, statements were made that dirt introduced into milk with particles of manure, hay, feed and the like was unpalatable; that it might be very dangerous because of the numbers and varieties of bacteria it carried; that the bacteria introduced with sediment might produce undesirable odors and flavors not only in the milk but in the milk products and that epidemics of disease traced to milk indicated that bacteria from dirt might even be the cause of sickness, particularly in the case of intestinal diseases of children.

As a result of exhaustive studies on bacterial contamination of milk, made at the New York and Illinois state agricultural experiment stations and elsewhere during the decade from 1910 to 1920, many of the older ideas regarding the influence of dirt upon the bacterial colony content of milk were not substantiated. Conn and Stocking (1903-05) had paved the way for this by their early studies on the bacteria in strained and unstrained milks. It was shown by Ruehle and Kulp (1915) that the numbers of bacteria getting into milk from the air even under relatively dusty conditions did not materially increase the germ content of milk; by Prucha and Weeter (1917) that even in a dirty barn it was possible to produce milk showing relative low plate counts, and by Prucha, Weeter and Chambers (1918) that the utensils, rather than the barn, were responsible for excessive bacterial colony counts in milk. The conclusions were reached by Ayers, Cook and Clemmer (1918) that the sediment test bore a somewhat close relation to the bacterial colony counts in fresh, unstrained milk handled in sterilized utensils, and that as the udders of cows became dirtier the bacterial content of the freshly-drawn milk increased. Their data, however, would indicate it was difficult for them to secure bacterial colony counts of about 20,000 until relatively large amounts of stable manure were added to milk samples so that it would seem their data is in rather close agreement with that of the other authors mentioned even though their conclusions are differently worded. Although barn contamination was shown by the investigations of that decade to be less of a factor in the production of milk of satisfactory bacterial quality than previously had been considered, it came to be generally recognized, as was pointed out by Harding, Breed, Stocking and Hastings (1917), that cleanliness was one of the essential elements of quality in milk and the sediment test began to be used to a greater extent than ever before.

The Standard Method

In the third edition of *Standard Methods of Milk Analysis* (1921) directions were incorporated for making the sediment test essentially as previously described by Schroeder and that technique, as slightly modified in later editions, has apparently rather generally replaced other suggested methods for estimating visible sediment. There is no evidence to indicate that the committee made any special study of the various methods that had been proposed by other investigators up to that time so it may be that important earlier suggestions have been overlooked.

There are several points that deserve emphasis regarding the method as it appeared in the third edition. The committee called attention that if the sample of milk had been clarified or strained the test became valueless and so it was of greatest use at milk receiving plants. They stated that dirt of any sort was sufficiently objectionable to be condemned solely on the ground that it was dirt. The statement was made that the use of the sediment test had usually resulted in a reduction in the amount of visible sediment accomplished in too many instances by greater care in straining or clarification; that is, in the production of "cleaned" rather than "clean" milk, but added the very pertinent statement that a proper combination of dairy inspection with the sediment test may be made a valuable means of securing clean milk. Any one of several types of filtering apparatus was allowed.

A photograph of five discs prepared as Schroeder had previously described (using quarts however instead of liters) was published in the third edition which was quite similar to the illustration given by Schroeder but inferior to it as resembling the discs usually obtained by filtering milk samples. The writer has been informed that the photograph first used by Dr. Schroeder had become lost and that a second, inferior one was furnished for use in *Standard Methods* that was not recognized as being different until after it had been used. It was stated where pint samples are used, standards corresponding to the smaller quantity of milk should be prepared. The directions are indefinite as to the use of the standard gauges but, at least in Connecticut, most laboratories prepared similar sets of gauges for use directly as standards by adding dirt to milk, and made no attempt to use a photographic standard.

In the fourth edition of the *Standard Methods* (1923) a slightly different photograph of discs was printed on a better grade of paper; underneath the discs appeared the words: "Clean, Fairly clean, Slightly dirty, Dirty, (and) Very dirty" instead of "Clean, Fairly clean, Moderately clean, Dirty and Excessively dirty" given originally by Schroeder, and the following legend was added which did not previously appear: "Standards for use in grading samples of unstrained or unclarified milk. Satisfactorily strained or clarified milk should show less sediment than is shown an Gauge No. 2."

Several changes appeared in the text of the fifth edition of *Standard Methods* (1927). The directions as given in the fifth edition were still left somewhat vague and ambiguous and some differences of opinion have apparently resulted in respect to the separation of the grades. Pint samples only were regarded as standard, and in the case of quart or other size of sample, it was required that the report state the size used. The directions for making the standard gauges were changed accordingly, and in addition the fourth disc was made to correspond to 7.5 instead of to 7.0 milligrams. Three sets of standard pads are illustrated that were each prepared in a different laboratory and that are very much alike, but quite different from those in previous additions. The author uses for comparing sediment discs in his laboratory photographs prepared from the originals of these negatives that are much more satisfactory as standards.

The Connecticut Modification

The modification of the test adopted for use in Connecticut in laboratories approved by the State Department of Health has been published by Mickle (1928) (1928a) and need not be much discussed here. During 1926 it was found that the standards in use in the various laboratories and prepared by following the directions in *Standard Methods* were far from uniform; that the sizes and colors of the dirt particles varied greatly from each other, and that quite generally the particles themselves were different in appearance from and larger than the particles caught on the discs in filtering milk samples received at the same laboratory; that very little milk was being examined that was graded other than clean; and that the directions in *Standard Methods* did not appear as specific as seemed necessary for Connecticut conditions where uniformity was especially desirable among approved laboratories frequently examining what were essentially duplicate samples.

A committee of approved milk laboratory representatives appointed to study the situation recommended certain modifications, interpretations and additional procedures which were not in direct conflict with the *Standard Methods* and those were adopted on January 9, 1928. They have been in use since that time and have been hailed enthusiastically by most of the laboratory workers using them in grading milk.

Author's Further Suggested Changes

As a result of experience with the modified technique in Connecticut the author (1929) has suggested additional changes in the standard method that would seem to render it more satisfactory for conditions in Connecticut which he believes cannot be very different from conditions generally throughout the territory where *Standard Methods* are in use for grading milk. These suggestions embrace:

1 The use of pint samples. Where absolutely necessary to use less, the size of sample to be stated plainly on the report.

2 It is not essential that the testers in use be uniform providing a standard cotton disc is adopted. There are many valid objections against the use of one type of tester under the various conditions that obtain in the central laboratory, the milk-plant laboratory and the field test.

3 All grading to be done against a photograph of standard discs prepared by a central agency and not against standards made by filtering milk to which different amounts of dirt have been added.

4 The entire disc to be returned to the dairyman because of difficulty of cutting many discs into two portions showing equal amounts of dirt.

5 No attempt should be made to grade as sediment any hair, piece of hay or straw or large particle of dirt. These should be reported separately.

6 Additional standards (Figure 6) are recommended, representing, respectively, .25, .50, .75 and 1.00 milligram of dirt per pint, as otherwise, nearly all milk as sold to the consumer will be classed as "clean."

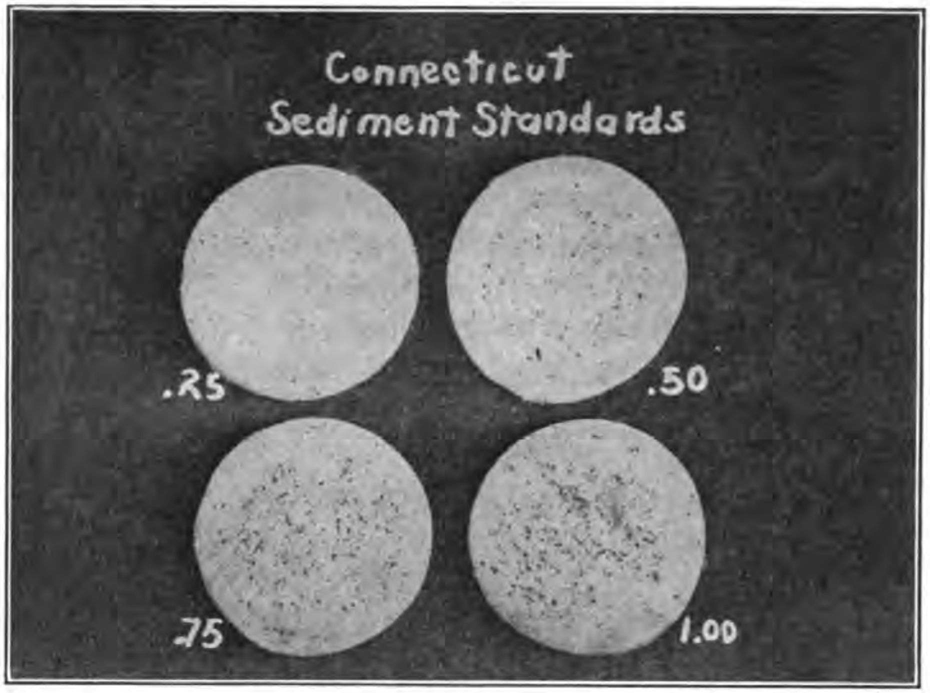

Figure 6. Connecticut sediment standards designed for present-day conditions to supplement those given in Standard Methods.

7 The descriptive terms in *Standard Methods* are not apt for use on bottled milk and should be changed. It is hopelessly confusing to have one standard for milk as sold to the consumer and another for milk as received at the milk plant.

TABLE 1

CHART FOR GRADING VISIBLE SEDIMENT IN MILK ACCORDING TO PROCEDURE SUGGESTED BY MICKLE

Terms Not to be Reported	Terms to be Reported	
Milligrams per pint	Sediment Score	Cleanliness Ratings
.00– .12	0	Clean
.13– .37	25	Fairly clean
.38– .62	50	Acceptable
.63– .87	75	Slightly dirty
.88–1.12	100	Dirty
1.13–1.77	125	Very dirty
1.78–3.75	250	Very dirty
3.76–5.00+	500	Very dirty

8 Since the term "milligrams per pint" is not strictly accurate, is cumbersome and is often misunderstood, it is suggested it be

abandoned in place of the term "sediment score." A table for use in grading is appended. (Table 1.) No "sediment score" should be reported within closer limits than the eight figures given in the score. Samples should always be reported *both* in terms of the "sediment score" and by one of the descriptive terms for "cleanliness rating."

Summary

The history of the development of the sediment test for undissolved foreign material in milk is reviewed. The standard method of making the test and the modification adopted for Connecticut approved health laboratories and recently published by the author are discussed. In the light of recent experience further changes seem desirable. The present procedure of reporting dirt in terms of "milligrams per pint" is inaccurate and cumbersome. Reporting by a "sediment score" and in "cleanliness rating" descriptive terms is offered for consideration.

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REPORT OF COMMITTEE ON MILK PLANT PRACTICE

DR. H. A. HARDING, *Chairman*

Your committee is mindful of the fact that practices in milk plants change but slowly and that even where such modifications are taking place a number of years are required before they can be said to have come into general use.

BUYING MILK ON QUALITY

In 1913 the Committee on Milk Quality of the American Dairy Science Association suggested that the elements which taken together made up the quality of milk were (1) richness or food value, (2) safety or freedom from pathogenic bacteria, (3) cleanliness or freedom from visible dirt, and (4) keeping quality or ability to remain sweet and in satisfactory condition.

During the succeeding 16 years this suggestion has continued to gain favor and is now fairly generally though not universally accepted. It has the merit of separating the qualities of milk into four reasonably distinct divisions for the majority of which workable standards of measurement are available. It is only as workable standards of measurement are available that the purchase of wholesale milk on the basis of its quality becomes practicable.

Richness

The Babcock test is the index of richness which has thus far been used in the purchase of milk. Such use began in the city milk trade about 1912 and now is all but universal practice. However, although this principle has been applied for 17 years the allowance made for each pound of fat varies from 29 cents to one dollar per pound in different parts of the territory, forty to fifty cents being most common.

Safety

In stimulating improvement in the safety of the raw milk supply there have been many instances where the plant management offered an increase in price, commonly 10 cents per hundred pounds, for milk produced from tuberculin tested herds. In many cases such offers were continued only for a year or two, until the producers had entered into the tuberculosis eradication plan. This failure to continue this increased price is looked upon by some of the producers, at least, as an evidence of bad faith and has tended to make them suspicious of later offers to modify the wholesale price on the basis of the quality of milk delivered.

While the movement to obtain the milk supply more generally from cows which have successfully passed the tuberculin test is commendable, many of the attempts to sell such milk to the consumer as safe milk are very regrettable and in some cases border closely upon fraud.

Cleanliness

The sediment test is the only available test for measuring the amount of visible dirt in the raw milk as it comes to the milk plants. The results from this test are used in two slightly different ways. In a large number of instances the sediment pads are shown to the producers and moral suasion is exerted in various ways to induce them to produce a clean milk. In a limited number of plants these sediment pads are reduced to classes and the price of the wholesale milk is modified on the basis of class into which the sediment pad is placed.

The progress of this practice is hampered by the lack of satisfactory standards to be used in classifying the sediment pads. Photographs of typical sediment pads have been furnished from a number of sources and these are the best standards now available. Agreement upon and development of satisfactory dirt standards is a necessary step in the more general use of cleanliness in modifying the price of milk. Observations already made seem to agree that a bonus of 10 cents per hundred pounds properly applied is sufficient to stimulate the general production of a very clean milk. This can probably be accomplished under proper management at a still lower figure.

Keeping Quality

The earlier attempts to apply a financial stimulus to the production of milk with a better keeping quality upon the basis of bacterial counts dates back at least to 1910. This has been continued in various ways to the present time and price of considerable volumes of milk is now being modified upon the basis of such determinations. Both bacterial plate counts and direct microscopic determinations are being used. The expense connected with such determinations and the technical difficulties involved have resulted in such measurements being restricted to the higher priced milks.

Evidence continues to accumulate that the methylene blue reductase test is a very satisfactory basis for determining the keeping quality of the raw milk supply and its use is spreading among both milk inspectors and milk plants. When using it as the basis of modifying the price of milk as delivered it is common practice to follow the method suggested by the American Public Health Association, taking Class 2 as the quality to be expected and paying a bonus for Class 1 milk.

To produce the desired results most economically the bonus offered should be slightly more than the expense connected with securing it. During the colder months there is ordinarily little expense connected with producing milk of excellent keeping quality while during July and August such expense is considerable. The problem of adjusting the amount of bonus to the requirements of the case is not solved as yet but is being attacked in various ways.

Standardization of Milk

This practice is very widespread among milk plants. It is rarely detectable by laboratory methods and it is impracticable to control it by inspection. It would seem best handled by requiring on each package a statement of the fat content of the milk and specifying that the contents of the package must be fully up to the statement as is the law in Ohio.

Recording Thermometers

The requirement that recording thermometers on pasteurizers should be provided with an open one degree scale throughout the pasteurizing range has become very general and apparently is satisfactory in connection with plant operations. The State and City of New York now require that in addition to the one degree scale in the pasteurizing range such recording thermometers shall also have sufficient range to record the temperatures reached in the apparatus during the preliminary heat treatment preparatory to pasteurization. This requirement calls for two different types of graduation on the thermometer. This matter has been the basis of considerable discussion during the year and is being continued.

Self-Draining Leak Detector Valves

Experience with the steam heated leak detector valves in milk plants has not been entirely satisfactory. Considerable difficulty has been experienced in connection with their operation and it is to be hoped that a more successful valve will be developed.

Heat Treatment of Milk Bottles

There is a growing appreciation of the effect on cream development of putting cold milk into a cold bottle. Particularly in the case of the single tank soaker type of bottle washer, facilities are not available for both heating and cooling the bottles properly. Largely on this account recourse has been had to the use of chlorine upon these low temperature treated bottles.

It should be remembered that tests of the tubercle bacillus show that it is very resistant to the destructive action of both alkali and chlorine. Results of similar technical tests of the other pathogenic bacteria do not seem to be available.

While health authorities are commonly permitting the use of chlorine in lieu of temperature treatment there is a growing feeling that closer attention to the temperature treatment of milk bottles is desirable.

Finger Capping of Bottles

Increased safety of milk is closely connected with preventing contact between humans and the pasteurized product. In practically all plants there is the filling of small orders from bulk. In a large proportion of such cases such bottles are finger capped. The use of hand cappers should be required in all such cases.

Milk Stone on Coil Vats

The formation of milk stone on coil and similar vats and on hot surfaces in contact with milk is one of the serious problems in many milk plants. Such deposit is unsightly, its removal is a matter of labor and expense, and its presence is believed to favor the development of heat loving bacteria in connection with the process of pasteurization. It is most commonly observed in connection with coil vats but is found on practically all surfaces where milk comes into contact with metallic surfaces which are much hotter than the milk.

Experience indicates that milk stone formation can be readily controlled on coil vats by the use of a pumped circulation of water in the coils, such water to be not above 160°F. and preferably even lower in temperature.

Sanitary Supervision of Workmen

Experience in connection with the production of certified milk indicates the practicability of requiring of all workmen a medical examination accompanied by laboratory tests of swabs from nose and throat and of bodily secretions to be repeated at intervals of six months. Repeated instances of epidemics caused by typhoid and other carriers among plant workmen make evident the need of similar supervision of the health of all persons whose activities bring them into contact with the milk, particularly those coming into contact with the milk after pasteurization and before it is capped in the bottle.

DEVELOPING EFFECTIVE MILK SUPERVISION IN A SMALL OREGON MUNICIPALITY

J. E. Blinkhorn, *Dairy and Food Inspector*
Marion County Health Unit
Salem, Oregon

Previous to April 1, 1928, the city of Salem, Oregon, had a milk ordinance, which was passed in 1912, with the enforcing power in the hands of a single sanitary inspector whose duty it was to answer all calls ranging from complaints concerning dead cats and plugged sewers to requests for food and milk inspection. Since the city had a population estimated at 28,000 the one inspector could not develop effective milk supervision. Consequently, by 1928 practically the only inspection given the producers and distributors was the regular state inspection coming about three times every two years.

In the spring of 1928 Salem and Marion county were in the fourth year of the Marion County Child Health Demonstration, one of four demonstrations conducted by the Commonwealth Fund in the United States concerning itself with public health especially in those aspects which most affect the child. Inasmuch as a good milk supply was considered important a full-time milk inspector was secured April 1, 1928. The inspector made a survey of all the conditions of the industry and became acquainted with all the distributors and many of the producers. Late in June the services of an eastern milk specialist who has requested that his name be withheld were obtained for a month to assist in the organization of an efficient system of supervision. The local inspector feels very much indebted to this man for the sound and practical system he advocated.

The general requirements of the City with regard to milk supervision having been found, a local ordinance was drawn up, at the advice of the milk specialist, very similar to the United States Public Health Service Standard Ordinance. The local ordinance differed from the standard mainly in the procedure in obtaining a license, the fees and in the lack of several definitions. The Salem ordinance also recognized only Grade A Pasteurized, Certified Raw, and Grades A and B Raw.

This ordinance was submitted to a gathering of all the distributors, several of the councilmen and the city attorney. Approval of the general plan of the ordinance was secured and the ordinance was then introduced into the city council. Some objection developed to the clause subjecting even one cow dairies to inspection. This was overcome, however, and the ordinance passed July 16, 1928.

Immediately letters were sent out to producers and distributors informing them of the passage of the ordinance and pointing out some general points that were of prime importance. These were followed by personal calls to talk over what was necessary in each particular instance and to leave a written notice of alterations necessary.

Our supervision of the distributors includes the obtaining of samples from the delivery wagons once a week, samples which are tested in a local laboratory for butterfat, solids not fat, bacteria and sediment. During the hot season, especially, the distributors' milk is tested for adulterants in the form of preservatives. This extra test was thought advisable after one man was found using hydrogen peroxide, evidently as a preservative. The taste of the peroxide in the milk revealed his practice. Since then we have tested for various preservatives at intervals. If results of any of the tests are not what they should be, the inspector cooperates with the plant foremen in tracing the trouble. Inspections are made of the plants, and the plant practices are watched at least every ten days. At frequent intervals in the course of these visits the recording thermometer charts are checked, and the accuracy of the recording and other thermometers checked against a pocket thermometer accurate to one-tenth of one degree. Temperatures of milk on the delivery wagons are tested and are kept under 50°F. Besides the regular inspections of the milk line an occasional check on condition of equipment, temperature of wash waters, strength of chlorine solution and on the observance of ordinary good plant practices in the pasteurizing room are made.

In work both with the producers and with the distributors, inspection is done with a "yes and no" type score card, and in our section this score card has been successful. No one wants a check mark in the "no" column, and each individual exerts himself to get a clean sheet. In addition to frequent use of these cards, verbal encouragement, warning and praise are given as the individual case permits.

Control of the milk producers is the most difficult problem since the average herd numbers only seven producing cows. The milk shed embraces the country around Salem within a radius of twenty miles and overlaps part of the Portland milk shed. Sediment and methylene blue keeping quality tests, however, are made monthly on each producer and the results are reported back to him. We feel that the use of these tests has given us a very good idea of the quality of each producer's product. At the same time it has cut down the number of producer inspections during the summer which gives us more time to devote to control of the distributors at the season when they need it most. We have found that the cause for milk falling into Grades 3 and 4 is poor cooling. To meet this situation we have tested out and are recommending a system of cooling that is inexpensive but invariably puts the milk in grade 1 or 2. We believe the methylene blue test supplemented with the sediment test is the foundation of improvement of producers' milk. We have seized an opportunity to do a little educational work by writing a mimeographed monthly letter one corner of which contains the sediment pad and keeping quality test results. The letter deals with items of seasonal interest to the dairyman such as proper cooling of the milk, cleanliness of cows and so forth. Any general announcement that we wish to make is written into this letter. These letters seem to be getting worth-while results. Inspections of the producers' supplies are made at least twice a year and if the methylene blue test gives a result of grade 3 or 4 according to Standard Methods, the producer is called on and given advice as to the necessary changes. In nearly every instance improper cooling is found to be the cause of such a low grade. Milk falling in grades 3 and 4 is classed as unsatisfactory and is gradually being eliminated. The inspector travels over 1800 miles each month in making the necessary inspections. On the routine calls the inspector checks over the producer's equipment, pointing out the places where improvements are necessary.

All laboratory work is done by a local laboratory under contract to the Marion County Health Unit for all county public health laboratory work. This laboratory does the bacterial tests, but not the methylene blue tests, and analyses of the laboratory specimens taken in connection with the health examinations of milk handlers. These examinations at the present time consist not only of physical examinations and the recording of history of communicable diseases suffered, but also include, routinely, throat and nasal swabs which are examined for possible streptococci and for diphtheria, stool cultures for typhoid and Wassermann's for venereal diseases. The first examinations made included only the thorough physical examinations and the throat swabs, but additional investigations mentioned above have been found advisable. So far no carriers have been found but the examinations are regarded as a good precautionary measure. Examinations of milk handlers in distributing plants have been completed and those of the producers and their employees are being carried out as fast as the health officer has the necessary time available. The laboratory has also tested local water samples from dairies, has made tests for adulterants and preservatives in milk samples and has obliged with carrying out some simple research problems later used educationally.

We have just passed the eighteenth month of supervisory work under the ordinance and this period of time has made marked changes in Salem's milk supply and the methods by which it is handled.

In regard to the milk itself, the number of one cow raw milk producers has been reduced nearly one-half. This has made the general supervision easier and more complete. The quality of pasteurized milk has risen for in 1927, the year before local inspection started, the state inspectors found only 60 per cent of the pasteurized milk had bacterial counts under 25,000 per c. c. as compared in 1928 and during this year with 100 per cent. Likewise the state survey found that only 43 per cent of the raw milk had counts under 25,000 while in 1928 this per cent was raised to 50 per cent and has continued to increase so far this year. As to sediment, 44 per cent of the samples were found to be clean in 1927, 80 per cent in 1928 and 96 per cent in 1929. The bacterial counts were determined for the most part by the laboratory mentioned above, but have been checked at intervals with the State College laboratory for accuracy. In most instances the State College counts were lower than the municipal counts.

The use of pasteurized milk has been steadily on the increase. When inspection started early in 1928, 75 per cent of the milk supply consumed was pasteurized milk. By January 1, 1929, the precentage had increased 10 per cent and by September 1, 1929, the percentage was 89 per cent making a total increase of 14 per cent in eighteen months. This has been due partly to public opinion following several cases of undulant fever and partly to the activities of the doctors and nurses, both in the County Health Unit and out, in favor of the pasteurized product.

This occurrence of undulant fever was suddenly found in eight cases at the state tuberculosis hospital. Reactions to both *B. melitensis* and *B. Bang* were found in most of these cases. All had a history of drinking milk for some time from a herd of cows badly infected with contagious abortion. Pasteurization of the milk supply was ordered and no more cases were observed. Since then several sporadic cases have occurred with history of handling infected animals or drinking milk from such animals. This has helped the campaign for abortion tested herds and for pasteurized milk.

Milk houses have increased in number. When milk supervision started in 1928 there were only twenty-five milk houses found among the one hundred and fifty producers, and several of the distributors were using the back porch as a milk plant. Now there are over eighty milk houses on producers' farms and all distributors have milk houses used for milk handling alone. We have noted that wherever a milk house has been built and properly kept a considerably better product has resulted, probably because of correspondingly increased interest in the milk quality.

Although it has been the policy of the Health Unit to subordinate the demand for better equipment to that for better methods considerably better equipment is being used. An example of this is the barns. Many of the barns have had to be altered to exclude horses. Floors have been made watertight and gutters have been put in. Several new barns have appeared here and there and in every case the new barn is built according to requirements.

The largest improvement has been evident in the milk plants. All plants now have mechanical cappers whereas in 1928 40 per cent of the raw milk plants capped by hand. No caps are bought in bulk. Instead they are purchased in the sterile tube container. This was done by only 40 per cent of the raw milk plants before inspection began. Cooling systems adequate to cool the milk to at least 50°F. have been installed in every plant while previously the cooling was seldom below 60°F., especially in the raw milk plants. Some of the raw milk dealers did not cool the milk at all. All milk is being labelled either Grade A Raw or Grade A Pasteurized, which eliminates a large number of meaningless "special" quality labels. As far as we have been able to ascertain, after diligent inquiry, Salem is the only city in Oregon actively grading the milk supply. Beginning March 1, 1929, all distributors have been given Grade A ratings, and in only a few cases was even the threat of degrading necessary. This is due to the hearty cooperation of all the distributors with the inspector in the matters of equipment, methods and inspections of producers' supplies.

All the vats used for pasteurizing the Salem milk supply are equipped with recording thermometers and with flush valves. Neither of these devices were on any vat in Salem prior to inspection and they had been regarded as unnecessary. They are now regarded by the operators as being nearly as essential as the vats themselves. The recording thermometers are being checked by the inspector for accuracy and the charts are checked for proper holding. Other new plant practices in addition to proper pasteurization have helped improve the quality of the milk. Sterilization of the pipe line with steam and also with chlorine is being practiced by several plants. The bottle washing machines are watched to see that proper temperatures and strengths of solutions are used. Several of the plants used a chlorine rinse at high temperature. Temperatures of refrigerator rooms are observed.

An educational campaign among the producers has been carried on since May 1928 by means of what we term milk letters. These were mentioned before as being the instrument to carry the sediment and reductase test reports to the producer. The letters have been supplemented by talks to groups of school children, women's clubs, Parent-Teacher associations, granges and other organizations. The inspector has had the privilege of conducting several groups and numbers of individuals through some of the pasteurizing plants, explaining each process in detail. The visitors are always astounded by the industry itself and also express surprise at the extent of the milk supervision work.

With the cooperation of the distributors and producers much has been accomplished in the last year-and-a-half. But much remains to be done to bring the quality to the standard which should be maintained. We feel that we have the right basis for effective control and that our future program will be an elaboration of the present work. With a continuation of the cooperative attitude among the distributors and producers and with a little more time we expect Salem milk to take its place with the best quality milk anywhere.

REPORT OF COMMITTEE ON METHODS OF BACTERIAL ANALYSIS OF MILK AND MILK PRODUCTS

GEORGE E. BOLLING, *Chairman*

Twenty years ago many of us milk inspectors were perturbed lest too much milk should be pasteurized; now the reverse is true. Nevertheless, occasions might arise when we would like to assure ourselves that certain milk is not pasteurized but is in reality what it purports to be—raw milk. With this in mind, the efforts of this committee this year have been devoted to trial of a differential staining method that might prove useful for the identification of pasteurized milk.

Such identification by means of staining reactions must necessarily depend upon changes brought about in the body cells or in the bacterial sells that have been killed by heat, the difference in appearance to be made clearly visible by means of some differential stain. A few investigators have attempted to find a staining procedure that would be satisfactory.

Dr. W. D. Frost, of Wisconsin, was apparently the first in this country to report upon a series of studies on the use of a stain to distinguish pasteurized milk. His work was reported at the Ninth Annual Convention of the International Milk Dealers' Association in 1916.

The method consisted in adding 1 part of a dilute aqueous solution of methylene blue to 5 parts of milk. The stain was left in contact with the milk for 15 to 30 minutes and then the mixture was centrifuged. The precipitate was smeared upon a glass slide, allowed to dry and examined. The differences noted by Dr. Frost are as follows:—

1. *Raw milk.* Entire field stained light blue. In this blue background appeared numerous clear areas. The smaller areas represented fat globules and the larger, for the most part, the leucocytes, because living leucocytes in raw milk are colorless; they are not stained by this method.
2. *Heated milk.* Background not stained so deeply. Leucocytes are stained more deeply blue. Apparently the leucocytes are the only body cells to be thus affected.

Doctor Frost claims that this method was suitable to detect the influence of heating at 140°–145°F. He further claimed that the bacteria in raw milk were stained while those in pasteurized milk were not stained. Doctor Frost suggested the possibility of confusion arising from the fact that mononuclear cells all stain readily in raw milk, while the polymorphonuclear cells do not. There could easily be some difficulty in distinguishing between the two in heated milk.

A Frenchman, Proca, in 1909, noted that dead bacteria stained previously by Loeffler's methylene blue, lose the blue color and become red under the influence of a 10 per cent solution of carbol-fuchsin poured rapidly over the preparation. Treated by the same process, the bacteria of a living culture do not give up the blue dye which they have fixed. Apparently this stain was tried out on cultures suspended in physiological salt solutions or in a 1 per cent broth, which is quite a different proposition from the staining of bacteria in milk with its ¾ per cent protein content.

Miss Beattie, of the University of California, reported in 1927 (*American Journal of Public Health,* October, 1927) a series of studies on the use of Proca's stain in differentiating living and dead bacterial cells in milk. She found that with smears of milk made according to the original method of Breed and Brew the background remained a deep blue and that enumeration of the bacteria was impossible. After trials of various modifications she obtained the best results from thin smears of milk (0.01 c. c. over an area of 4 sq. cm.) and a more concentrated stain than Proca's.

The method follows:

Glass slides ruled with two squares of 4 sq. cm. each were placed on the frame of an electric stove. The stove was leveled and freshly cleaned glass slides placed over the ruled slides. A 1/100 c. c. milk pipette (Bausch and Lomb) was washed in cleaning fluid (sulphuric acid and potassium dichromate), rinsed twice in fresh water and rinsed out with the milk sample. The rinsing water was in test tubes and a separate tube of water was used at each rinsing. The sample of milk was spread over the area marked on the slide by a stiff needle set in a metal handle. The needle was flamed between samples. The films were allowed to air-dry but if longer than 10 minutes was required for the process it was assisted by gentle heat from the stove. The dried films were immersed for 20 minutes in a mixture of equal parts of ether and alcohol. The films were then air-dried and immersed from 1 to 3 minutes in a mixture of 8 c. c. concentrated carbol-fuchsin with 100 c.c. Loeffler's methylene blue. This stain differs from Proca's in that the 100 c.c. of distilled water is omitted from the mixture.

The dried, stained smears were examined under the microscope by artificial light with a blue glass below the condenser. A 170 mm. tube length, oil immersion lens and No. 5 ocular gave a factor of 1,200,000. For each sample of milk 300 fields were counted, the sum of the organisms in these multiplied by 4,000 gave the number of organisms per c. c. Counts of the individuals and the groups of bacteria were made.

She claimed this staining process gave a bright red background against which both dead and living bacteria could be easily differentiated, red in the former and blue in the latter instance, and concluded that Proca's stain gives a lower count with pasteurized milk than does methylene blue since the latter does not differentiate between living and dead organisms. This method was tried out by several of the committee with, we regret to report, rather indifferent success as far as confirming this author's conclusions. Plate counts were used as checks on the direct counts.

In general it was found that the so-called "living" bacteria stained blue but "dead" bacteria did not stain either red or blue. One of us (Dr. W. H. Price) thinking that organisms might be too few in regular milk to disclose full utility of the test, made slides of Acidophilus Milk known to contain about 700,000,000 organisms per

c. c., and also slides of the same after heating; the results being the same as for the regular milk.

This confirms the observations of Dr. R. S. Breed in his studies of thermophilic bacteria in pasteurized milk; he found that practically all of the bacteria present in the raw milk lose their staining power and disappear from the pasteurized. Furthermore, as pointed out by the same writer, it must be remembered that in staining bacterial slides all of the bacteria are really dead when the stain is applied.

The conclusion of your committee is that the method investigated cannot be used for the detection of pasteurized milk.

As empowered by 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.

REPORT OF COMMITTEE ON EDUCATIONAL ASPECTS OF DAIRY AND MILK INSPECTION

PROF. J. D. BREW, *Chairman*

Two years ago your committee submitted a report upon the Educational Training of the Dairy and Milk Inspector Himself. This phase of the general subject "The Educational Aspects of Dairy and Milk Inspection" was dealt with first because it was agreed that it was fundamental. It was obvious that an inspector who was to educate others must himself have adequate education, training and experience.

Certain educational requirements were set forth as an ideal. It was recommended that the man selected as dairy control official should be a graduate of an agricultural college or of an accredited veterinary college and as a part of his regular work he should have intensive training in certain specified fundamental subjects.

Unfortunately in many municipalities the position of "dairy or milk inspector" is not taken as seriously as the responsibilities connected with such a position, demand. The need of adequate training will be more fully appreciated when one takes into consideration the character of the contacts which a dairy control official must make. These are given in the following paragraph which is copied from the report submitted at the Toronto meeting in 1927.

Dairy inspectors must meet dairy farmers of all degrees of educational training; the health officer and his assistants and other members of the medical profession; the courts and members of the legal profession; the representative citizens of the community who are interested in important community problems, of which an adequate, safe milk supply is one of the most important; the leaders in community enterprises; chambers of commerce; public welfare organizations, such as the Red Cross, women's clubs, and the Parent-Teacher Association; city and village officials; business men, and operators of dairy plants. The dairy inspector should be able to meet the individual or the group. He should understand their point of view, and in his work get results without making enemies. This demands, in addition to technical training, both tact and a pleasing personality.

It was also suggested in this report that the title of "dairy and milk inspector" was open to criticism because it did not properly indicate the true responsibility of this profession or the dignity that it justly deserves. Several more appropriate titles were suggested. It is hoped that the International Association of Dairy and Milk Inspectors will give serious attention to this suggestion and that each member will begin to actively develop sentiment in this direction.

The report at the Chicago meeting in 1928 emphasized and suggested methods whereby men now engaged in dairy and milk inspection work could expand their own knowledge.

Anyone who has an opportunity to meet with large numbers of inspectors throughout the United States and Canada, soon becomes impressed with the fact that real progress is being made in the selection of sanitary milk control officials with reference to training. The men in the field of sanitary milk control at the present time are better trained men than were those of a decade or more ago. The growing appreciation, which is observed everywhere, of the importance of sanitary milk control makes it practically certain that greater attention will be given the training of the future dairy control supervisors. The facilities for self-improvement are far in advance of those of a few years ago, and there is every reason to believe that the rank and file of the present day supervisors are taking advantage of these opportunities.

It is believed that our association should direct its attention from now on to the educational aspects of dairy and milk inspection which was the original purpose for which this committee was appointed. In this title is involved primarily the type and character of information to be disseminated and the method of presentation.

The following information is believed to be of special interest to the various groups and regarding which a well trained supervisor should be able to give constructive help based upon facts.

A. CONSUMER

1 The aims of sanitary control.
2 The true meaning of the various grades or classes of milk.
3 The relative safety of raw milk supplies as compared to pasteurized supplies.
4 The proper care of milk in the home.

B. PRODUCER

1 The factors that are directly correlated with the bacterial quality of milk and milk products.
2 The aims of sanitary control.
3 The true meaning of the various grades or classes of milk.
4 Dairy barn ventilation.
5 Dairy barn construction and arrangement.
6 The proper construction of milk houses and cooling tanks.
7 The importance of properly waterproofed insulation in milk tank construction. The proper size of cooling tanks. The amounts of ice required to properly cool a given amount of milk.
8 The use of cleaning solutions, of hot water and of disinfectants such as hypochlorites and the like in the cleaning of utensils.

9 The economical generation and effective use of steam for sterilizing dairy utensils.
10 The necessary precautions that will aid in reducing to a minimum all possibilities of infecting the milk supply.

C. MILK PLANT MANAGEMENT

1 Types of pasteurizers and operation.
2 Cleaning and sterilizing milk plant equipment.
3 Exact sources of bacterial contamination and high counts.
4 The use of cleaning compounds.
5 Milk plant equipment.
6 The more fundamental facts regarding milk plant construction, arrangement of equipment, lighting and ventilation.
7 The fundamental principles of refrigeration.
8 The necessary precautions that will aid in reducing to a minimum all possibilities of infecting the milk supply.

The most effective method for disseminating most of the information, as has always been true, is through personal contact at the time of regular inspections. Such information should be based upon facts capable of demonstration. A tactful supervisor who is able to present his ideas effectively should seize all opportunities to appear before public groups. The printing and distribution of small leaflets has proven an effective method in some places. It is better to treat one important topic in a single leaflet and such presentation must be simple, concise and right to the point. A well directed newspaper publicity is another most effective method, but this method of presentation has its serious limitations. A spirit of cooperation must be fostered to the extent that the newspaper editors will refrain from all tendencies to sensationalism and to enlarging upon the more morbid aspects of the milk control problem and the printing of any information that may prove more injurious than helpful to the cause of safer milk supplies.

The committee believes that a well trained inspector will be able to make most effective use of these methods. It is also believed that wherever possible there should be held at least once a year a conference of all of the dairy control supervisors in a given area. This may comprise the whole state, or a part, or parts of two or more adjacent states. Such conferences should be devoted primarily to bringing to the supervisors technical information that will expand their knowledge and broaden their capacity to render a better service.

TUESDAY, October 8
10.00 A.M.

THE EFFECT OF HOLDING MILK AT LOW TEMPERATURES ON BACTERIAL PLATE COUNT

RUSSELL R. PALMER, *Chief Milk Inspector,*
and E. T. MCCUTCHEON, *Bacteriologist,*
Department of Health,
Detroit, Michigan

Scattered observations in connection with previous work on heat loving bacteria led us to make some observations about the effect on the plate count of pasteurized milk, of holding samples at various intervals before plating.

We are well aware of previous observations regarding the lowering of bacterial plate counts of pasteurized milk by prolonged refrigeration. However, it seemed desirable to determine to what extent counts would be influenced by delays in plating after the samples had reached the laboratory.

The routine method followed in Detroit for collecting samples for plating is as follows:

Milk pasteurized on one day is refrigerated at the pasteurizing plant during the night and is delivered to the consumers on the following morning. The inspector collects samples from delivery wagons during early morning, beginning about 5:30 A. M. These bottles of milk are kept iced and are delivered to the laboratory at about 8:30 A. M. Thus all of the samples have already been refrigerated for periods varying from 12 to 20 hours.

When the customary routine is followed the samples are plated immediately. However, occasionally something interferes with the routine in which case the samples are placed in an electric refrigerator at 42°F. and are plated later in the day.

The primary purpose of this study was to determine the effect on counts of variation in the time of plating in the laboratory. A further point studied included the determination of the effect of holding the samples under refrigeration for 24 hours in the laboratory before plating. Consequently, plates were made in the early morning as usual, six hours later and twenty-four hours later than the usual time of plating.

Standard methods were followed in the work and Difco Dehydrated Agar with a pH of 6.6 was used.

The samples thus plated numbered 105 representing 32 creameries. The results appear in the following table:

The column designated "Original Count" refers to the count as ordinarily made in connection with the milk control work of the Detroit Department of Health. The two columns under the heading "6-Hour Period" contain the counts that decreased or increased during the six-hour interval. Columns likewise indicate the counts of samples that decreased or increased during a 24-hour interval of refrigeration at 42°F.

BACTERIAL PLATE COUNTS OF PASTEURIZED MILK
AFTER REFRIGERATION OF SAMPLES FOR VARIOUS PERIODS

		6-Hour Period		24-Hour Period	
Plant No.	Original Count	Decreased Counts	Increased Counts	Decreased Counts	Increased Counts
1	6,000		15,000	6,000	
2	11,000	2,000		10,000	
3	3,000	1,000			6,000
4	35,000	19,000			40,000
5	24,000	14,000		10,000	
6	3,000		4,000		10,000
7	17,000	6,000		10,000	
8	20,000			18,000	
9	19,000			11,000	
10	3,000				9,000
11	18,000				44,000
12	150,000			65,000	
13	52,000			34,000	
14	10,000				12,000

BACTERIAL PLATE COUNTS OF PASTEURIZED MILK
AFTER REFRIGERATION OF SAMPLES FOR VARIOUS PERIODS—(*Continued*)

Plant No.	Original Count	6-Hour Period Decreased Counts	6-Hour Period Increased Counts	24-Hour Period Decreased Counts	24-Hour Period Increased Counts
10	8,000				14,000
15	9,000				24,000
16	2,000				219,000
16	4,000				17,000
5	40,000				43,000
17	40,000			26,000	
10	15,000			13,000	
18	12,000				41,000
19	38,000				46,000
20	5,000	2,000		1,000	
21	27,000	12,000		22,000	
2	34,000	17,000		10,000	
3	5,000	3,000			4,000
22	1,000		6,000	1,000	
23	7,000	5,000		1,000	
8	60,000		90,000	35,000	
24	35,000	20,000		6,000	
11	6,000	3,000		1,000	
25	12,000	6,000			50,000
26	34,000	31,000		22,000	
27	31,000	7,000		4,000	
12	48,000	26,000		20,000	
13	18,000	16,000		14,000	
28	53,000		63,000	6,000	
19	10,000	6,000		4,000	
14	6,000	4,000		4,000	
9	15,000	6,000		6,000	
11	35,000	1,000		15,000	
8	70,000	15,000		24,000	
10	16,000	10,000		12,000	
20	16,000	10,000		9,000	
17	110,000	50,000		16,000	
1	55,000	30,000		6,000	
15	150,000	20,000		6,000	
21	100,000	70,000		6,000	
23	185,000	90,000		6,000	
1	30,000	15,000		6,000	
10	8,000				10,000
6	16,000				18,000
2	24,000				40,000
3	60,000			11,000	
18	22,000				25,000
24	16,000				20,000
7	34,000			15,000	
25	45,000			20,000	
28	35,000			15,000	
12	8,000			5,000	
26	25,000			6,000	
13	45,000			15,000	
29	45,000			20,000	
30	165,000	135,000			250,000
14	38,000	17,000		5,000	

Bacterial Plate Counts of Pasteurized Milk
After Refrigeration of Samples for Various Periods—(*Continued*)

		6-Hour Period		24-Hour Period	
Plant No.	Original Count	Decreased Counts	Increased Counts	Decreased Counts	Increased Counts
31	25,000	16,000		20,000	
29	80,000		85,000		95,000
10	50,000	40,000			90,000
11	35,000	5,000		18,000	
25	85,000	65,000		50,000	
26	48,000	45,000		40,000	
12	11,000	10,000			20,000
27	10,000	8,000		8,000	
28	11,000	2,000			13,000
13	20,000	8,000		11,000	
31	12,000	10,000		8,000	
20	10,000		12,000		15,000
23	40,000	4,000		25,000	
22	16,000	6,000		4,000	
21	35,000	34,000		12,000	
15	30,000	16,000		18,000	
25	8,000	5,000			10,000
8	26,000	16,000		11,000	
11	38,000	18,000			56,000
9	21,000	20,000		14,000	
6	15,000	6,000		9,000	
7	24,000		65,000		29,000
14	15,000	14,000		12,000	
10	28,000	10,000		10,000	
17	250,000	25,000		50,000	
5	11,000	10,000			12,000
2	125,000	120,000			130,000
1	10,000	9,000			17,000
3	5,000		120,000		250,000
18	64,000		70,000	50,000	
10	9,000	8,000		6,000	
27	15,000	4,000		12,000	
28	175,000	160,000		90,000	
13	59,000	10,000		2,000	
12	18,000	15,000		9,000	
26	10,000	8,000		10,000	
29	24,000	21,000		16,000	
30	48,000	20,000		38,000	
32	35,000	15,000			60,000

On comparing the original counts with those made after a six-hour interval it will be noted that a decrease in count occurred in 66 cases and an increase in 10 cases. Likewise, 71 samples held for 24 hours in the laboratory showed a decrease, and 34 samples showed an increase, as compared with the original count.

These decreases are more significant in view of the fact that all of the samples had been refrigerated in milk plants for 12 to 20 hours before our original plate counts were made.

Discussion

Experience indicates that when a given sample of milk is plated after successive intervals there will be some variation in the counts obtained. Where these differences are due solely to accidental variations in the technic the number of cases of increased and of decreased counts should be equal. In considering the results obtained from the platings of samples after six hours' refrigeration it will be noted that a decrease in counts was met with in 87 per cent of the samples. When similar comparison is made with counts obtained after 24 hours it will be noted that there is a decrease in the case of 68 per cent of the samples.

From these results it would seem plain that holding samples of pasteurized milk at 42°F. leads to a reduction in their standard plate count.

Apparently, in handling milk samples which have already been refrigerateed for 12 to 20 hours, continuation of this refrigeration for 6 hours longer is accompanied by a distinct reduction in the bacterial plate count. When such refrigeration is continued to a total of 48 hours the results suggest that the bacterial plate count tends to increase.

Conclusions

The count which will be obtained from a routine plating of milk samples will evidently be modified by the length of time during which the sample of milk has been refrigerated, as well as by other factors.

Inasmuch as the conditions under which samples are necessarily taken from the wagons preclude the possibility of knowing the time during which the particular bottle of milk had been subjected to refrigeration, how is the laboratory to so handle these samples as to obtain comparable counts?

REPORT OF COMMITTEE ON FOOD VALUE OF MILK AND MILK PRODUCTS

PROF. IRA V. HISCOCK, *Chairman*

Milk has long been recognized as an indispensable food for children and a valuable food for adults. In recent years, more consideration has been given than previously to the food value and supervision of various milk products, including skim milk, dried and condensed milk, buttermilk, butter, cheese, and ice cream.

The report of the Committee on Serving Milk in Schools, Offices, and Factories deals with several recent projects of a research nature which suggest the value of milk for mid-morning or mid-afternoon lunches for these groups. One of the most interesting of these tests was carried on with a fairly large group of school age children and was reported in the *British Medical Journal*, January 28, 1928, and January 26, 1929. Children who received an addition of milk to their diet showed a rate of growth in height and weight 20 per cent greater than those not receiving extra milk accompanied by an improvement in their general condition.

Milk is a unique food since it furnishes some of all the material necessary for building tissue, and it also supplies energy for work and play and warmth. As emphasized by the U. S. Children's Bureau in its excellent pamphlet on milk (Folder No. 3, 1929) the need for all tissue-building material is greatest during early life, the period of most rapid growth. To quote from this pamphlet:

> Milk is an indispensable part of the diet of mothers who are carrying or nursing babies and of young children. As long as a child is growing, milk should be included in the diet. A pint and a half a day is a safe allowance of milk for an average child. Pregnant or nursing

mothers, infants after their first year, and many children need a quart of milk a day, but not more.

As pointed out in previous reports of this committee and by other publications, milk contains:

Protein for body building;
Minerals for blood, bone and teeth;
Vitamins for health and growth;
Fat and sugar for fuel.

Several reports dealing with vitamin factors have appeared in the literature during the past year. Studies have been made of the effect of the cow's ration on the Vitamin A and Vitamin B content of milk (Ohio Agri. Exper. Sta. Bul., No. 135, 1928). Comparisons were made from milk of cows on both a high and a low protein ration. Milk from low protein cows seems to contain less vitamin B than that from either high protein or normal cows tested. While some experimental work has indicated that the presence of Vitamin B in milk is not dependent upon the ration but is manufactured in the cow's paunch, the author concludes that this activity is influenced by the feed consumed and this may explain the difference in Vitamin B content in this test. It seems apparent, however, that a cow can tolerate a very low level of protein feeding without materially affecting the Vitamin A and Vitamin B of the milk.

Subsequent studies by the same author (Krauss, Ohio Agr. Exp. Sta. Bul., 14:57, 1929) suggests that milk from cows fed on a low protein ration that contained timothy hay was slightly more potent in Vitamin D than milk from cows fed a high protein ration containing alfalfa hay. Whether this difference was due to the kind of roughage, the manner in which it was gathered and handled to the stage of maturity at which it was cut, or to the presence of molasses in the low protein ration must yet be determined. The results obtained also indicate that cow's milk is a relatively poor source of the antirachitic factor, at least 23 c.c of milk being required to allow practically normal bone formation in rats fed on a rickets-producing basal ration.

An investigation of the effect of heat on the antineuritic vitamin of milk covers three types of dried milk.* In addition, tests were made of commercially pasteurized and home pasteurized milk, and of milk quickly boiled. (Daniels, Giddings, and Jordan, *Journal of Nutrition,* May, 1929).

Various mixtures of these preparations were given to suckling rats whose mothers were on high protein ration. Results indicate destruction of the antineuritic vitamin in some processes of superheating milk. Milk heated to boiling temperature quickly and cooled slowly is severely affected, while the same milk cooled quickly shows no adverse effect. The authors conclude that temperature and aeration are important factors in the destruction of the antineuritic vitamin.

The concentrated water soluble fraction of milk as a source of Vitamin B has been recently studied by Supplee and his associates (Jour. Dairy Sc., Sept. 1928) who find that the solids of the water soluble fraction, when properly prepared and concentrated, are highly potent in Vitamin B content and compare favorably with dried yeast as a source of the growth-promoting and antineuritic factor. These authors used white rats as experimental animals.

Underhill and Mendell have shown that there is a fat-soluble substance which prevents the development of a pellagra-like condition in the dog. (Am. J. Physiol. 83:589, 1928). When butter fat is fed to dogs suffering from the pellagra-like deficiency disease described by Chittenden and Underhill in 1917, these animals are quickly restored to a normal condition and may be

* The section on Food, Drugs and Nutrition of the *American Journal of Public Health* has been freely drawn upon for certain of these reviews, and grateful acknowledgement is expressed.

maintained in health for prolonged periods. The effective factor is apparently quite labile, for the potency is diminished by maintaining in cold storage during a period of 9 to 11 months. The presence of the potent factor in butter fat is associated with the color of the butter. As the color decreases the potency is diminished.

The last report of the Committee on Nutritional Problems of the American Public Health Association (Amer. Jour. P. H., May, 1929) contains the following interesting paragraphs:

> Among the somewhat diverse impressions as to particular articles or types of food (for in most cases the diet has been enriched in several ways at once), there is such a general consensus of opinion that dairy products are especially effective, that in parts of the South the Red Cross is reported to be combating pellagra by the lending of cows—an excellent educational device, but not to be taken as meaning that physical proximity of cow and patient is essential, for milk contains the needed factor or factors in sufficiently stable form so that the cow can function at any distance that may be economically convenient.
>
> Unanimity of opinion that milk is of high pellagra preventive value is equally consistent with any of the nutritional theories, because milk contains all the nutritionally essential factors, and is an outstandingly valuable source of nearly all of them.

It is commonly recognized that milk contains some iron but not enough. Leafy vegetables, egg yolk, liver, prunes, and beef supplement milk in regard to iron, and, properly prepared, should be given to young children.

Whole milk, cream, and butter are the most important and most economical source of Vitamin A. Another Vitamin D affects tooth and bone formation just as direct sunlight does. Milk fat may furnish a little of this vitamin but cannot be depended on to supply sufficient for the infant, but this may be supplemented with such fish fats as cod-liver oil. Other vitamins (B and C) are found in the breast milk of healthy mothers and in fresh milk from properly fed cows, but C may be scarce or even lacking in poor, stale or heated milk. But fresh fruits, especially oranges and lemons, and green vegetables, are sources of vitamins. Milk needs supplementing to supply certain minerals and vitamins, and after the early months of life for energy and roughage.

Whole milk is recognized as the best form of milk for the child, for all its parts—fat, sugar, protein, minerals, and vitamins—are necessary for growth. The U. S. Children's Bureau, in its new pamphlet No. 3 on milk, properly stresses the importance of safe milk and urges that no milk be used raw. "Ice cream, cheese, and all other milk products should be made only from pasteurized milk." It is also noteworthy that boiling milk, like drying or evaporating it, makes it easier to digest. Previous reports have discussed in detail the food value of butter, cheese, and ice cream.

REPORT OF COMMITTEE ON SERVING MILK IN SCHOOLS, FACTORIES AND OFFICE BUILDINGS

M. O. Maughan, *Chairman*

It is the purpose of this report merely to set forth new developments during the past year with reference to serving milk in schools, offices and factories. This is a progress report, following up similar reports of previous years.

New Developments During the Past Year

*Second Scottish Experiment**

A second experiment to determine the value of serving milk in school was conducted in Scotland by Dr. Gerald Leighton and Mabel L. Clark. The total number of

* Reported in *British Medical Journal*, Jan. 26, 1929.

children studied was 1,425. The centers at which the test were made were:

Peterhead	Glasgow
Aberdeen	Greenock
Edinburgh	Dundee
Belfast	

The ages of the children were 13 to 14, 9 to 10 and 6 to 7. At each of the seven cities, the children were placed in four groups. The first group received whole milk at school—the second separated milk—the third a biscuit ration of the same caloric value as the separated milk—and the fourth group had no addition to its diet and acted as a control. The daily milk ration was one pint for the ages 13 to 14 and 9 to 10, and three-quarters of a pint for the ages 6 to 7.

The period of the inquiry was from November, 1927, to June, 1928. The average fat content of the whole milk was 3.85 per cent.

1,157 children finished the experiment. This experiment was purely one to determine the value of a supplementary ration to the regular home food. The result, therefore, will be regarded as the effect of the additions of different quantities of milk to the average home diet of children of school age, living in ordinary working-class conditions in industrial centers.

The findings proved conclusively the "Great value of the additional milk ration to that already taken at home; this is true for all ages of school children. From the particulars gathered at the home dietary of 626 households, it would seem that the average milk consumption in the home was 2.5 pints per head, per week."

One very interesting result came out in this repeated investigation. In order to ascertain what would occur if two of the previous feeding groups were reversed, the group which in the first investigation received separated milk now received biscuit; another group which in the first investigation were "controls" now received whole milk. The general result in both cases was that they changed places, the former milk group now receiving biscuits fell to the biscuit standard, while the former control group now receiving milk rose to the milk standard.

Conclusions of Second Test

In the repeated test the average increase in height in the milk-fed groups in all ages combined is actually 1.21 per cent more than in the first test. The average increase in weight in the milk-fed groups in all ages combined is no less than 3.75 per cent more than in the first test; not only have the same milk-fed children benefited again but they have done so to a greater extent than before. Their initial improvement has continued over the second period.

Dr. C. A. Douglas examined all the children clinically when they were measured. Her report states:

In practically every case it was noted that the children receiving milk showed, even where there was obviously poor maternal care, that sleekness peculiar to a well-nourished animal, their hair had a glossy bright appearance, their nails were smooth, resilient and looked as if polished. General alertness was common to all the children fed on milk. It was gathered from teachers and janitors that the children receiving milk were much more alert and very much more boisterous and difficult to control than the others. This latter fact was only too evident when they were waiting in small groups to be weighed.

Dr. C. W. Simpson states:

The difference in nutrition between groups receiving milk and not receiving milk was plainly evident.

It is also seen that these increases are greater in this second and repeated test than they were in the first test (1927).

Editorial Comment

In an editorial in *The Lancet,* under date of January 5, 1929, the editor of this recognized medical journal says:

The good effects of adding milk to the diet were, indeed, even more obvious in the period covered by this second report than they were in the previous period, and it was significant that the improvement was mental as well as physical.

It is to be recalled that Dr. C. A. Douglas, one of the observing physicians, indicated that general alertness was common to all children fed milk.

When these results are considered along with those published by Dr. Corry Mann in England and those of observers in other countries, the only conclusion possible is that they have a wide public health significance.

Sir Leslie MacKenzie, Chairman of the Scottish Board of Health, says:

Two things are quite clear—

First—Medical examination and superintendence are essential conditions of any system of physical education.

Second—In the end the fundamental problem is one of nutrition . . . When every preventable ailment is prevented, and every serious disease treated to its finish, the new battalions of children coming forward have to be superintended from the nutritional standpoint.

Observations Made at Syracuse, N. Y.

Dr. George C. Ruhland, Commissioner of Health of the City of Syracuse, N. Y., has studied this problem of milk in schools considerably and has the following to say:

In general we might say that milk is a beneficial morning lunch for the children:

1 Who do not, for various reasons, drink milk at home.

2 Who come to school without breakfast.

3 Who will not eat the other necessary foods and drink milk at the same meal.

4 Whose rate of digestion is rapid and milk can be readily digested. That fruit juice or fruit is a beneficial mid-morning lunch for the children.

  1 Whose appetites are poor or who are at all "finicky" about their food.

  2 Who have plenty of milk at home.

  3 Whose rate of digestion is slow. The children would receive good food value from either lunch.

University of California Work

Dr. Agnes Fay Morgan, who has done considerable work in California to determine the relative value of milk and orange juice, is still at work. She is very enthusiastic over orange juice as well as milk. Nothing of special interest has developed during the past year.

The Journal of Agricultural Science

In reporting an experiment at the Reading Research Institute Journal speaks of milk as having, as it were, a catalysing action, allowing more nourishment to be obtained from other foods taken at the same time. In other words, the feeding value of milk is something beyond itself.

Observations at Fargo, No. Dak.

Miss Maud Brown of Fargo, North Dakota, in her careful study of nutrition outlines in her new book entitled "Teaching Health in Fargo" six recommendations for every child to follow each day—one of the six is "Serving milk in school to all children."

Milk in California Schools

Six years ago, in 1923, school milk service was started in Los Angeles. That year 80 schools were provided with some sort of milk service. Of the 340 schools now in operation in Los Angeles, 293 now have well established milk service. This is 86 per cent.

Those without regular milk service are small schools in outlying districts where individual families have their own cows and the children go home for lunch.

Research Experiment at The University of Chicago

During the past year, Miss Gladys Stillman, faculty member of the University of Wisconsin, in co-operation with The Milk Council of Greater Chicago, did research work at the University of Chicago to determine whether or not the serving of milk at mid-morning affected favorably or unfavorably the appetite of the child at noontime. She studied 18 children of preschool age. All children were kept at the same institution so their food intake and reactions through the entire day were carefully observed. In brief, she found that the serving of milk in mid-forenoon did not unfavorably affect the appetite for the noon-day meal; she is of the opinion that it is decidedly an advantage. This experiment is of great value in that many have held the contrary.

Serving Milk in Factories

Factory milk service is still on the up-grade. Prohibition has been a remarkable force in bringing about a decided use of milk in the factory; along with prohibition should be listed improved quality of milk and third, the constructive advertising put out by the various individual dealers throughout the United States, along with co-operative work which is being done by dairy bureaus, milk councils, dairy councils and other cooperative agencies.

It is almost amazing to see the amount of milk being consumed in our factories today. We believe it can be safely said that fully 50 per cent. of the factory workers now drink milk—either at mid-morning, noon, or mid-afternoon.

Milk dealers can well afford to follow up this activity, especially after they solve their bottle loss problem.

Recent Report From Huntington, Indiana

Edith M. Hawley of Huntington, Indiana, has been a very remarkable character in stimulating milk service in factories. Her city is one of the pioneer cities in the United States in instituting the mid-session milk lunch. This mid-session includes mid-morning service and also afternoon service. In the little town of Huntington, Indiana, they have five small factories which now use over five thousand bottles of milk each week.

According to Edith M. Hawley, there are two problems in getting milk drinking established in the factories. The first is to convince the executives that rather than being a time-waster, it is an efficiency aid. The second is to find some method of distributing the milk.

It has been found that if one can convince the presidents or superintendents of the factories of the efficacy of the plan that there is no difficulty in getting the employees, from white collar workers in the offices down to the men in their overalls, to join the milk brigade.

Charles Brown, Superintendent of the Huntington Shoe and Leather Company, recently said:

> We are convinced that the efficiency of the men is increased by the use of milk at mid-morning, especially. They used to get hungry, to slow up their work and to begin watching the clock before the morning or afternoon was half gone. Now the milk appeases their appetites and the few minutes respite makes the day seem shorter. We find that there is less tobacco used by the men, no more sneaking down the fire escapes to buy near beer and soda water, no more demands of the industrial nurse for stimulants of hot ginger or bromo seltzer. The factory also gains by not being compelled to hire so much substitute labor as the health of the employees is better. If a factory insures its men for sickness, the milk is a financial aid. The employees are also put in a happier frame of mind by being allowed a few minutes in which to drink their milk and the feeling of good-will is strengthened between employer and employee.

Milk in Offices

The milk lunch in offices is working effectively in thousands of offices throughout the country today. It started at the suggestion of heads of departments as a remedy for fatigue and fainting spells of office girls who often came breakfastless to work and who seemed to lunch on confections and pink drinks. Without any charitable or welfare object, these business executives set out to build up more stamina in their workers. They were successful.

Nothing new has been observed during the past year, except a steady increase in the use of milk in offices.

General Interest

Dr. James A. Tobey, in a recent article appearing in the *American Mercury*, July, 1929, points out that Professor Sherman reported an experiment to the National Academy of Sciences last November, to the effect that 400 rats were studied, using different dietary habits. Particularly were they interested in the study of the longevity of life. "The result of doubling the amount of milk was a gain of exactly 10 per cent in the span of life for both males and females. Translated into human experiences, Dr. Tobey says this study indicates that at least six years could be added to the span of life of human beings by means of proper nutrition. The fluid in the fountain of youth is pure milk, and nutrition, in proper combination with other sanitary and hygienic factors, can actually promote longevity."

Conclusion

1 Milk in the schools is still a problem. Some schools are sold on it, as in Los Angeles, and other schools are not. There is real need for work to be done. Some authorities feel that all children should have milk at mid-morning recess time, and others feel that only the seriously undernourished children should get it, that school is not a place for dispensing food, but a place to teach health habits, etc., and to check up on the children's use of milk at home.

2 Factory milk service is forging ahead nicely. It is proving its value in a very tangible manner.

3 Milk for office-workers is on the up-grade. Many office-workers who are located in buildings with restaurants, find it advantageous to get a drink of milk,

malted milk, or buttermilk at mid-forenoon and again in mid-afternoon.

The milk message is spreading—in all fields and among all workers.

THE PITFALLS CONNECTED WITH DAIRY AND MILK INSPECTION

DR. W. G. HOLLINGWORTH, *City Veterinarian*
Utica, N. Y.

Public policy requires conservation of human life, preservation of public health, and to establish public sanitation on a firm, sound workable basis.

The increased consumption and production of milk and its products has brought with it many problems relating to its safety, and in order to satisfy the public as to its purity, they must be reasonably assured that the same comes from healthy cows, under sanitary conditions, properly cooled; and the responsibility of this essential food and what it means to public health depends upon the activity of the health department in whatever locality that may be.

While good safe milk has done more than any other single food to obtain and maintain health; unclean milk was formerly responsible for more sickness and deaths than perhaps all other foods combined. There are several reasons for this. First, milk conveys a greater variety of infections than any other food. Bacteria grow well in milk; therefore a very slight infection may produce widespread and serious results. Second, of all food supplies, milk is the most difficult to harvest, handle, transport and deliver in a clean, fresh and satisfactory condition. Third, it is the most readily decomposable of all our foods. Fourth and finally, milk is the only standard article of food obtained from animal sources consumed in a raw state.

Milk is the only single substance whose sole function in nature is to serve as a complete food.

With the growing sentiment in favor of this important factor, our social and political units must be equal to the occasion for the reason that great vital responsibility rests upon their decision which tends toward the health of the community.

Fresh clean milk from healthy cows, properly fed, is wholesome for children and adults, not a perfect substitute, but a good one, for breast milk. It will favorably take its place. It contains all the essentials of a balanced ration and is rich in vitamins. When it is a vehicle of pathogenic bacteria it brings danger to all that consume it, especially infants.

Our work must be well done if we are to succeed.

A competent system of inspection will help the farmer very much with his problems in regard to milk production, which seem to be two in number. First, the production of a safe milk of sufficient amount to meet the demand. Second, the marketing and price.

The civilization that we possess has been developed to its present efficiency by education, the object of which is to serve us as a practical guide through the world and it realizes this end, and our education has been brought about by healthful propaganda that has so greatly been, and is being continually brought forth for our benefit.

An efficient inspection service is a preventive measure. We are living in such an age. Prevention is better than cure, and that strikes at the root of the milk industry. It may be a little expensive, but is worth every cent expended.

The inspector cannot prevent occasional insanitary conditions. No veterinarian can prevent the occasional infection of the milk from cattle diseases. The medical inspector cannot prevent the occasional infecting of milk from human sources, but there is an effective safeguard to prevent such occurrences, and that is by perfect pasteurization, as per our state sanitary codes.

There are few food problems which present as many difficulties as that of giving a wholesome milk supply at a reasonable price, especially to those who are a distance from the point of production. The great problem is to see to it that the consumer has a safe milk and it is up to the milk and dairy inspector to know that conditions at the seat of production, at receiving stations, the plants, raw and pasteurized, also at places that handle, prepare, dispense and serve milk or its products are adequate.

People nowadays know more about the food they consume than their ancestors did, and want to know more and they are going to ask information from those who ought to be well qualified to give the knowledge that they require.

To make a success of our work, we must have the respect of the health respecting public; we must be educators; we must be equal to the occasion. America is governed by public sentiment. With that at our command there is no reason why, if we do our duty and necessarily solve the problems and bridge the pitfalls as they occur, achievements will not be forthcoming.

Milk and dairy inspection had its beginning, as near as I can find out, about the year 1842, due to a book written by Dr. Robert M. Hanty, New York City, exposing the very insanitary condition connected with the milk industry in and around that city. Since that time, great progress has been made and that has been brought about by education.

Milk and dairy inspection brings the inspector in contact with four groups, the producer, the milk dealer, consumer and health departments. In order to accomplish the goal looked forward to, harmony should be our slogan. The Golden Rule should govern; each should meet each on an equal basis; each must give and take.

Sentiment must not interfere with good judgment, and there is one thing more than anything else that should be exemplified, and that is more common sense and less nonsense should be used.

Our municipalities should stop, look and listen and think when they are appointing milk and dairy inspectors and see to it that they are competent, capable and will use good judgment.

In our work we must remember the producer has all kinds of problems to fathom out, so do not at the start cut the head off the hen that is laying the golden egg, the producer. He needs our assistance. I find if you follow out the thoughts expressed you will have a co-operating friend, but constantly make a plea for clean, cool covers. You will always find a black sheep in all flocks. You will often have to do some detective work and at times you may have to use the last resort, the law, but I find you can catch more flies with molasses than vinegar.

The dairy and milk inspector finds many pitfalls connected with the dealers or distributors. Again following the above mentioned plan, equal results will be forthcoming; be governed by sanitary codes.

The consumption of milk concerns the milk and dairy inspector to a great extent. According to statistics a person should consume 1000 pounds of milk or its equivalent annually. This group of individuals needs much education in regard to care of this essential food.

The responsibility as to the care of milk after the distributor leaves a wholesome product is up to the consumer, or the persons that handle, prepare, serve or dispense same.

The purest milk placed in the hands of an ignorant or careless mother may within a few hours become a deadly poison to her child. While there is some exaggeration, there is much more truth in the statement that whether a child lives through its first two years or not is largely determined by the intelligence of the one who feeds it, and generally that is the mother.

The health of a community is figured to a great extent by its annual consumption of milk. Many municipalities are below the required per capita amount. In Utica the consumption of milk increased from 25,000 quarts in 1925 to 62,250 quarts in 1928. That was brought about by a clean milk campaign sponsored by our health department. We created a judgment among the citizens of our city that was very much in favor with our propaganda, and our success is going to lead to more success, as "Nothing succeeds like success."

The greatest asset any community can have is the extent the health department cares for those under its charge, and I feel that under this head many of the dairy and milk inspectors will find terrible pitfalls. If the health officer is not a cooperating person we will have a rough road to travel on.

The health officer should be a person who has certain attributes which may be grouped under the heading of broad-mindedness, a person who will not stoop to revenge or retribution for personal reasons, one who will not be biased or prejudiced in his judgment because of what may be held out to him as personal gain, one who will stand firm when temptation to run occurs. With that kind of an official the milk and dairy inspector will certainly have cooperation if he is of the same type.

Public health education is fundamental. It must be considered under two aspects. First, the acquisition of knowledge. Second, the diffusion of knowledge. With that as a foundation to build a substantial structure we must have the respect of a health respecting public.

Milk-borne diseases are always very serious problems to the dairy and milk inspector. I am in constant fear that some one of the various maladies may occur. We so often read of such happenings and the serious out-come. Eternal vigilance must be our motto. Lock the barn door before the horse is stolen. Enhance perfect pasteurization.

Milking machines may or may not be a pitfall. I am afraid of them.

The study of human nature is an art we all should acquire. The knowing of your subject is the keystone. There are hardly two persons alike. What will win with one individual might be an absolute failure with another. Do not be too hasty; study the whole situation from all angles; use elasticity if necessary. Do not persecute or prosecute until you have used all your tools to your best judgment; then if that fails, remember no law is any more effective than its administration.

We must keep on the alert for bootleg milk and cream. I care not how efficient an inspection service a municipality may have, it is more than possible that such will slip in. If the inspectors are good mixers you will find that little humming birds will call on you and whisper in your ears something wrong. All you have to do is to saw wood. Results will be forthcoming.

The progress that milk and dairy inspection is making in this country (that is, some parts of it) is very encouraging; the pitfalls are being constantly fathomed out and remedied. The territory is spreading out and this Association has a great amount of work ahead to do, as the surface has only been scratched. There is no limit to our function. Our civilization's regard to health is going to demand that the food they consume must be wholesome, and their confidence is clearly shown by the increased consumption of a good clean product. Our attitude in regard to clean safe milk is being constantly watched by others who will be governed by our results.

What is happening in our municipality can happen in others. I allude to the decrease in the mortality of children under two years old due to gastrointestinal disorders. With my city I happen to be more conversant than with others. Our death rate from acute gastroenteritis under that age in 1919 was 55; 1920, 53; 1921, 52; 1922, 41; 1923, 46; 1924, 35; 1925, 48; 1926, 37; 1927, 22; 1928, 5; 1929, 3 up to Nov. 1. In 1926 we started our clean milk campaign. The figures will show the great saving of infant life. We feel that at least 121 babies' lives have been spared. What is a human life worth?

There are many localities that have done practically nothing. There is a cause. Why should it so exist? Somebody is at fault. We must remember we are not here for ourselves alone, but for others and to do a good turn whenever possible, and so continue 'til the end comes.

I make this plea to the milk and dairy inspectors. Remember your great responsibility. Just think what might and does rest on your decision. We are all liable to mistakes. Be keen in your vision. There is something in this world besides the almighty dollar. Have a clear conscience and act accordingly.

"SAFETY FIRST" IN MILK SANITATION

Paul B. Brooks, M. D.
Deputy State Commissioner of Health, Albany, N. Y.

Fifty years ago bacteriology was in its infancy and little was known concerning the real causes of what we now speak of as the "preventable" diseases. When New York City was stricken with an epidemic of typhus fever it was observed that the disease prevailed chiefly in those over-crowded places where people and houses were dirty and where garbage rotted in the streets. It seemed quite evident that filth was the cause of the disease. From similar observations it appeared that upon drains and cesspools, decaying garbage and other things offensive to sight and smell were responsible for diphtheria, typhoid fever and other diseases. Eventually a "clean-up" movement was started. Garbage was collected and sewers constructed. This was the beginning of general sanitation. People lived more decently and comfortably and, for reasons then not well understood, there was less sickness.

It was not until years later that it was established that an infected body louse, and not dirt, conveyed typhus and that diphtheria and typhoid fever occurred only when specific micro-organisms were conveyed fairly directly from infected persons to others who were susceptible. In recent years we have been using our knowledge of bacteriology, concentrating our efforts against the real causes of disease and leaving the things that look and smell bad, so far as the public will let us, to the police or other agencies. The results speak for themselves. Municipal cleanliness has become a habit and there is little danger of reversion to the old conditions.

Milk sanitation, starting later, has been passing through somewhat similar stages. Remarkable progress has been made, particularly in the last twenty years, in *cleaning up* municipal milk supplies. All concerned, including the milk industry, have benefited by the change. Our slogan has been "Clean and Safe Milk." It is not remarkable that there has developed a somewhat confused idea as to just what constitutes *safe* milk and an erroneous impression that "Clean" and "Safe" are synonymous.

Prof. Hammer, in his book, Dairy Bacteriology, indicating his belief that safety is the "prime consideration", says:

The prevention of the spread of disease through milk and its derivatives constitutes the most important problem involving the bacteriology of these products.

Now that the old unlimited bacteria counts have gone out of style and the clean milk movement has acquired such a momentum that it needs but an occasional push to keep it moving "the prevention of the spread of disease through milk" practically means keeping out of it a certain few pathogenic bacteria or destroying them if they get in. If this is conceded I would like to raise the question whether we are using the knowledge now at our command to the best advantage to accomplish these ends.

We know that the sources of dangerous bacteria are two: diseased cows and milk handlers who, as cases or carriers, are harboring the germs of certain communicable diseases. As for the bovine diseases, tuberculosis we can pass over quickly. Tuberculin testing, sponsored primarily by the agricultural interests as an economic measure, is gradually eliminating it as a public health problem. It is enough to say that milk from untested herds should be pasteurized. We know too little yet about the role of milk in the transmission of the infection of contagious abortion to human beings to discuss preventive measures intelligently. The real problem remaining is mastitis. Recent experience in New York State has impressed on us the fact that, although the organism commonly causing mastitis is not usually pathogenic for man, epidemics do not wait for the laboratory identification of causative organisms and every case is potentially dangerous. As for the human sources of danger, out of 78 milk-borne outbreaks in up-state New York during a ten-year period 61 were typhoid fever, a large majority from carriers on dairy farms. There were six epidemics of scarlet fever and five of diphtheria. Only one milk-borne septic sore throat epidemic was recorded in that period, but in that there were 366 cases. In the past eight months we have had three epidemics. It seems quite clear then what the dangers are.

The next question is: "What are we doing to guard against them?" When first confronted with this question I turned to our revised state milk code which I discussed here two years ago. It was something of a shock to me when I realized that few of its requirements have any direct bearing on the safety of milk. Of course, there is *pasteurization* which, properly applied, will make almost any milk *safe*. We define and regulate but do not require it. The few provisions bearing directly on the safety of raw milk are mostly so general as to lose much of their force on this account. There are, however, certain measures, none of which are required, which if regularly and intelligently applied would have a direct and positive effect on safety. These measures, briefly outlined are the following:

A PROTECTING AGAINST MASTITIS

1 Manual examination, by the dairyman, of the udder of each cow daily;
2 Milking foremilk on a pail cover or other flat surface and examining it;
3 Immediate exclusion by the dairyman of milk from any cow showing evidences of mastitis;
4 Continuous veterinary supervision, the dairyman to call the veterinarian at the first sign of trouble;
5 Weekly bacteria counts on herd samples.

B PROTECTING AGAINST CASES OF COMMUNICABLE DISEASE

Immediate reporting by the dairyman to the health officer of all cases of illness on the farm or in the plant, however apparently trivial, involving fever, sore throat or stomach and bowel trouble.

(Note: This would give the health officer a "check" even though he did not consider it necessary to personally investigate every case. The New York State code requires physicians to report.)

C PROTECTING AGAINST CARRIERS

1 Typhoid history and Widal of all milk handlers with a sufficient number of specimens of excreta for laboratory examination to give reasonable assurance of freedom from the typhoid carrier condition.
2 At least one throat culture from each milk handler and additional cultures upon the occurrence of any sore throat.

Veterinary service and collection and examination of milk samples and specimens of excreta for detection of carriers should be in the hands of competent persons selected and compensated by the municipality. The primary purpose of such service is the protection of public health. It has been argued that the producer and distributor should be required to assume the expense necessary to meet established requirements and this is a logical argument. Opposed to it, however, is the fact that examinations made by persons selected and paid by those whose personal interests are at stake are, generally speaking, of much less value than those made by individuals free from local influences and in a position to give first consideration to the interests of the municipality.

The natural first reaction to the suggestion that these measures be made a part of the common practice in the handling of raw milk would be: "Why that would practically be Certified milk! The cost would be prohibitive"; and then "It is all right in theory but it would be impossible to get such measures carried out as a routine; the laboratory tests are not infallible, etc." It is quite true that the systematic application of these measures would produce milk as *safe* as Certified. In the Methods and Standards for the handling of Certified milk are many requirements which, when applied, help to make Certified a fine product with a strikingly low bacteria content but which also add to the cost. The measures responsible for its being *relatively safe* raw milk are only a few and are included in those just enumerated, i. e., those directed toward the prompt detection of transmissible infection in cows and milk handlers. In New York State the provision of the necessary laboratory service by the municipality would only mean adding a little to that already being provided. The laboratory, it is quite true, is not infallible.

Because the discharge of typhoid bacilli by a carrier may be intermittent, a single negative fecal specimen may mean nothing. The answer, of course, is that where there is a suspicious history or positive Widal enough specimens should be taken to give reasonable assurance of freedom from the carrier condition. Notwithstanding its obvious limitations, systematic use of the laboratory will provide protection that is lacking without it. To prevail upon municipalities to furnish the "continuous veterinary supervision" and upon health officers to assume the additional burden of collecting laboratory specimens would be admittedly difficult, but certainly not impossible. As for the farmer and plant operator his cooperation will depend on our ability to make it clear to him that he will be insuring himself against trouble and helping to give raw milk a new lease of life. "Where there's a will there's a way." To make raw milk *safe* undoubtedly will cost something both in money and effort, but it is better economy to pay more and get something than to pay less and get nothing. Bear in mind that we are talking only about making milk *safe*.

To compensate for what would be added there is quite a possibility of saving through modification or elimination of some common requirements. If the requirements as to pasteurization could be simplified there would be greater inducement for raw milk men to take it up. To cite an example, while our New York State milk code does not require that milk that is to be pasteurized be from tuberculin tested herds, several of our cities have established this requirement and the idea seems to be spreading. Where there is any real supervision of pasteurizing plants such a requirement should be unnecessary. There is little likelihood that the occasional tubercle bacillus that will survive even an approximately efficient pasteurization will come through in condition to do any harm. Not only is the danger practically negligible but there is even a fair possibility that the organism, in its attenuated condition, might contribute to immunity. "But," someone always says, "It is an added precaution." Possibly, but "added precautions" impede traffic and cause trouble and expense for someone. *Essential* precautions should have the right of way. Let the "added precautions" fall in behind if there is room.

Going through our code I find requirements like these relating to raw milk as well as pasteurized:—Stable floors sound and tight; gutters drained; ceilings dustproof; adequate light and ventilation; manure removed daily; no liquid to collect under stable; separate milk house or room; milk to be removed from the stable immediately; sediment test to be made; time limit fixed for delivery of different grades of milk, etc. These are standard requirements which relate primarily to cleanliness, flavor and keeping quality and no longer have an important bearing on safety. I say "no longer" because most of them relate to things that, at least in our section of the country, are now attended to as a matter of common practice and the dairyman must observe them to obtain a satisfactory market for his milk. Though his pocketbook gained nothing from the omission of requirements like these it might be some satisfaction to him to feel that he was acting voluntarily and not from compulsion. Most of us who are burdened with hair get it cut periodically because we think it is the thing to do. If there was a law compelling it our natural inclination would be to let it grow. It is "human nature." Avoiding the wear and tear due to unnecessary friction is almost as important as saving dollars and cents. As a matter of fact it would be hard to prove that the public health would be menaced even if there were cracks in the stable floor and liquid under it or if there were too few windows, and it has come to be a well recognized fact that milk that is clean as well as safe can be produced in surroundings in many respects unsatisfactory. We should be as willing to consider taking out old requirements no longer necessary as to add new ones.

Here again I can sense some quite natural reactions. "Here is a man who was a member of a committee that spent two years preparing a revision of a milk code and now he comes here criticizing some of the very requirements his committee advocated. Highly inconsistent! He is trying to 'let down the bars'; to tear down a structure that has been years in building. If such ideas as these get out, it will cast doubt on the necessity for requirements that we have been insisting on for years and undermine public confidence in our judgment."

Emerson says in his essay on Self Reliance,

> Speak what you think today
> * * * and tomorrow speak what tomorrow thinks * * *
> though it contradict everything you said today,

and I find some consolation in his observation that

> A foolish consistency is the hobgoblin of little minds.

We would walk in the straight and narrow path indeed if we never changed our minds. That committee functioned two years ago. If I have used our milk code, which I still consider one of the best of its kind, as a "horrible example," it is only because it is fairly representative of the general run of milk codes and I feel free to criticize it, having had a hand in its preparation. Have you not had the experience of walking over an old trail and coming upon a view that you never noticed before? Just so, from studying our code and closely observing its operation, I have come to see things that had not been clearly apparent to me before. We must occasionally break away from time-honored traditions if we are to have any progress. When the time comes for the parting, postponement only makes it harder.

It is not proposed to "let down the bars" but to move them to a point where they are more needed. The structure that has already been built need not be damaged by the operation of putting on the roof and repairing the siding. Such changes as have been suggested can not be made overnight and educational work must be done to pave the way.

In concluding, I would like to draw your attention away from the somewhat controversial subject of possible deletions from existing requirements—deletions can wait—back to the main theme. The first and most important duty of those who are responsible for the character of the public milk supply is to make it *safe*. Those who have gone before have cleared the way by making it *clean*. It now rests with us to take up those weapons best suited to close combat and go over the top.

REPORT OF COMMITTEE ON DRY MILK

HORATIO NEWTON PARKER, *Chairman*

The endeavor of the committee this year, has been to present facts which would enable those interested, to familiarize themselves with a brief history of the dried milk industry, with its growth in production, with the standards of sanitation maintained in manufacturing dried milk, together with the composition of sundry dried milks, and with their bacterial content. In the preparation of the report the several members of the committee have helped, and material contributions have been made by Prof. H. E. Van Norman, and by R. McCann, director of the American Dry Milk Institute. For their cooperation hearty thanks are given. Material is taken from the fugitive literature on the subject and reference is made to the articles utilized.

The fundamental idea of reducing milk to dry form for commercial purposes was conceived more than 100 years ago. It is only within recent years however, that the mechanical and engineering sciences have made available the apparatus to meet the necessary requirements for the production of a good milk powder at a reasonable cost.

The early methods used for the desiccation of milk were slow in operation, and the product was of unsatisfactory quality, as judged by present standards. As early as 1810 Appert produced milk tablets by slowly concentrating milk to a pasty mass with the aid of a warm air current. A little later Malbec followed the same general procedure but added sugar to the product.

The first application for a patent for the production of concentrated milk was filed by Gail Borden in 1853, and granted in England and America in 1856. At the same time (1855) a patent was issued to Grimwade in England for the production of desiccated milk. The first suggestion of desiccating milk by spraying it into a current of hot air is contained in a patent issued to S. R. Percy in 1872. These early sporadic attempts to industrialize the desiccation of milk met with little or no success.

It was not until the beginning of the present century that the drying of milk began to assume the role of a stabilized and permanent industrial process. During the period from about 1900 to 1912 numerous patented processes and improvements in desiccating apparatus came into existence. These processes and their subsequent modifications may be roughly classified as follows:

1 The dough-drying or matrix system involves as its principal feature the concentration of the milk to a pasty consistency, with or without the addition of extraneous substances, and subsequently reducing the mass to dryness by heated air (Grimwade, 1855; Wimmer and Campbell 1901-1904, processes.)

2 The film-drying system involves as its principal feature, the spreading of the milk, either with or without previous concentration,

in a thin film upon heated surfaces, for example, revolving heated cylinders. At a suitable stage of dryness, the film of milk solids is scraped from the heated surface and subsequently reduced to powder and bolted or sifted to the desired degree of fineness. Various forms of apparatus have been adapted to the utilization of the film drying system. The efficiency of the mechanical devices, economy of operation, and quality of the dried product are factors which have determined the extent of utility of the particular adaptations. While numerous contributions to the perfection of the desiccating mechanism have been made from time to time within the past 25 years, the basic principles of design are limited to a relatively few outstanding examples. The following brief list of so-called "processes" probably represents the more outstanding commercially practicable methods for utilizing the film-drying system:

Just process (1902) Atmospheric double drum dryer.
Passberg (1903) Vacuum double drum dryer.
Ekenberg (1899) Vacuum double dryer.
Govers (1909) Vacuum double drum dryer.
Mignot-Plumey (——) Atmospheric single drum dryer.
Buflovak (——) Vacuum single drum dryer.

3 The spray drying system involves as its principal feature the spraying or atomizing of the milk into a chamber, or series of chambers through which a current of heated air is passed. Previously condensed milk is usually used for this method of desiccation. As in the case of the film drying system, numerous adaptations of the principle with varying degrees of efficiency and economy of operation have come into existence during the past 25 years. The following "processes" have gained prominence as economical and practical methods for the production of desiccated milk on a commercial basis:

Stauf (1901) Pressure spray.
Merrell-Merrell-Gere (1907) Pressure spray.
Krause (1912) Centrifugal spray.
Gray-Jensen (1913) Pressure spray.
Rogers (1917) Pressure spray.

The rapid development of the desiccated milk industry during recent years, has no doubt been due to the perfection of drying methods wherein recognition of the fundamental importance of the time-temperature factor has been embodied in the commercially successful processes.

The above-mentioned film-drying and spray-drying methods are in general use for the commercial production of desiccated milk in this country and abroad. One process (Campbell) representing the dough-drying system is

TABLE 1

STATISTICAL REVIEW OF THE DEVELOPMENT OF THE DRY MILK INDUSTRY IN THE UNITED STATES

1920 to 1928 Inclusive

(Data Furnished Through the Courtesy of The American Dry Milk Institute)

State	Number Plants Drying Milk			Production by States (thousands of lbs.; 000 omitted)								
				1920			1925			1928		
	1920	1925	1928	Dry Skim Milk	Dry Whole Milk	Dry Cream	Dry Skim Milk	Dry Whole Milk	Dry Cream	Dry Skim Milk	Dry Whole Milk	Dry Cream
California	7	9	23	—	—	—	17,891	239	—	41,798	319	—
Colorado	1	1	1	—	—	—	346	—	—	266	—	—
Idaho	—	—	1	—	—	—	—	—	—	598	—	—
Illinois	4	2	8	—	—	—	2,996	—	—	3,184	—	—
Indiana	—	—	2	—	—	—	—	—	—	284	—	—
Iowa	—	—	4	—	—	—	—	—	—	346	—	—
Kansas	1	2	2	—	—	—	619	—	—	1,266	—	—
Louisiana	—	—	1	—	—	—	—	—	—	512	—	—
Maryland	1	1	1	—	—	—	758	—	—	1,853	—	—
Massachusetts	—	—	1	—	—	—	—	—	—	20	—	—
Michigan	4	6	22	—	—	—	4,888	1,514	41	14,245	2,142	30
Minnesota	2	4	13	—	—	—	1,338	4	—	6,332	—	—
Mississippi	—	—	1	—	—	—	—	—	—	196	—	—
Missouri	1	—	1	—	—	—	—	—	—	729	287	68
Montana	—	—	1	—	—	—	—	—	—	95	—	—
Nebraska	1	1	2	—	—	—	69	—	—	874	—	—
Nevada	—	—	1	—	—	—	—	—	—	37	—	—

New Jersey		1	1				110			472		
New York	23	29	37				22,424	6,227	217	31,307	5,677	575
North Carolina		1										
Ohio	2	1	5				437	22		1,162	7	
Oklahoma			1							40		
Oregon		1	6				446			1,095	173	
Pennsylvania	5	8	7				5,999	725	81	8,260		
Tennessee			1							2,575		
Texas	1		3							328		
Utah			1							63		
Vermont			1							2		
Virginia	1		4							456	513	
Washington	2	6	9				7,912	159		10,774	36	
Wisconsin	7	11	32				7,084	41		18,827	451	
U. S. Total *	63	84	193	41,893	10,334	309	73,317	8,931	339	147,996	9,605	673

* The above figures represent the largest number of firms reporting for any one month in that State during the year.

Production figures for 1920 not tabulated by States.

Of 87 firms for which the American Dry Milk Institute has complete records for the year 1928, 62 or 71% report the drying of milk the year round, and 25 to 29% dry milk only during the season of surplus milk flow.

also being used for the commercial production of milk powder, but only to a limited extent. Although, it is not within the scope of this brief historical review to discuss the merits of the individual methods, it may be stated that the processes which have proven to be commercially successful are those which embody the fundamental principle of the time-temperature ratio to the maximum degree—or, in other words, those methods which can desiccate the milk at the lowest possible temperature within the shortest possible time.

The progress in production of dried milk is well set forth in table No. 1 which is furnished through the courtesy of the American Dry Milk Institute.

Standards of Sanitation

It should be remarked that particularity should be observed in specifying dried milk products. Distinction should be made between milk powder, and skim milk powder. The industry has adopted the term Dry Skim Powder as synonymous to skim milk powder because though all powdered milks are dry, all dry milks, either skim or whole are not necessarily in powder form, some are in flakes; others in granulated form.

About two-thirds of the national production of skim milk powder is represented in the membership of the American Dry Milk Institute by some 35 manufacturers, many of whom use open rollers and make a product that does not compete with recognized brands of spray powder.

The companies maintaining a national selling and distributing organization are reported to produce their milk under the highest possible standards, selling cream for sweetened cream, retailing, and for ice cream use. A number of the large manufacturers have qualified and are registered as producers of milk in tuberculosis free areas.

As Dr. G. C. Supplee has pointed out dry skim milk and dry whole milk is desiccated milk, and its composition can only be influenced by an inherent composition of the product as secreted by the cow, providing moisture content dictated by good commercial practices is satisfactory. As illustrating the composition of some of the principal of dry milks Table 2 is offered.

TABLE 2

TYPICAL ANALYSES OF DRY MILK

PRODUCT	% Butter-Fat	% Protein	% Lactose	% Ash	% Lactic Acid	% Moisture	REMARKS
Powdered Whole Milk	27.5	26.7	38.2	5.8	—	1.8	Spray Process
Powdered Whole Milk	28.0	26.3	36.6	6.6	—	2.5	Roller Process
Powdered Skim Milk	1.0	36.5	51.8	7.9	—	2.8	Spray Process
Powdered Skim Milk	1.0	35.14	51.92	8.22	—	2.72	Roller Process
Buttermilk, Number 1	6.4	34.1	42.2	8.1	6.0	3.2	
Buttermilk, Number 2	8.14	33.29	33.35	14.40	6.40	4.42	

As to dry buttermilk it may be said that the composition varies considerably according to the type of buttermilk used in manufacture. Analysis of buttermilk Number 1, Table 2, represents the dry product made from freshly separated cream soured with a culture. Besides this type, there is on the market a dry buttermilk made from sweet cream; in composition it is practically the same as powdered skim milk, except that the butterfat is much higher. There is also a dried buttermilk made from cream gathered cream. Usually, a good deal of neutrilizer is used in its manufacture, which very greatly increases the mineral content, sometimes doubling it. Analysis of buttermilk Number 2, Table 2, is illustrative of this type of product.

With regard to the vitamin content of milk powder, it is stated in fundamentals of Dairy Science, P. 476, that it is a good source of vitamin "A", a fair source of vitamin "B", and may contain some of the "C" vitamin. Kennedy states that so far as can be determined by experiments on animals it may be concluded:

1 That milk powders as a class, contain practically the same amount of vitamin "B" as the fresh milk from which they were made, whether manufactured by the spray or drum process.
2 That vitamin "A" is preserved better in drum-processed milk than in spray-processed milk.
3 That vitamin "C" will be retained in the dried milk only when the process of manufacture is such as to prevent oxidation and long periods of heating.

In judging the quality of dry milk, various factors must be considered. These include odor, flavor, solubility, color, butterfat content, presence of foreign matter, such as black and brown specks, bacterial content, moisture content, and presence of lumps of powder.

The exact limits which may be set for a fine quality product will vary somewhat with the process of manufacture—that is, whether open roll, vacuum roll, flake, or spray—and to some extent, on how the milk is to be used. In general, however, it may be said that prime quality products will be of good flavor and odor, be low in moisture, will dissolve readily, be free of lumps and foreign matter and have a low bacterial count with no pathogenic organisms.

Dry milk of inferior quality would be deficient in one or more of the qualities referred to.

The particular merit, or value in dry milks lies primarily in the possibility of preserving the milk for long periods of time, so that an all the year round supply is insured for the industries requiring milk. During the summer months, when production is heavy, the surplus can be packed away, and during the winter months when the supply is short, this dry milk can be brought out and used as required. It also makes it possible to ship milk long distances at little expense. The saving is due to the elimination of water and to the reduction in the transportation charges due to the fact that the dry milk is much less perishable than the fluid milk and does not have to be transported by express shipments. Dry milk has a decided advantage in some lines of manufacture, due to its high concentration—for instance, in the manufacture of confectionery where it does away with long boiling for the elimination of moisture. It is also used to advantage in the manufacture of ice cream to increase the milk solids content without adding water.

Dry milk is not subject to the same degree of contamination as is liquid milk. As far as we know, there is no growth of any microscopic organisms in the dry state, whereas with liquid milk, any slight contamination quickly develops into a very marked growth which injures both the flavor and purity of the product.

As to defects, there are not very many; one is that milk powder will not keep indefinitely. It must be carefully packed under reasonably good conditions, and even then, it will usually deteriorate to some extent, the rate depending on the degree of exposure to air and moisture.

Malted Milk

Malted milk is the product made by combining whole milk, with the liquid separated from a mash of ground barley malt and wheat flour, in such a manner as to secure full enzymic action of the malt extract, and reducing the mixture to dryness by desiccation. It may also contain sodium chloride, sodium bicarbonate and potassium bicarbonate. The United States Federal Standard provides that malted milk shall contain not less than 7.5 per cent milk fat and not more than 3.5 per cent moisture.

Malted milk is dried in a vacuum pan with agitators, or in drying drums, inclosed in a vacuum chamber, or by a spray process. The best quality product is not subjected to over 130° to 140° Fahrenheit. An analysis of malted milk is:

Butterfat	8.7
Protein	17.3
Lactose	24.7
Maltose	26.5
Dextrin	17.3
Moisture	2.5
Ash	3.0
	100.0

Bacteriology of Dry Milk

Dr. G. C. Supplee submits the following statement of the bacterial content of dry milk.

Before reviewing the research which has established the fact that although properly prepared dry milk is not sterile in the strict bacteriologic sense, it contains relatively few harmless saprophytic species, it seems desirable to indicate briefly the factors contributing to the bacterial flora usually found in dry milk prepared by the two common processes. Since the application of heat by either methods does not sterilize the milk completely, certain species which are present normally in the orignial fluid milk are found in the final product. In addition to these residual species, milk powder, as it is found on the market, may contain additional numbers and varieties of bacteria introduced by recontamination between the actual drying operation and the final packing. Even though these general conditions contribute to the bacterial flora of all desiccated milk, certain variations may be found in the kinds and numbers of organisms. These variations depend primarily on the method of desiccation employed, since each applies a different degree and amount of heat, rather than on the degree of recontamination. This is true, at least, of those establishments in which practical precautionary methods are used to protect the product.

In the spray method of drying, the milk is usually preheated to the usual pasteurizing temperature of from 142° to 145° F., at which it is kept for thirty minutes. The pasteurized milk is then condensed in a vacuum pan at a temperature rarely exceeding from 145° to 150° F., in some instances being as low as 123° F. After condensing, the milk may be sprayed, by any one of the several devices, into a heated chamber through which hot air circulates. The temperature of the dry air with which the milk comes in contact varies somewhat with the method employed, but a temperature of from 340° to 380° F. is not unusual. The milk, however, is not heated to this temperature, on account of the cooling effect caused by the rapid evaporation of the water. The temperature to which the particles of dry milk are actually heated before removal from the drying chamber probably does not exceed 180 F. in most instances, and in certain operations it may not exceed 150 F.

In the Just revolving cylinder process, cold milk (40 to 45 F.) is continuously supplied to the trough formed by two steam-heated steel cylinders which are tangent at their horizontal diameters and revolve inwardly in a contrary direction. During the brief interval in which the milk is held in the trough, it reaches the boiling point; at this temperature it is continually drawn between the cylinders into a thin film approximately 0.027 mm. in thickness. The speed at which the cylinders revolve is such that this thin film of milk is exposed for about two and a half seconds to a temperature accurately determined to vary between 250 and 258 F.

From the foregoing data, it is to be noted that the two principal methods of drying milk, which of necessity must utilize the same number of heat units for evaporating a given amount of water, employ, nevertheless, somewhat different principles of heat application and ratios of time to intensity of temperature. These relationships are particularly significant in interpreting the results of bacterial analyses of milk powders.

The greater part of the recorded data pertaining to the bacteriology of dry milk concerns the products made by the roller processes although certain data are available concerning the products made by the spray process. The various studies have dealt with: the numbers and types of bacteria found in dry milk; the inability of certain species, particularly the tubercle bacillus, to survive the drying process; the degree of recontamination after desiccation, and the survival of the flora of the dry product during variable periods of storage. Hoffman[1] added cultures of the tubercle bacillus to milk and dried the infectious mixture by the double roller process. Guinea-pigs that were inoculated subcutaneously with

[1] Hoffman, W.: Arch. f. Hyg 59: 216, 1906.

the sediment obtained by centrifugating the reconstituted dry milk failed to develop tuberculosis. Bacteriologic examinations, by Grosso,[2] of dry milk prepared by the roller process revealed from 4,000 to 5,000 bacteria per gram, including such organisms as *Bacillus brevis, Bacillus subtilis, Streptococcus varians* and other common saprophytic forms. No pathogenic types were found. Kossowicz [3] found from forty-five to eighty bacteria per gram of powder taken directly from the drying cylinders, whereas that taken from the collecting boxes contained from 750 to 1,250 organisms per gram. This recontamination included micrococci, *Sarcinae,* streptococci, molds and yeast. After the powder was stored in hermetically sealed containers for two months, it showed only about 50 per cent of its original bacterial content, the decrease being due to the inability of certain species to survive the conditions of dry storage.

Klein [4] published a report of experiments in which tuberculous milk dried by the Eckenberg roller process was used. Guinea-pigs inoculated with the infected fluid milk showed definite tuberculous lesions after twenty-one days, whereas those inoculated with the dried product did not show these lesions on postmortem examination after the same period. Klein also performed other experiments with milk inoculated with *Bacillus coli, Bacillus typhosus,* the diphtheria bacillus, and a mixture of *Staphylococcus aureus* and *Bacillus prodigiosus.* All of these organisms were found to have been destroyed by the drying process described. In the experiments conducted by Carre [5] and by Martel,[6] milk that was heavily infected with virulent tubercle bacilli was dried by the

[2] Grosso, G.: Ztschr. f. Fleisch-u. Milchhyg. 17:312, 1907.
[3] Kossowicz, A.: Ztschr. Landw. Versuchswesen in Osterreich 2:719, 1908.
[4] Klein, quoted in Reports to the Local Government Board, n. s. 116, Food Reports, 1918, no. 24, p. 44.
[5] Carre, H.: Soc. Cent. de Med. Vet., 1910, p. 556.
[6] Martel, H.; Soc. Cent. de Med. Vet., 1910, p. 563.

Just roller process. Intraperitoneal injection and ingestion of the resulting powder did not produce tubercular lesions in guinea-pigs or monkeys.

Downs,[7] in an unpublished thesis, reported the presence of staphylococci, *Sarcinae,* members of the *Streptococcus lacticus* group and spore-bearing bacilli in practically all the samples of dried milk examined. His results showed that powders made by the spray process have a higher bacterial count than powders prepared by the roller process. Stocking[8] recorded about 20,000 bacteria per gram as the average content of more than 2,800 samples of powder prepared by the spray process; of these, 96 per cent contained less than 250,000 per gram.

Delepine[9] dried milk, heavily infected with the bovine tubercle bacillus, by the use of the heated cylinder and came to the conclusion that living tubercle bacilli might survive the process. Inoculation of guinea-pigs, however, showed that the course of the desease was much delayed by those organisms which had been subjected to the heat of the drying cylinders. Feeding with the dried tuberculous milk failed to produce any evidence of infection. Delepine's observations, which contradict all published work of a similar character, are difficult to explain. In discussing the matter, he concluded that the maximum temperature reached by every part of the milk did not exceed 205 F., and that the duration of the exposure never exceeded three and three-tenths seconds. If these conclusions are correct, it is evident that his results were not obtained from the operation of a normally conducted Just process. Delepine also showed that a total count of more than from 265,000 to 588,000 bac-

[7] Downs, P. A.: Thesis, Cornell University Library, 1920.
[8] Stocking, W. A.: Manual of Milk Products, New York, The Macmillan Company, 1917.
[9] Delepine, S.: Reports to the Local Government Board, n. s. 97, Food Reports, 1914, no. 21.

teria per gram of fluid milk was reduced by the roller process to from 70 to 300 bacteria per gram of powder as it fell from the hot rollers, but that recontamination on subsequent handling might greatly increase these figures. The organisms found were staphylococci, a few streptococci, *Sarcinae*, sporulating bacilli, streptothrices and a few molds. His investigation of the spray process method of drying showed a higher number of bacteria per gram of powder than was found in the product prepared by the roller process; the counts ranged from 110,000 to 154,000 organisms per gram, and the flora included a moderate number of streptococci, many saprophytes, *Sarcinae*, a few Bacillus coli-like bacilli, large sporulating bacilli, streptothrices, yeast and molds. None of the forty-two samples of various powdered milks submitted to the Lister Institute [10] produced tuberculosis in guinea-pigs kept under observation for six weeks after innoculation. Thirty-six samples had counts of from no bacteria to 870 per gram; four samples contained between 1,000 and 2,278, and two contained 43,000 and 89,000 per gram.

Supplee and Ashbaugh [11] found that the number of bacteria in powder prepared by the roller process did not depend on the bacterial content of the original milk. Nine samples of milk containing from 1,520,000 to 345,000,000,000 bacteria per cubic centimeter gave powders which contained from 200 to 880 bacteria per gram. The monthly average of daily bacterial counts in dry milk manufactured in routine production by the Just process ranged from 405 to 1,785 bacteria per gram; only three of the averages were above 1,000. Jephcott, Hunwicke and Radcliffe[12] likewise reported a low bac-

[10] Reports to the Local Government Board, n. s. 116, Food Reports, 1918, no. 24, p. 122.

[11] Supplee, G. C., and Ashbaugh, V. J.: J. Dairy Sc. 5:216, 1922.

[12] Jephcott, H.; Hunwicke, R. F., and Ratcliffe, N.: Proceedings of the World's Dairy Congress 2:1265, 1924.

terial content in dry milk prepared by the routine method of the roller process when proper provisions were taken to prevent recontamination. In the dry milk produced during one month, more than 90 per cent of the samples showed a count of less than fifty bacteria per cubic centimeter, while 6 per cent were completely sterile. Later, Hunwicke and Jephcott[13] inoculated milk with human and bovine tubercle bacilli and dried it by the double cylinder process under normal operating conditions. Guinea-pigs inoculated intramuscularly with the reconstituted milk did not develop tuberculosis. These experimenters concluded that "the roller process of milk drying is capable of either destroying or rendering completely avirulent *Bacillus tuberculosis* of both human and bovine origin." These investigators also added other species of bacteria to milk and dried the mixture by the roller process. The results are shown in Table 1.

TABLE 1.—*The Destruction of Bacteria in Milk by the Roller Process, Reported by Hunwicke and Jephcott*

Type of Bacteria	Bacteria per Cubic Centimeter in Fluid Milk	Bacteria per Cubic Centimeter in Reconstituted Dry Milk
Bacillus coli	300,000,000	0
Bacillus cloacae	2,000,000,000	4
Capsulated, producing red pigment	320,000,000	0
Sarcinae lutea	1,000,000	0
Staphylicoccus albus	510,000,000	0
Long chain streptococcus	10,000,000	0
Bacillus mycoides, spore-bearing	120,000,000	47,000
Bacillus subtilis, spore-bearing	2,000,000	50,000

Dick and Dick[14] recently examined two samples of powdered protein milk and found 88,000 and 80,000 bacteria per gram. A sample of powdered modified milk contained 19,000 bacteria per gram, and a sample of powdered whole milk contained a bacillus which spread too rapidly to make accurate counts possible.

[13] Hunwicke, R. F., and Jephcott, H.: J. Dairy Sc. 8:206, 1925.
[14] Dick, G. F., and Dick, G. H.: Bacteriology of Dried Powdered Milk Preparations Used in Infant Feeding, Am. J. Dis. Child. 34:1040 (Dec.) 1927.

Three of these samples were found to contain 12,000, 30,000 and 10,000 green-producing streptococci, respectively, per gram of powder, and a variety of spore-bearing bacilli, *Sarcinae,* staphylococci, gram-negative bacilli and lactic acid bacilli. In one sample of powdered protein milk these authors reported 700 hemolytic streptococci per gram. They concluded that "the presence of a variety of living bacteria, including streptococci, in preparations of powdered milk indicates that the methods of manufacture did not destroy the bacteria in the milk and that the bacteria remain viable in the powder." In a later report, Dick, Dick and Williams [15] recorded an epidemic of enteritis among infants which was shown to be caused by the Morgan dysentery bacillus. One is led to infer that feeding with dry milk was one of the contributing causes of the infection. The epidemic was brought to an abrupt end with the adoption of special prophylactic measures which included the substitution of boiled milk for the dry milk preparations, the boiling of all water and other precautions. It was not stated that boiled water was used for the preparation of the feedings of dry milk nor did it mention the process by which the milk powder was made.

Supplee and Bixby [16] in a recently published paper concluded as a result of their studies that;

"1. The dry milk made by the Just roller process rarely has a bacterial content of more than 1,000 per gram."

"2. A slight increase in the bacterial content may take place from the time the dry milk leaves the drying cylinders until it is packed."

[15] Dick, G. F.; Dick, G. H., and Williams, J. F.: Etiology of Epidemic of Enteritis Associated with Mastoiditis in Infants, Am. J. Dis. Child. 35:955 (June) 1928.

[16] Supplee, G. C. and Bixby, E. M. Am. Jour. of Diseases of Children, Vol. 37:1016, 1929.

"3. Hemolyzing bacteria, including rods, staphylococci and micrococci, many of which are shown to be survivors of the natural fluid milk flora, were found in approximately the same proportions in the milk powders made by the Just and by the spray processes. Hemolytic streptococci or green-producing streptococci were not found in the samples of powder made by either process."

"4. The total bacterial count and the total count of hemolyzing colonies were found to be much higher in the milk powder prepared by the spray process than in that made by the Just process."

"5. Hemolyzing streptococci, including *S. epidemicus*, enterococcus, a green-producing streptococcus, and the Morgan dysentery bacillus, all were destroyed by the Just milk drying process."

A recent report by Hucker and Hucker [17] containing results from the bacteriological examination of dry milks used for infant feeding shows that a representative series of such samples contained no hemolytic streptococci.

From the available literature, it is to be noted that many saprophytes and the following pathogens have been shown to be destroyed by the Just process of drying milk: *B. tuberculosis; B. typhosus;* diphtheria bacillus; *S. aureus; S. epidemicus; S. mastiditis;* the Morgan dysentery bacillus, and the green-producing enterococcus. The presence of these organisms in dry milk prepared by this process is highly improbably, therefore, unless recontamination of a most unusual and improbable character takes place. The presence of pathogenic hemolytic streptococci in milk powder, irrespective of the method of manufacture, is to be accepted as a probability only after careful and thorough con-

[17] Hucker, G. J. and Hucker, A. M. Am. Jour. of Diseases of Children, Vol. 38:310, 1929.

sideration of the dfficulties of morphologic, cultural and pathogenic identification.

Macy, made bacteriologic examination of domestic and foreign dried milks, most of which were purchased in the open market but some of them had been on laboratory shelves for years. After careful mixing of the samples, 10 grams were weighed out and dissolved in 90 c.c. of sterile water, and plates were made, using milk agar for a medium. The data obtained, indicate that the original bacterial content of spray powder may be expected to be in thousands and sometimes in millions per gram. Only a few samples of the drum process were studied; most of the original counts were in hundreds, with occasional counts of a few thousands, per gram.

Samples of powder kept in the original containers or in glass stoppered bottles, were held in a protected place, at room temperatures for a time, dependent on the quantity of the sample, and examined over a period of 6 years. Because the quantity of the samples was limited, a count on every sample each year could not be made. So, to give a wide range of data irregular periods of storage for the various samples was decided upon.

There was a decided decrease in most spray process samples in the first year of storage, which continued through increasingly long periods of storage. In the drum process dried milk, the decrease was not relatively as great as in the spray process of dried milk; in the latter there seems to be a greater variety for organisms that resisted drying. In the drum process product, the forms that survive exposure to the high temperatures of the drum, are probably spore forming types that are able to withstand storage. After one year storage both types of dried milk showed remarkable decrease in counts. In 2 years, spray process dried milk showed the more marked reduction. The maximum reduction in counts, 99.9 per cent, for spray process powders took place after 5 years and for drum process samples, the maximum, 97.9 per cent was reached after 3 years.

The effect of storage temperatures upon the bacterial content of dried milk, was tested in 3 samples representing respectively the atomized spray, centrifugal spray and drum process, by dividing them into 4 lots, and storing them in sealed porcelain jars for one year at 4° C., 10° C., 20° C. and 37° C., at the end of which period the bacteria count was made. In general, samples stored at 37° C. showed the greatest reduction, and those kept at 5° C. the least.

A study of the types of bacteria occurring in the different groups of dried milk at the time of the original analysis, was made. The differentiation of types was based on the action of the organisms on litmus milk, incubated for 5 days at 20° C. and for 2 days at 37° C. The results accorded with what might be expected from the different processes of manufacture; the drum process dried milk showed a predominance of peptonizing types, and the spray process of acid producing types.

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THE FIRST SPRAY DRIED MILK*

R. M. Washburn

There is an elderly gentleman with snow white hair and alert mind who knows the true beginning of the

*Read in connection with committee report.

spray drying of milk; he knows because he did it. He is John C. MacLachlan, of Chicago, Illinois. At the request of a member of your committee he has told the story. It follows:

In the year 1900 I became interested in a portrait copying house, having both men and young women artists working, with crews of agents traveling and taking orders for the work.

I had charge of the studio and had to see that salesmen had proper samples. The samples were carried rolled up, and so they soon were blurred and ruined, necessitating their replacement very often, which was expensive.

I began experimenting to make the samples more durable. I tried different ways to fix the work on the canvas without injuring the picture. I found that skim milk, when sprayed lightly on the work with an artist's air brush, gave the qualities that were desired. I would put the picture on the easel, fill the fount with skim milk and spray a very fine spray on the canvas. This I found a success.

One hot summer day, there were about a hundred 16 x 20 samples ready to be fixed. The pressure of air used was twenty-five pounds. I had to get a couple of feet from the picture and move the spray back and forth until I had sufficiently covered the picture. Also, I noticed that the milk would rebound by the force of the air as a fog. By the time that I was through with the bunch, there was a fog all over the room. Then, when the girls began to go home, their wraps and clothing had a white coating of milk dust. I told them that I was sorry, and that it would not happen again.

The next bunch of portraits were fixed in a smaller room and when they were finished I noticed that the rest across the easel, which was about 2½ x 24 inches, had a white covering. I looked at it carefully and could see that it was caused by the milk. I got to thinking. I then got a paint brush such as is used by artists, and carefully gathered the fine dust together. There was no ton of it, I can assure you, but enough to arouse my curiosity. Later, I put up a drawing board and kept on spraying on it until I had enough rebound from the board and fall in dry powder on the easel ledge. I gathered that together. I had another thought; I took a glass of water, and into the water dusted the white powder; it instantly dissolved and gave the water a milky appearance. This gave me something to think about. The house that I was living in was my own property. I fixed up one of the rooms that had a high ceiling and a steam radiator by increasing the heat with an oil stove and covering the floor with heavy brown wrapping paper. To get the air pressure, my young daughter pumped the air with a foot pump such as artists use, while I went up on a step ladder and sprayed the fine fog of milk into the room. After an hour or two of this work, the foot pump was slow work; the fine particles fell and settled on the floor in quantity to make a showing, but not enough. We concluded to keep this up, and after several days were able to sweep up a good tablespoonful of milk powder, *the first made by spraying.* This satisfied me that there might be something in this, if only for the pleasure I was getting out of it. A brother-in-law who worked for Swift & Company managed to rent from them an old smokehouse at the stock yards for one month. I lined the walls with tin, put in a floor about twelve feet from the bottom of the smoke house, got a few salamanders to heat with coke, had compressed air carried by heavy rubber tubing from a nearby building, and had a spray atomizer made. After some trouble and a lot of work, the first full pound, of spray dried skim milk, whole milk, dry egg, ox-gall and blood was made. I made a few quarts of each of these products. I then went to my patent attorneys, Parker & Carter, and had them send to the Patent Office and get all the patents pertaining to this art of the dairy indusry. Then I made an applicaion for patent, filed February 21st, 1903, S. N. 144,464. In this application I made this direct statement, "If, for example, the product to be acted upon is milk, I prefer to first reduce the bulk of the milk by evaporating it. Any suitable means for this purpose may be used, and the amount of the evaporation may of course be arranged to suit the conditions to be met with."

My first patent was issued on December 5, 1905, No. 806,747. In this patent the claim for condensing was kept out, for the attorneys' opinion was that if I could dry liquid milk it would only narrow the patent by claiming condensing.

After making application for patent, the next step was to form a company. This was done, and it was called "The International Desiccating Company." Some stock was sold and a frame building erected. This was a demonstrating plant. I had two cabinets put in, 15 x 15 feet by 20 feet high; one was for condensing, and the other for drying. The first power I used was compressed air; I had a tank and a gasoline engine to compress the air. The cabinet was heated by steam, with coils inside the cabinet at the bottom; over the coils was a floor that had openings for heat to rise.

At this time I did a lot of experimenting with skim milk, but was afraid that I was not going to get anywhere. There was no dictionary, encyclopedia, book or anything else from which I could get any information on dehydration. I, of course, found that albumin would begin coagulation at or around 136° F. I had to experiment to find how high a temperature I could use without cooking or scorching the product, and I was making some product by heating at from 180° to 185° F., and exhausting at 130° F. I had come to the limit. I was in my studio during the day and at the test plant at night. I had a friend who attended to the boiler and gas engine, while I was upstairs, atomizing into the cabinet. One certain day in the winter, the air was frosty and dry. As I was spraying a good deal of milk, the gasoline engine stopped. I shut off the flow of milk into the cabinet and ran downstairs. We primed the engine; started the fly wheel, and did everything we knew to start the engine. We kept on working until we were tired out; it was now midnight. I said, "George, we might as well go home." The only light we had was from oil lanterns, which we carried around with us.

Then we went to the boiler to draw the fire; there was a good fire and so we attended to that. I had given no thought to the cabinet, for I felt sure that the powder on the floor would be burnt. I glanced at the thermometer; it was away over 200° F. We had everything made safe and were going out, when a thought stopped me to look into the cabinet. I opened the door, held up my lantern, and looked on a white floor! I called George. We got glasses of water, and found the product was not scorched in the least, and was perfectly soluble. We made up some to drink; the taste was good. I had solved the problem. I could hardly wait for the next night. We made a nice lot of skim milk powder that night.

We had to have more heat and so got a large furnace and attached it. We could then make skim, whole milk and egg powder. It was in 1905 that the National Biscuit Company first became interested in the egg powder; they ordered one barrel. That was satisfactory. The next order was for two barrels and the next for four (a barrel was 200 lbs.) Then the company wanted a contract for the year. This could not be made, for I did not have people around me with enough foresight to take this contract. There was no one at the time making dry milk by the spray process, but the word was passed around as to what I was doing. About this time, people from the East came to see what we were doing and we made a demonstration for them. They later claimed that we did not use condensed milk. No, I made a demonstration with skim milk only; that was enough. I told them that I could powder condensed milk, that to do so was in my first application for patent.

A plant was built in Mason City, Iowa, in 1907. A license was given to Paltridge, Boyce and Paltridge to manufacture skim milk powder. They made a considerable quantity and shipped it to New York. They were getting ready to put in a condenser but got no further, for they had to stop because of lack of funds, which ended their operation. Throughout these many tests and commercial runs trouble was experienced with the spray mechanism. It would clog and stop, or it would drip, and at all times it required too much power; moreover, I found that the pressure spray was not well adapted to such products as were grainy, gluey or fibrous.

I began making a change in the method of spraying. During the shortage of milk in the summer, distributors of milk would take dry skim, add the required amounts of water and fresh butter, and homogenize the two together, thus making liquid whole milk. There was trouble in mixing the fine powder with the water, for the powder would form lumps in the mixing vats and so necessitate a lot of stirring and beating before it would dissolve. At this time, after seeing the production of liquid milk from the dry, I wondered if I could not change the method of spraying so as to make a dry product that would go into solution quickly.

I wanted to accomplish something but did not know how to do it, so I began frequenting a machine shop. I began to experiment with a single disc; first, I put something at the end of the disc that would break the film into a spray. I kept changing. I worked on air currents, then on beater blades, then on a combination of the two, then on the peripheral speed at different points. I began to get results that surprised me. I was getting a good product, but had a dirt catcher, and so the head had to be changed every few hours. More work brought results.

The present machine for atomizing has overcome all obstacles, and will atomize any product that will flow, and it will run continuously and at very low power cost.

Tuesday, October 8

2:00 P.M.

POSSIBILITIES OF CERTIFIED MILK IN MEMPHIS

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Memphis, Tennessee

Investigation of historical facts concerning Memphis' first Medical Milk Commission is sadly lacking. In 1911 an effort was made to obtain a "certified milk" for babies and a Medical Milk Commission was appointed by the Memphis and Shelby County Medical Society. Let us review some events which perhaps led to the appointment of a Medical Milk Commission.

In 1890 and 1891 milk was cited as a responsible factor in the increase of typhoid fever, diphtheria and scarlet fever. Sanitary officers were appointed and made inspections between 1892 and 1895. The report of the Board of Health for 1897 recommended the appointment of a bacteriologist and provisions for a well equipped laboratory. A milk ordinance was passed by the City Council in 1898; 663 Babcock tests and 168 chemical analyses were made. The milk supply was found to be "very poor and dirty," the butterfat was less than 3 per cent, and preservatives, namely boric acid, formaldehyde, and salicylic acid were in common use.

In 1900 an inspector of milk was appointed. An occasional tuberculin test was made. Insanitary and filthy barns were reported. Standards for cream, buttermilk and butter were defined in 1902. Milk was examined for "pus and pus germs" in 1894. Bacteriological examinations were made in 1908. It was demonstrated that milk produced and handled under clean conditions contained few bacteria. Dairies were scored for the first time in 1909, using the Bureau of Animal Industry Score Card. Accurate and satisfactory tuberculin tests were instituted in 1910.

During the year 1908, 242 samples were bacteriologically examined. A table submitted during this time showed the results of bacteriological examination of fifteen samples of milk collected on the street. The average count exceeded 7,000,000 bacteria per c. c.; only one count was under a million; the highest count was 17,800,000. In 1911, 1,002 samples were examined and in many instances the count ran from 5,000 to 60,000,000 per cubic centimeter of milk.

From August 1920 to date complete information concerning Memphis' milk supply has been tabulated. Much of the information listed above was presented in a "Study of Memphis' Milk Supply" and published in 1925.

In August 1920 there was only one certified dairy. Samples of milk from the dairy examined during the years 1920 and 1921 were found to contain bacteria ranging between 400 and 1,600,000 per c. c. A large percentage of the samples contained bacteria in excess of the standard of 10,000 per c. c. In June 1922 a second dairy was certified. This dairy discontinued operation in July 1924. A third dairy was certified in May 1923.

At the present time there are two certified dairies. These distribute betwen 400 and 500 quarts of milk daily. These dairies are Walnut Hill Dairy at Raines, Tennessee, about six miles south of Memphis, and Duntreath

Farm, located at Forrest Hill, Tennessee, 18 miles east of Memphis. These dairies are on good pike roads which makes distribution easy.

The certified milk movement received its impetus from Dr. Henry Coit over thirty years ago. Dr. Coit's theories and practical application of same began in a dairy plant near Newark, New Jersey. Indeed it is remarkable how the original methods and standards have withstood the test of time. The grading of milk began with certified. Before its advent there were no grades. Since its advent a multitude of grades have developed. Even, today, in our largest cities eight different grades may be found. In some cities perhaps more.

Certified milk, according to the American Association of Medical Milk Commissions is distinctly a medical product and is particularly recommended for the pregnant and nursing mother, the bottle-fed infant, the growing child, the convalescent and in all cases of malnutrition, gastro-intestinal disturbances, and gastic ulcers.

Certified milk from the beginning unto the end has always striven to keep becteria of every sort and description out of milk rather than take the easier way and kill them out after having once gained access.

This is a fundamental principle that we cannot get away from. Certified milk farms have exerted at all times a most beneficial influence on the general milk supply and producers of this milk are recognized as leaders in sanitary milk production. Certified milk producers do not and should not offer their products in competition to pasteurized milk. "It is produced to meet specific needs and requirements demanded by the medical profession."

The production and sale of certified milk for over thirty years has been under the supervision of the medical profession. We have seen the development of a commercial commodity which is unique, in that it is a food product conceived, and later produced, directly under scientific specifications, with the medical profession as sponsors.

Originally each Medical Milk Commission functioned as a separate unit with its own rules and regulations. Ten years later an association of the American Medical Milk Commissions was formed, and today all Medical Milk Commissions abide by a working set of rules and standards known as methods and standards for the production of certified milk. The immediate ambition of the Association is, that there shall be produced under the auspices of each member Commission, a product which is as safe and pure as it is humanly possible to produce in a given locality. The author firmly believes that the personnel of a Committee decides the factor of a good or poor committee. In Memphis there are five pediatricians who serve without compensation as representatives of the Memphis and Shelby County Medical Society. The Pediatrician knows the value of pure milk as a baby food, whether he belongs to a group which is feeding either boiled, or raw milk, to infants under his care. Our local committee feels, that to have certified milk that does not measure up, not only reflects on the Milk Commission itself, but also upon each member of our local Medical Society. One or two members of the Memphis and Shelby County Medical Commission are new in the work but are making a conscientious effort to live up to the duties as a member of this committee.

For some years in the past the producers have lacked support from some members of the Commission. That has been remedied, and the many details in connection with certified milk production are being carried out.

Physical examination of the employees, the construction of the milking barns with good ventilation, and lighting, and no flies, the securing of proper dairy equipment, cleanliness, sterilization and a proper water supply are just a few of the details.

Through the efforts of the State Laboratory and the U. S. Public Health Service blood examinations of the cattle for contagious abortion has begun. Before many months we hope to make more definite reports concerning this work at Memphis. The American Association of Medical Milk Commissions, at its annual meeting in Montreal in June adopted a definite requirement that all cows involved in the production of certified milk be tested for contagious abortion, and that all animals known to be infected with Brucella abortus be removed. Undulant fever is not a new disease but only one newly recognized. Whether the drinking of raw milk is an etiological factor indirectly in the spread of undulant fever has been much debated. Especially, your attention is called to the fact, that infants and children, the largest users of milk, are rarely infected. Let us adopt a conservation attitude at this time. Let us all, dairy and milk inspectors, scientists, bacteriologists and physicians work hand in hand until this problem of undulant fever is settled for all time.

The sale of certified milk in our city is between 400 and 500 quarts per day. This is altogether too small for the amount of capital invested in the two certified dairies. The local Medical Milk Commission realizes that the increased output can only come through the prescribing of certified milk not only by the pediatricians, but by all members of the medical profession, the physicians, the surgeons, the otologists, orthopedists, the obstetricians and all other groups.

There are eighty-four active Medical Milk Commissions in the United States, and many of them during this year have reported large increases in the sale of certified milk. In some cities one hundred per cent increase is not unusual. The demand has increased steadily in Worcester, Mass., in Philadelphia, Pittsburgh, Cincinnati, Detroit, Louisville, Milwaukee, Chicago, San Francisco, and San Antonio; in Brooklyn, New York, an increase of 500,000 quarts is reported for 1928. Think of it, in the metropolitan area of New York which includes the northern part of Jersey, 15,000,000 quarts were sold in 1928.

The price, in practically all the places mentioned above, is between 25 and 30 cents per quart. Certified milk sells for 30 cents per quart in Memphis. The question is frequently asked, "Why pay an extra ten cents a quart?" No housekeeper would think of buying unclean, stale or dirty butter, eggs, or meat for her family. There is a great difference between good milk and bad milk.

Certified milk has great possibilities in our city. We must not shirk our duty but strive by pronouncements of its value to our colleagues. Our local Medical Journal, which has a circulation of 800, has cooperated at all times with the local commission, and its space is free for its use.

Closer relations, and better understanding, between members of Medical Milk Commissions and local and state and public health authorities is most desirable. Conscientious effort on the part of all will assure progress.

The writer wishes to congratulate the members of your organization who have helped our own city during the past year. Memphis, as you know, with its milk supply is ranked fourth among the leading cities of the

United States. This in no small part has been due to the efforts of Dr. W. H. Haskell, Public Health Representative, and Dr. L. M. Graves, Superintendent of our local Board of Health. Dr. Haskell has been most generous in assisting the Memphis and Shelby County Certified Medical Milk Commissions.

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PROGRESS IN THE CONTROL OF THE PRODUCTION OF CERTIFIED MILK

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Civilization, to a large extent, has been dependent on the health of the community. Public health, more than ever before, plays a dominant role in the affairs of mankind, and every industry concerned with food, or food products must keep pace with the new and additional knowledge which science and research bring before us.

This alertness applies to the milk industry, and especially to the certified milk business, which is in a class by itself, standing upon a pedestal, and representing a goal to which milk of all other standards has aspired. The movement to improve the quality of certified milk has been concerned, not only with the sanitary control, but with the nutritional value also. Physicians, pediatricians, and dietitians are well aware of the high nutritional value of milk, and the future growth of the milk business and increased demand for milk will depend on the efforts made by producers to maintain, and if possible, standardize the nutritional qualities of milk—that is, to insure a milk of definite protein content, of sufficient mineral content, and of definite vitamin content. It has been proved conclusively, that the feeding of the cow directly influences the milk, producing either a milk of the necessary protein, mineral and vitamin content, or not. In this paper, I feel it is unnecessary to discuss in detail the feeding of the cow to produce a milk of high nutritional value, but I consider this matter is of vital importance. Although, the methods and standards for the production of certified milk designated by the American Association of Medical Milk Commissions do not yet include standard feeds which would insure a certified milk of prescribed nutritional value, I am glad to state that the producers committee is at present examining and studying the whole question, preparatory to drawing up suggestions and recommendations for the standardization of feeds which the Association will eventually incorporate in its Standards and Methods.

For over twenty-five years, certified milk has set the ideal for the standard of all milk, and although in the past, emphasis has been placed on the sanitary control, which we heartily agree is still absolutely essential, attention has been focused recently on the nutritional value and its control. Certified milk producers are again taking the initiative and centering their attention on this question. Many certified farms have been giving attention to feeding problems during the past few years, so that the solution of the problem has passed the experimental stage and it is now about ready to be incorporated in the general standards for the whole industry.

In Minneapolis, in 1928, the President of the Association of American Medical Milk Commissions, stated that: "in the past ten years we have heard a great deal about the pasteurization of certified milk, and all medical men agree that if you pasteurize certified milk, you destroy the industry." No matter what may be required by health boards in the future, in the processing of certified milk, the goal of certified milk producers will always be, the finest, cleanest, most nutritive milk right from the cow to the customer *without* processing or pasteurizing. To illustrate, we might cite that in controlling an outbreak of anthrax we do not entirely depend on vaccination of cattle. Complete eradication will come, when stock raisers destroy every carcass falling on the ranch. The eradication of diphtheria will not come alone with vaccination, with positive diagnosis by skilled laboratory technicians, but will result from mass education on proper sanitation and better health standards.

The laboratory plays an important role in milk control, and its findings have helped develop standards and methods for the production of certified milk. How can an inspector accurately judge the merit of farm operation, and the quality of milk without laboratory aid? Until last year, the American Association of Medical Milk Commissions gave prizes to certified milk producers submitting milk which was scored on bacterial count, flavor, package, etc. Butter is judged the same way. No consideration is given as to whether the bacteria in the bacterial count are injurious, or whether the nutritional values are satisfactory. The really important factors were not considered in the awarding of these prizes.

In the past few years the Methods and Standards Committee has been fully cognizant of the progress made in science and medicine, and based on this knowledge, has introduced some of the following procedures into their regulations:

1 Rigid examination of milk handlers.
2 Analysis of milk by the blood agar plate.
3 Study of flaky milk.
4 Isolation of and significance of the B. coli-aerogenes group.
5 Systematic examination of water on farms.
6 Significance of the bacterial count of milk from individual cows.
7 B. abortus and its relation or significance to human health.

The time now has come when we must take into consideration to the extent of incorporating into our standards the elements governing the nutritive side of certified milk, and attempt to control and improve it as science and research point the way.

LABORATORY CONTROL OF CERTIFIED MILK AT THE SOURCE

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The effective control of certified milk today merits a precision of method and a completeness of detail which reflect the advances that have been made in dairy science in the past few years. The trend of quality in the various grades of market milk has been strongly upward so that our present standards for cleanliness, purity and safety are on a much higher level than formerly.

The sponsors and producers of certified milk have taken recognition of and kept step with modern requirements as shown by the activities of the Methods and

Standards Committees of the American Association of Medical Milk Commissions and the Certified Milk Producers' Association of America, and as pointed out by the previous speaker.

The writer has endeavored to show in a previous paper (5) that the major requirements for producing milk of the highest quality involve dairy units of economic size coupled with well-developed *production management and technical control.* It is the purpose of this paper to present more particularly the details of technical control as they apply to laboratory procedures. The system to be described is not speculative, but has been developed, found to be feasible, and is in routine operation on several large certified milk farms.

The technical control of this milk is based upon a plan of daily veterinary, daily medical and daily laboratory examinations. While each of these forces functions as a unit, yet they are interdependent and cooperative. Thus the veterinary division looks to the control laboratory for information concerning the fitness of individual cows for production, and the laboratory also acts as a supplement to the medical side in checking the possibilities of contamination by human carriers.

The system of laboratory control starts with dairy cows healthy in all respects as determined by: (1) physical examinations prior to the following purchase; (2) tuberculin test prior to purchase and by subsequent retests; and (3) agglutination tests for B. abortus infection prior to purchase and subsequent retests. From this point on, the veterinary supervision of the cows and the laboratory control of the milk they produce dovetail, and are carried on according to the following routine:

1 Examination of the milk from individual cows prior to admission to production.
2 Examination of the milk from all cows (prior to re-admission

to production) after they have been removed from the milking line for any reason (so-called hospital cows).
3 Examination of the milk from all cows detected by the fore-milking.
4 Examination of the milk of the entire producing herd by means of group samples taken at weekly intervals.
5 Daily tests of the bottled product.
6 Weekly equipment and efficiency tests to check the various dairy operations.
7 By repeated tests for B. abortus infection and removal of reactors.

1 Examination of Fresh and New Cows

On the seventh day following parturition, fresh cows are examined by the veterinarian to determine fitness for milk production. The control laboratory is notified of all cows that are passed, and collects a composite sample of milk from the four quarters of each cow listed. These samples are then subjected to culture in blood agar plates and to a microscopic examination for the determination of leucocyte count.

The use of the blood-agar plate in certified milk control has been fully described by its originators, Brown, Frost and Shaw (2), and its application to this type of work reported by Parker (8), by Frost (3), and his associates (4), and others. It represents an indispensable adjunct to the control laboratory, permitting differentiation of the various types of organisms encountered in milk, more particularly the hemolytic streptococci.

Individual milk samples are plated in a dilution of 1-100, incubated for eighteen-twenty hours and then examined. The total numbers of bacteria per c.c. are then noted, together with the percentages of types of streptococci present (non-hemolytic, hemolytic alpha, hemolytic beta, and green producing).

Any cows exhibiting counts in excess of 10,000 per c.c. are withheld from production, re-examined, and not admitted until the count drops to below the prescribed level, (more than 95 per cent of cows freshen with a count of 200-300 up to 2000-3000 per c.c.). In addition, any cows are withheld that show the presence in their milk of streptococci of the beta type, not definitely recognized as of bovine origin. These types are then fished from the plates and examined according to the routine technique described by Brown, Frost and Shaw (2) for the identification of *Streptococcus epidemicus*. This same technique is of value to detect other strains of human hemolytic streptococci that may be associated with scarlet fever. As soon as the identification is completed, the cow concerned is either released for production when it is known that the type is non-pathogenic, or is disposed of if the type is considered harmful. We have found that cows actually harboring *Streptococcus epidemicus* or related types of *S. pyogenes* are encountered only with exceeding rarity. It is a common occurrence to withhold temporarily from production a cow with suspicious types of beta streptococci; but these usually prove to be *S. mastitidis* or less frequent strains.

Leucocyte counts are made by the direct microscopic smear method of Breed and stained according to the combined fat extraction, fixing and staining technique of Newman (7), which has been found very satisfactory. The numbers of leucocytes are reported in thousands per c.c. and the predominant types noted. Cows with clumped leucocytes or with excessive numbers of leucocytes are withheld from production even though the bacteria count and type may be satisfactory. However, in dealing with *fresh* cows, it must be remembered that a certain leucocytosis in the milk is physiologic, not pathologic, and that the milk may be normal even with a relatively high white cell count. In interpreting a high leucocyte count, the veterinarian and the laboratory base opinions upon the careful inspection of the milk from such cases. (For a valuable reference concerning the sanitary significance of these leucocytes, the reader is referred to the bulletin by Breed (1).)

Results of laboratory examinations of fresh cows are reported to the Veterinary Division upon blank forms as are also all other individual milk examinations. The Veterinary Division then admits to production the cows that have passed physical and laboratory examinations and withholds the others for subsequent tests.

This same routine applies to any new cows that are fresh when purchased.

2 Examination of Hospital Cows

Cows may be removed temporarily from the milking line for a variety of reasons. Some are so-called flaky-milk cows, others develop frank mastitis, go "off-feed" for a variety of reasons, or prove to be high-counters, and so on.

Every cow that is removed from the milking line for whatever reason, must undergo the same routine as fresh and new cows. They must be re-examined and passed by the veterinarian when ready for discharge from the hospital and their milk must be passed by the laboratory as normal.

3 Examination of Cows Detected by Foremilking Operation

The practise of examining the foremilk from each quarter of every cow in certified milk production prior to each milking is well known. As a routine procedure to check the normality of each cow's milk, I believe that it has no superior when done carefully. *Most* abnormalities in the udder are soon reflected in the milk and a well-trained operator equipped with a proper stripping-cup performs an exceedingly important function. In our system, in addition to discarding the milk from flaky-milk cows or from those showing other abnormalities of secretion, the ear-tag number of each such cow is noted by the foremilker and reported to the laboratory. Individual milk samples are obtained from all the cows so reported during the previous twenty-four hours. These samples are then subjected to blood-agar plate culture and leucocyte count as previously described.

In passing, it might be well to state that any cow showing abnormal or flaky milk on two successive milkings, is removed at once from production, goes under hospital routine, and does not return to the milking line until passed by the veterinarian and the laboratory.

Jones (6) has made an excellent study of the bacteriology and significance of flakes in milk.

4 Weekly Examination of Milking Herd by Groups

Once that dairy cows have been passed for production, it is essential that they be subject to frequent re-examinations, both physical and laboratory, in order to note their continued fitness. Under this system, the physical condition is checked by monthly examinations which are supplemented by full-time veterinary supervision. At the present time the personnel required for adequate supervision of a herd that totals some 1800 dairy cows, about 1300 being in production, comprises three veterinarians and several trained lay assistants. In addition, and as pointed out previously, the foremilk examination constitutes an important routine check on the condition of each cow's milk secretion from day to day.

We have found it desirable to augment this supervision by a weekly bacteriological examination of the entire producing herd. This is accomplished by means of group samples which are subjected to the same blood-agar examination as the individual sampled. In case any group sample shows an excessive number of bacteria or the presence of suspicious beta types, the group of cows contributing to the sample are checked individually to locate the cow responsible.

This routine is especially valuable for the detection of so-called "high-counters" because often times the milk of such animals shows no physical sign of abnormality that can be detected. By this means also, any cows that may be harboring beta-type streptococci in significant numbers can be located and the strain definitely checked for identification.

During the past four years, the certified milks produced in Wisconsin under the jurisdiction of the Chicago Medical Milk Commission have been regularly examined once a month for the presence of hemolytic streptococci. This work has been done at the University of Wisconsin under the personal supervision of Dr. Frost. The frequency, the numbers and the kinds of strongly hemolytic streptococci that have been encountered in this control work have been made the subject of a valuable and interesting report (4). It is shown that of 3,353 samples analyzed, only nine or 0.27 per cent proved to contain streptococci of the human type; six were identified as *S. epidemicus* and three as *S. pyogenes.* While a considerable number of beta-type colonies were encountered, they were, with the exceptions noted, of bovine origin and identified principally as *S. mastitidis, S. infrequens,* and so on.

5 Daily Test of the Bottled Product

Each day from four to eight samples of the bottled product are collected and examined according to

Standard Methods for bacteria plate count on nutrient agar. This examination furnishes information on the product as it goes to the consumer.

6 Weekly Equipment and Efficiency Tests

Each week at the same time that group samples are collected for checking the producing herd, samples of milk are checked at intervals from the time it leaves the cow, as it passes through the various phases of cooling and bottling in the dairy house, up to the time that it is filled into the final containers. These tests act as checks on the dairy operations.

Examinations are also made two or three times each week to check the condition of dairy utensils and bottles with respect to bacteria content. The water supply is tested weekly according to Standard Methods for the colon-aerogenes group.

7 Tests for B. abortus Infection

The control laboratory acts as an aid to the Veterinary Division in controlling the elimination of cows infected with B. abortus.

All replacement cows are purchased subject to the agglutination test, negative animals only being accepted. New cows are retested upon arrival and again after freshening in order to detect the small number of cows that will not react to the test while in calf though infected. Retests of the entire herd are made at two to three months intervals and reactors are disposed of. In the control work on abortion infection, the laboratory is checked twice yearly by the official laboratory of the New Jersey Bureau of Animal Industry.

The statement has been made in discussing the efficiency of the agglutination test that many cows eliminate the organism in the milk and still fail to react. This is a damaging criticism of the test which is not supported by the facts. It is conceded that rarely a cow may shed B. abortus organisms in the milk and perhaps show no reaction to the blood test for a period, but that this condition persists for a long time or that it is a common occurrence, is contrary to scientific data and to the bulk of expert opinion.

Discussion

In presenting the details of the control system described, I wish to emphasize that one of the most essential features of the plan is its routine character. To be effective, the operation must be a regular procedure. Rather than a burdensome method, it has proven in practice to be a valuable contribution to the organized supervision. Followed systematically, it is simple in operation. The great advantage in being in immediate contact with all phases of production from the cow to the bottle is readily apparent. In the exact detail presented, it is restricted to the larger dairy units where scientific methods of production can be made an economic success. The Wisconsin system, however, is a striking illustration of a similar plan applied to a number of smaller dairy units under a centralized control so as to operate with efficiency.

The natural reaction to this discussion may be to question what we hope to accomplish by the system described. In short, is it not possible to attain the same goal of purity, cleanliness and safety by the substitution of other methods that are relatively more simple and cheap? To accept this viewpoint is to overlook what we consider as the fundamental principles for producing the highest quality milk. We are convinced of the place and necessity for a milk sound in every respect, beginning with the dairy calf and dairy cow and utilizing all the scientific knowledge available to get a milk that contains every desirable element that can be incorporated by natural means. This product should then be surrounded by all the safeguards that may be applied through a system of technical control involving medical, veterinary and laboratory supervision. These principles we believe are basal and offer opportunity for great development in the dairy industry of the future.

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

A. R. B. Richmond, *Chairman*

From your Committee's study during the past year, of bovine diseases—their relation to the milk supply and to the public health—there is nothing of a particularly outstanding nature to mark the period covered.

Reports come from localities in which no efficient control of the milk supply is maintained, of the more or less explosive occurrences of diseases among the population, directly attributable to this food and its products. Of all the diseases, however, coming within the category of those transmissible from the cow to man, none has caused greater sensation or grown around it a more voluminous literature than Bovine Infectious Abortion.

So much interest was manifested in the subject during the Conference of the American Public Health Association in October, 1928, that the several papers presented have been published in pamphlet form and we submit the Foreword by Dr. C. C. Young.

> In preparing the program for the Fifty-seventh Annual Meeting of the Laboratory Section of the American Public Health Association in October, 1928, the committee chose a very fortunate topic for a symposium and apparently secured a series of papers which aroused the interest of the majority of persons who attended the Association meeting. So many requests were made for immediate publication of this series of papers that, after an organized inquiry, the idea was crystallized that these papers should be published as a separate pamphlet by the Association. No subject has created so much comment by lay and technical groups in several years. The possibility of transmission of cattle diseases to human beings has interested public health officials. Until recently the question of abortion diseases in cattle had been considered only as an economic problem in herd management. Even certified milk dairies were not questioned as to the presence or absence of this disease in their herds and to date no regulation has been adopted by the Medical Milk Commission for the elimination of infected cattle from certified dairy herds. *The specific relationship of caprine, porcine, equine and bovine infection in man is intriguing to say the least, and it is difficult for any laboratory worker to avoid dabbling in this problem.* Certainly the solution has not been found. The varying opinions expressed in these papers prove conclusively the necessity for bringing together the different viewpoints under one cover so that public health officials can get some idea of the problem.

Your Committee commends to all members of the Association who may not yet have obtained it, the securing and perusal of this symposium on "Undulant Fever."

In October, 1928, a further contribution to our knowledge of Bovine Infectious Abortion was made by Dr. Charles A. Mitchell, of the Health of Animals Branch of the Federal Department of Agriculture, Ottawa, Canada.

His paper on "Bovine Infectious Abortion and its Relation to Public Health" was presented before the Canadian Public Health Association in conference at Winnipeg in October, 1928 and we submit the following extracts as being of particular interest.

> In order that we have a better understanding of infectious abortion and its relationship to public health it is necessary that we trace through in a very elementary way the history of a few of the investigational efforts directed against infectious abortion and against Malta fever, that we may glean, as it were, a few of the high lights of the subject.
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> The first light was thrown on the cause of Malta fever when Bruce in 1887 isolated from the spleen of a man who had died an organism which several years later was named Micrococcus melitensis. The next advancement was made by Wright in 1897 when he discovered agglutinins in the blood of patients that were or had been infected. This was a distinct advance as it gave a specific means of differentiation of Malta fever, from other fevers of unknown origin. The next advance was made by Zammit in 1925 when he discovered by accident that the causative agent of Malta fever was harboured in the milk of goats. This was the key that opened the secret of the epidemiology of the infection. From that time on the struggle against Malta fever has been to a great extent a struggle against melitensis infection in goats. It is interesting to note that goats show no clinical evidence of infection, save abortion, which takes place in a large number of the infected animals and which may re-occur for several periods of gestation.
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> Bovine infectious abortion which is of great economic importance to the cattle industry in all parts of the world is an infection that has as its principal symptom the abortion of the foetus. This symptom occurs usually once and rarely more often than twice, while the infection continues in many cases for the life of the animal. Because of the great economic loss connected with this infection it has been one of prime importance in comparative medicine for many years. In addition to the

original infection frequently secondary infections, such as pyogenic endometritis and mastitis are grafted on, and it is these secondary infections that cause the greater economic loss in connection with the disease.

Since the commencement of last century the infection has been looked upon as contagious but it was not until 1896 that Bang of Denmark isolated the causative agent. Following this discovery many workers, including M'Fadyean and Stockman of England, Priesz of Hungary, Holth and Wall of Denmark, Nowak of France, Zwick of Germany and Schroeder and Cotton of the U. S., have made important contributions to our knowledge. It would serve no useful purpose in a paper of this kind to review the work of each author.

One point is of especial interest, however, in connection with public health; that is the discovery by Schroeder and Cotton in 1911 that the organism, Br. abortus, is eliminated in the milk of many infected cattle, and even at that early date Schroeder especially urged upon public health bodies the danger of the organism. Concisely, his argument was that the organism infects various mammals, that it had not been proven harmless to man and, that therefore it should be considered potentially dangerous until more definite and precise knowledge was obtained. How clear was this conception, we of the present day are in a position to judge. The work of Schroeder and Cotton caused a wave of interest at the time but this gradually died down and the subject was almost forgotten.

The discovery of Miss Alice Evans in 1918 that M. melitensis (Bruce) and the B. abortus (Bang) are similar united the two subjects and Malta fever and bovine infectious abortion and from a public health standpoint it is impossible to-day to divorce one from the other.

One point that impresses us was the extraordinary fact that although M. melitensis was isolated in 1887 and B. abortus in 1896, yet 22 years were destined to elapse before it was discovered that they were so closely related. Perhaps it is pertinent that laboratory workers ask themselves why such a long period of time elapsed before this comparatively simple observation was made. It seems to me there are four reasons: First, the relative indifference with which workers in human and comparative pathology regard the others' work. While there are many notable exceptions to this, still it must be admitted that in general it is true. We in Canada have perhaps less excuse for this state of affairs than others, especially when we remember that the father of Comparative Pathology in Canada was a human pathologist of note and later one of the greatest physicians of his day; and had the example set by Sir William Osler been followed by us, it seems scarcely possible that 22 years would have elapsed before the observation of the similarity of the two organisms was made. Second, the advances that have been made in serological methods and studies. Third, the classical bovine symptom was looked for in women when Br. abortus infection of humans was suspected. Fourth, because the Brucella melitensis and the Brucella abortus are the organisms of negation, i. e., they are gram negative non-motile, do not ferment sugars, do not form indol, do not reduce nitrates, nor liquefy gelatine; in fact, all their characteristics seem to be negative.

Following the discovery of Miss Evans a second wave of interest was aroused, and we have as a consequence the finding of Br. abortus infection of man failing to cause the classical symptoms of the bovine infection and usually taking the form of an undulant fever. It is not necessary to go into the recent literature in connection with this since you are all familiar with it. I would like to mention, however, that the first cases recorded in Canada were by Harris, McCoy, Stevens and Lyman, and by McLean, McKinnon, Young and Jeffrey.

In connection with Br. abortus infection in man I believe we should not draw too many conclusions on this subject until more complete evidence is obtainable. I am especially mindful of the many times in which what appeared to be facts regarding bovine infection turned out to be suppositions. I think, therefore, that very conservative conclusions should be drawn at present in order that the literature of the future be not confused.

Serological examinations of bovine sera in our laboratories show that about 20 per cent of the animals tested are infected. Assuming that this represents a fair average of infection in our dairy herds, and taking a conservative estimate of 5 per cent of reactors eliminating infectious abortion organisms in their milk, we would conclude that 1 per cent of the dairy animals are eliminating Br. abortus organisms. I do not give these as authoritative figures and I wish to emphasize that they are based on a limited number of tests. But it may be said at least that, since tests have shown that infectious abortion is distributed throughout Canada from the Atlantic to the Pacific, those who drink milk in this country are daily consuming Br. abortus organisms. Now if ordinary strains of Br. abortus were very infectious for man—say, as infectious as the true melitensis strain—should we not have a veritable epidemic of abortus fever? There would therefore appear to be reason for believing that there is some factor governing Br. abortus infection of humans with which we are not acquainted.

Some of the factors that may conceivably play a part in infection of human beings are:

(1) *Strains.* It is known that a wide variation exists in the pathogenicity of different strains from bovine sources, and it

is known that porcine strains are more pathogenic than bovine strains. It is conceivable that certain bovine strains may be more pathogenic for man. Moreover, little is known except from the classification by Miss Evans of the distribution in man and animals of the various serological types. At our laboratories at the present time we are making a survey to find what serological types affect bovines in various parts of Canada. It would be interesting if each human case occurring in Canada were typed and a correlation of our work might throw more light on the etiology of the infection.

(2) *Individual susceptibility.*

(3) *Dosage of organisms.* Infection to some extent is dependent on dosage. Two ways in which this may play a part are an increase in the incidence of bovine infection, and an increase in milk consumption.

Live vaccines—I wish particularly to direct attention to the product known as the live vaccine.

It was found early in the study of bovine infectious abortion that a killed bacterin conferred no immunity. Since the actual abortion was found to be a self-limiting symptom of infection (infected animals aborting once or possibly twice) the use of live organisms was conceived with the idea of stimulating the formation of anti-bodies in healthy animals prior to conception, and thereby later during pregnancy protecting the animal against placental disease and the resulting abortion. The product is simply a suspension of viable Br. abortus organisms, and it is injected subcutaneously at a time favourable to pregnancy. In other words, the animals are infected and sufficient time is allowed for the formation of anti-bodies before conception.

This form of vaccination was at one time very widely used, and even to-day is being used to a considerable extent. Several years ago objections were raised to its use, principally on the ground that while to some extent it might control the symptom of abortion, still it resulted in a great increase in the number of infected animals and Br. abortus carriers. In the light of our knowledge to-day, this form of vaccination takes on a more serious aspect, and most imperative reasons exist for discontinuing its use, since this method must enormously increase the number of organisms in our country's milk supply. I will quote one experiment from the work of Hart and Traum. 16 animals known to be free of infectious abortion were inoculated subcutaneously with live vaccine; 10 of these animals at times subsequent to inoculation, varying from 7 to 55 days, commenced to eliminate Brucella abortus organisms in their milk and continued to do so over a period of several months; in fact, were still eliminating organisms when the experiment was reported and the authors thought that the animals had become chronic carriers.

Since every animal in a herd treated by the live vaccine method is inoculated with the culture, it is at once apparent that the number of animals eliminating abortus organisms in their milk is greatly increased. Dr. E. A. Watson, Director of our laboratories, was one of the first to condemn this method of vaccination, and we do not issue from our laboratories this biologic product.

In low grade infections, such as infectious abortion, the formation of anti-bodies is to a great extent dependent upon the pathogenicity of the strain. It follows that many workers in the field of vaccine therapy prefer to use strains of marked pathogenicity for infections of this type. It is therefore apparent that many workers would prefer Br. abortus strains of the highest possible pathogenicity including even those from porcine sources.

No better plan could be followed for the seeding of strains of this nature in the dairy herds of this country than the inoculation of a live vaccine containing such organisms. If these strains are more pathogenic for man than ordinary bovine strains, the use of the live vaccine may assist in explaining why infectious abortion of cattle has recently become a public health problem.

When we bear in mind that infection is often dependent upon dosage, that some of our cultural strains may probably be more pathogenic for human beings than the ordinary strains of Br. abortus, that man is susceptible to at least some Br. abortus strains, this method of vaccination with live vaccines would appear to be one fraught with potential danger to the health of man.

According to information very kindly given by Dr. J. B. Mohler, Chief of the Bureau of Animal Industry of the United States Department of Agriculture,

No very definite statement can be made as to the extent of infectious abortion in the United States as no systematic survey has been made. The disease is very widespread and there are probably no large areas in which cattle are kept that are entirely free from it. In sections where considerable blood testing has been done, the percentage of reacting animals varies in different infected herds but seems to average 20 per cent or more. Since little has been done in the way of area testing, there are no very accurate data as to the percentage of herds infected. It is believed, however, to be high, particularly in the older dairy and cattle-raising sections.

It is difficult, in connection with a problem so great as that of infectious abortion, to measure the progress made in a single year. In the way of investigation, much has been and is being done by the Bureau and by a number of State universities and experiment stations. Facts are being discovered from time to time which help to clarify our knowledge and, we hope, bring the solution of the abortion problem a little nearer. As to practical work in combating the disease, several States are aiding stock owners to free their herds from infection by blood testing and the segregation of reacting animals, and other means of reducing exposure, under the approved herd plan. Considerable progress seems to have been made in this direction, particularly in Pennsylvania which is reported to now have over 200 approved abortion-free herds. Seven States now have laws or regulations required that cattle intended for breeding or dairy purposes pass the blood test for infectious abortion before entering them.

The Bureau of Animal Industry is carrying on experiments and field investigations described as follows:

1 Experiments to determine the value of abortion vaccines.

2 The development of an improved vaccine safe to use even on pregnant animals.

3 Determination of the immunity afforded by vaccination.

4 The best age at which to vaccinate.

5 Determination, through field investigations, of the feasibility of combating the disease by eliminating or segregating affected animals, based upon the results of the agglutination tests.

6 Determining the practicability of developing a clean herd from an infected one by protecting the progeny from infection, and ascertaining the best method of handling herds to reduce losses while herd immunity is developing.

7 Determination of the best methods of limiting infection and reducing exposure in infected herds where more drastic means of control are impracticable.

8 Determining practical means of keeping abortion-free herds from becoming infected.

9 Studies to determine the part which other infections and factors play in the abortion problem.

10 Studies to determine whether deficiencies in certain vitamins and minerals tend to render animals more susceptible to infection with the abortion bacillus.

11 Determining whether there are other channels of infection than those commonly recognized, and their relative importance.

12 Studies of the reduction of milk flow of cows whose udders carry the abortion bacillus, compared with cows that are abortion free.

13 Experiments in the elimination of udder infection.

14 Studies of the virulence and other characteristics of different strains of the abortion bacillus.

With regard to bovine tuberculosis, it is gratifying to note from reports received from many countries that policies have already been and are being adopted which will ultimately lead to the eradication of this disease.

The following brief extract from a paper presented by Dr. E. A. Watson, Chief Pathologist, Department of Agriculture, Ottawa, Canada, before the Imperial Agricultural Reasearch Conference in 1927, your Committee considers is of special interest.

> While tuberculosis of cattle is being measurably reduced in North America, tuberculosis of swine and of poultry is found to be increasing and in many districts to an alarming extent. There are good grounds for believing that the relationship between the tubercle bacilli of human, bovine and avian types and their respective hosts is not a fixed one and is subject to change and variation under certain conditions—which we are not yet able to define—of environment, exposure to infection and reinfection, natural and acquired resistance, of successive passages through hosts of a species other than that of the original host, etc.
>
> We now know that tuberculosis of swine is caused by infection from avian as well as from bovine sources. Human tuberculosis is caused by infection from human and from bovine sources; but human infection with the avian type of bacillus is also occasionally recorded. Tuberculosis of horses, dogs, cats, sheep, foxes and other animals may be caused by bacilli which in some cases do and in others do not fit in with the human, bovine and avian types and have to be placed as mixed or as intermediary types. We have isolated avian and intermediary types of tubercle bacilli from naturally infected cattle and are obtaining evidence, direct or indirect, that contact with avian and human sources of infection is a factor not to be disregarded in bovine tuberculosis eradication.
>
> Evidence is accumulating to show that in order successfully to control tuberculosis in cattle, it will be necessary to deal effectively with sources of infection other than the bovine, and to control tuberculosis in swine and in poultry.

> A better understanding of those factors, the constant and the varying, which fix, alter or modify the course and evolution of tuberculous infection and resistance, can only come through continuous research and the experimental method of study. The longer our experience and the closer our observation, the more are we compelled to change or re-adjust previously held views and conceptions of tuberculous infection, of virulence and adaptation, host susceptibility and resistance, and of the possible transmissibility and variable relationship between all types and strains of tubercle bacilli, including para-tubercle bacilli, and all species of animals, including man.

Harry J. Boyts, Live Stock Commissioner, Sioux City, Iowa, states in his foreword to the published addresses of the Midwestern States Tuberculosis Conference held in June of the current year:

> Two important facts gleaned from the conference:
>
> 1 Human lives are being saved and health improved by the control of bovine tuberculosis.
>
> 2 Those live stock states, which lag behind in eradication of tuberculosis will find their live stock being discriminated against on the public market.

Your Committee commends to members of this Association the perusal of the addresses contained in the above booklet.

With reference to Milk Sickness your Committee submits the following extract from the intensively interesting pamphlet on "Milk Sickness, the Result of Richweed Poisoning," by James Fitton Couch, Ph.D., Pathological Division, Bureau of Animal Industry.

> There is no reasonable doubt that cows feeding on richweed do secrete milk capable of causing trembles. Several cases are on record in which, under experimental control, richweed was fed to lactating animals, and the suckling young that took the milk developed characteristic trembles and died.
>
> The character of the poison that is present in such milk is, however, unknown. Whether it consists of unaltered tremetol or some metabolized product of that substance cannot be stated. From what is known of the chemical nature of tremetol it does not seem probable that it would resist the chemical processes of the body but rather that it would be oxidized to some derivative. It is, of course, quite possible that such an alteration of the

tremetol molecule could take place without seriously altering its poisonous properties.

Isolation of the poisonous substance in toxic milk and butter is necessary to complete the chain of evidence connecting milk sickness with richweed. Such milk and butter are very difficult to procure for experimental purposes, because the outbreaks of disease occur at some distances from laboratories and under circumstances which make it impracticable to obtain large samples either of milk or of butter. Any physician who may have an opportunity to obtain such milk or butter is requested to ship it to this laboratory (express collect) for analysis.

I have mentioned milk and milk products as the means of conveying richweed poisoning to man. Is it not possible that meat from poisoned animals may transmit the poisoning as well? On this point there is little agreement. Most of the early accounts contain statements that dogs and cats fed on the carcasses of animals which had trembles developed the disease and died. Some of the cases of milk sickness were attributed to meat from poisoned animals. Careful laboratory experiments, however, have uniformly failed to confirm these statements. I fed two cats on the muscle tissue and a third cat on the heart, liver, kidneys and spleen obtained from a sheep that had died of trembles, without producing abnormal symptoms in the cats. It does not seem probable that tremetol will accumulate in the tissues in quantities sufficient to poison other animals that may feed on the carcasses and, indeed, if that poison is distributed through the tissues of the original animal and if the toxic dose for all animals is about the same, a second animal would be forced to eat at least half its body weight of meat from the carcass before obtaining a lethal dose.

Certainly, danger of poisoning from the meat of animals that have fed on richweed would occur only with lower animals that habitually eat raw meat. The processes of cooking to which man subjects his meat would destroy in great part, if not wholly, any tremetol that might have been deposited in it. When all these things are taken into consideration there appears to be little danger that richweed poisoning may be conveyed to man through the medium of meat, especially if it is well cooked.

One of the peculiarities of richweed that has caused much uncertainty, confusion and controversy is the apparent variation in the toxicity of specimens from different localities. In some districts where there is an abundance of the plant milk sickness is unknown, while there are other places that seem to be especially deadly and in which fatal cases originate nearly every year. Such "plague spots" have caused many farms to be abandoned, and, in the pioneer days, were sufficient to induce the settlers to desert the neighborhood and move to some more healthful locality. The lack of definite knowledge concerning the poisonous principle of richweed has hitherto prevented a quantitative study of this variation. However, a few figures are available that illustrate the difference in the tremetol content of plants from different sections of the country.

Samples of richweed collected at Beecher City, Ill., in September, 1925, and samples of leaves of richweed collected at Lafayette, Ind., in September, 1927, yielded 0.15 per cent and 0.13 per cent of tremetol, respectively. Samples of leaves and of blossoms collected at Woodmont, Va., in September, 1926, yielded little more than traces of the substance. Milk sickness and trembles have been observed at the localities in Beecher City and Lafayette from which the samples were obtained. At Woodmont, however, which lies along the south bank of the Potomac River across from the District of Columbia, milk sickness and trembles have not been observed as far as the records show, although the plant grows very luxuriantly there. Feedings of plants from that locality to sheep have been without effect, as was the case also with extracts made from Woodmont richweed. It appears, therefore, that richweed is not dangerous in that locality. It is possible that there are many other such localities in the United States and that the comparative harmlessness of the local richweed may have given rise to some of the negative reports that are found in the literature.

Milk sickness has generally been a rural disease. Outbreaks have occurred principally on isolated farms and in small towns through the Middle West. Few cases have been reported from cities. This situation has undoubtedly arisen because it is on the farm that one gets milk from a single or, at best, from a few cows. If these cows have access to richweed the contaminated milk will be consumed day after day by the same persons and cumulative poisoning will occur. Even after the illness has commenced, it is likely that the patient will continue to drink the contaminated milk unless the disease is promptly recognized as milk sickness and the etiology known.

In urban communities, however, a different situation exists. There the milk supply is obtained from many sources and whatever milk from cows with trembles may find its way into the milk depots is mixed with other milk and so diluted that it is harmless. There has been some question whether the heat involved in pasteurization might not be sufficient to detoxicate tremetol. This does not appear to be likely. While it is sensitive to heat, tremetol is only slowly destroyed at the temperature of boiling water and probably is very slightly affected by the temperature of pasteurization. This would not account, then, for the absence of milk sickness in the cities. It has often been suggested that if a case of the disease did occur in one of the larger communities it would probably not be diagnosed as such but would more likely be considered food poisoning, acute gastritis, or some obscure digestive disorder.

In view of these facts, it is of the highest importance to recognize the relationship between poisoned milk and milk sickness and to insure a supply of wholesome milk to patients with that disease.

One of the first cares of physicians in districts in which milk sickness has occurred should be to detect the sources of the poisoned milk and to prevent the products from being used as food. Examination of pastures in which the cows graze will determine whether richweed is present. Areas where richweed is abundant should be fenced off or the plant should be eradicated. The latter task is not difficult, for the root system of richweed is shallow and may easily be pulled up, especially in the moist, woodland soil where the plant thrives. After the plants have been pulled up they should be burned, and the pastures should be inspected once a year to catch the seedlings and the plants overlooked in the first eradication. In this way a farm may be freed from richweed and the danger of milk sickness completely removed.

As already stated, reports have come to hand from nearly all countries of the world, of outbreaks of disease in the human for which the cow and her products are held responsible.

But what is significant and encouraging are the reports that authorities responsible for the safeguarding of the public health are, backed up by public opinion in most cases, arriving at the conclusion that scientific pasteurization is the process upon which they must depend to ensure a safe and wholesome milk supply.

Your Committee believes, therefore, that the milk control official may look to the future with feelings of optimism, realizing that eventually education will open wide the doors of ignorance and let in the light of hygiene equally as fully as other human knowledge.

SAN FRANCISCO'S MILK SUPPLY AND ITS PROBLEMS

ALEXANDER F. EAGLE, *Dairy Veterinarian*

San Francisco, California

It has been thirty odd years since San Francisco pioneered dairy and milk inspection on the Pacific Coast. Like most municipalities of that period, we were served with a mediocre supply. Milk was produced within city limits or adjacent thereto; the producer was his own distributor, and due to inadequate cooling and sterilization, preservatives often were added.

The delivery system was crude compared with that of to-day. Milk was measured from delivery cans to utensils furnished by the housewife and the contents left at the door-stoop, were subjected to various forms of contamination.

Dairy farm buildings were of poor construction, illy ventilated, dark, insanitary and unfit for the production of safe, clean milk. Milk-borne epidemics were a common occurrence due to pollution, all of which caused many premature deaths of infants.

In the latter part of 1898, to overcome such ills, the San Francisco Board of Health appointed an inspector, his duties being to look after the milk supply. The position was political and to hold same it was necessary to pick winners at election time, and to "Play the game" in a political way, with the powers that were. Some good work was accomplished in an educational way, but a change in politics meant another inspector. However, this political influence was a widespread evil at this time, and not peculiar to San Francisco.

There was nothing so objectionable to the well-meaning dairyman than to have such political appointees, with no status of permanency, directing his efforts. However, this system later changed, and in 1912 dairy inspection was placed under classified civil service. After a competitive examination two veterinarians were appointed and a general survey of conditions was made of dairy farms furnishing San Francisco with its raw milk supply, most of which was consumed at that time in the raw state.

San Francisco, the only city and county government in the State of California, has a land area of but forty-two square miles and is a peninsula, with a population of about 750,000.

An ordinance is in effect prohibiting the keeping of dairy cows within its boundaries unless the dairy farm contains one acre of land to every two cows. Our limited area makes impossible the keeping of dairy cattle within the city. Therefore we derive our supply from outside districts and every dairyman must obtain a permit before shipping milk into this market.

Owing to the insanitary conditions prevailing at that time it was conclusively decided that it was impossible to get a safe, clean product from the source of supply. Our efforts were confined exclusively to whipping the dairy farms into a state of sanitation. This was no easy matter, and, of course, meant an uphill fight. Now, it was impractical to condemn outright over two hundred dairies, as they were all somewhat similar. We could not curtail the milk supply or get the enmity of the dairymen as a class, because we did not want an organized effort against the movement. We then chose dairies in widely scattered sections and brought same up for revocation of permit. As a rule we made sure that the dairyman could afford expenditures necessary for the erection of modern buildings and equipment, or otherwise we confined our efforts to the large dairymen, as experience told us that the little fellow would fall in line with progress.

It is desirable that it be understood that it was for the correction of ills and evils associated with the artificial feeding of infants that our present system of dairy inspection was promulgated. The inspector holds a position of trust and he is not accountable to either producer or distributor, but to the public at large.

It may be of interest to you to know that the great bulk of milk consumed in San Francisco is produced by foreigners, principally Portuguese and Swiss. As a class we find them receptive to educational influence along the lines of dairy sanitation. They are hard working people and are ready to cooperate to the fullest extent for the best interests of the industry and, further, they show no apathy toward the inspector, but rather appreciate the mutual attempt to improve the quality of this product.

Now, after sixteen years of progress in veterinary and sanitary inspection on the dairy farm, we have two hundred odd dairies erected. They are of modern construction and furnish this market with approximately 50,000 gallons of milk daily, the bulk of which arrives at city plants four hours after milking and is transported in refrigerated or semi-refrigerated trucks. The average dairy farm score is 80.5 on U. S. dairy score card.

Due to the climatic condition that exists in California, the cows are housed only for milking—they are in the barn less than six hours daily. The milking-shed type was adopted; the floor plan including a four-foot area wall is of concrete construction, sides above area wall to plate are open, or contain four square feet of light per cow. Feed is stored in barn adjacent. Milk houses are also of concrete construction and are located within easy access of barn—generally on lee side—it being divided into two compartments—milk and wash-room. These rooms are provided with wash sinks, steam boiler, sterilizer, where all movable utensils are placed for sterilization, and a refrigeration system, either ammonia or brine, to cool milk below 40 degrees Fahrenheit. At this temperature the bacteria growth is greatly lessened. Milk secreted from the udder of a healthy cow is considered safely free of bacteria, as experimental evidence has shown that at least the majority of bacteria do not pass from the circulation into the milk.

Inasmuch as milk furnishes an excellent medium for the growth and multiplication of bacteria, it behooves the inspector to educate the dairyman in a bacteriological sense, that is, to impress upon him the responsibility he has after the milk is drawn. With the equipment that the dairies possess and the care used, they have as a rule no trouble in meeting our legal maximum requirements of 150,000 bacteria per c. c. In fact, it is so much lower than the legal maximum that visiting investigators to our city are amazed.

Now, the bacteria standard being the index of milk quality I would like to give you the bacteria count of raw milk shipped into San Francisco from distances ranging from 10 to 140 miles, for the year 1928-1929.

PRODUCERS

Total Samples—5,120

			Average count
Samples containing less than 15,000 col. per c. c.	4,411—	86.15%—	4,100
Samples ranging between 15,000 & 50,000 col. per c. c.	503—	9.82%—	27,400
Samples ranging between 50,000 & 100,000 col. per c. c.	121—	2.36%—	71,000
Samples ranging between 100,000 & 150,000 col. per c. c.	49—	.95%—	155,000
Samples containing more than 150,000 col. per c.c.	21—	.72%—	299,500

Average bacteria count of all samples—10,800

Average butter fat of all samples—3.62%

Of the 5,120 samples of milk taken from shipments of producers only 21 or .72% contained more than 150,000 colonies per c. c., the legal maximum.

From the above quoted figures it is readily observed that San Francisco is today enjoying a remarkable raw milk supply.

These improved conditions did not come of their own accord and will stay only as long as inspection is maintained. Another contributing factor is the team-work displayed between the producer and distributor.

Prior to 1913 San Francisco had over forty distributors of milk, some from cow to patrons and others from local plants. However, in the latter part of 1913 compulsory pasteurization was inaugurated, which caused combination of small distributors or the discontinuance of others, until at present there are only 21 left. Later the grading system was adopted and at present we have "Certified," "Guaranteed," "Grade 'A' Pasteurized" and "Goat's Milk Grade 'A' "—lower grades permitted by law have never entered this market.

The principle of pasteurization is not to make dirty milk clean, but to make clean milk safe for human consumption. It has been established beyond all doubt that pasteurization has eliminated such milk-borne diseases as typhoid, scarlet fever, intestinal disorders caused by the colon bacteria, and from the vital statistics of the Department of Public Health of San Francisco, for a twelve year period, after compulsory pasteurization, tuberculosis in children under twelve years of age has decreased 61⅔%. Also infant mortality decreased from 57 deaths per 1000 in 1912 to 45 per 1000 in 1929, the second lowest rate of any city in the United States. These facts, I think, can be attributed in part at least to the proper processing of our milk under supervision.

It is admitted that clean raw milk, properly pasteurized, is safe. However, if contaminated by a human carrier, it becomes a dangerous article of diet. To illustrate:

In the early part of 1928, typhoid was reported to the Health Department. After investigation it was thought that the infection was brought from some outside city, but as more cases appeared sporadically during a sixty-day period, suspicion was directed to a pasteurization plant that supplied the store trade. Stool samples were taken of all employees within this plant. The first test was negative; however, after a drastic purgative was given each employee, a stool sample resulted in one positive. It developed that the carrier was employed at the bottle and capping machine. Occasionally a cap became jambed, and in replacing the same with his hand he infected the content. The epidemic caused by this carrier resulted in sixty-two cases with twelve deaths. To guard against a recurrence of such an outbreak a regulation has been enacted requiring a medical examination of all employees, including a Widal and Wassermann test, in city pasteurizing plants.

It has been too often unwisely assumed that pasteurization constitutes a panacea of milk evils. It does not, for it should be ever borne in mind that there exists always the possibility of carelessness or neglect on the part of the person performing this important function. However, with efficient inspection and close supervision it should be held to a minimum.

The consumption of "Grade A" Pasteurized milk in San Francisco amounts to about 50,000 gallons daily, or 97.38% of our total supply. This milk is standardized at 4% butter fat. The last surprise contest that was held by the California State Bureau of Dairy

Control gave the score as 96.4%, being the highest in the State. To familiarize you with the wholesomeness of this finished product, the bacteria count for the year 1928-29 of samples taken from wagons throughout the city at different hours of the day were as follows:

DISTRIBUTORS

GRADE "A" PASTEURIZED

Total Samples—720

	Average count
Samples containing less than 15,000 col. per c. c.	674—93.61%— 1,800
Samples containing more than 15,000 col. per c. c.	46— 6.39%—29,900

Average bacteria count of all samples—3,600 col. per c. c.
Average butter-fat content of all samples—4.01%
Maximum legal bacteria content—15,000 colonies per c. c.
Minimum legal butter-fat content—3.4%

At present there are three dairies furnishing San Francisco with approximately 750 gallons of certified milk, or 1.5 per cent of our total supply. It is produced under regulations as promulgated by the Certified Milk Commission, and sponsored by San Francisco Health Department. The consumption has shown a rapid decline since the quality of grade "A" pasteurized has improved. Further 90 per cent of the pediatricians who answered a questionnaire sent out by a California City Health Department preferred pasteurized milk. The average bacterial count for the year 1928-29 was 3,100 colonies per c.c., and the butter-fat content was 3.84 per cent.

Guaranteed milk is a grade that is guaranteed by the Health Department. We have two dairies which supply about 550 gallons. The herds are both accredited by the U. S. Bureau of Animal Industry, against tuberculosis as well as being free of abortion infection. Employees must be free from any contagious disease and file a medical certificate with the Board of Health to this effect. The average count for this grade of milk was 6,900 colonies per c.c. with butter fat at 4.55 per cent for the year above mentioned.

Two goat dairies furnish about 40 gallons of milk to San Francisco daily. It has been widely advertised, especially by the goat industry, that goats are free from tuberculosis, while the scientifically trained men are aware that such is not the case. A short time ago we had the two herds supplying milk tested for tuberculosis and the results were 10 per cent reactors, all of which showed post-mortem lesions. Since the test was made all this milk has been pasteurized. The average count was 2,300 colonies per c.c. with butter-fat 4.03 per cent for 1928-1929.

The methods employed by the Board of Health laboratory for counting bacteria in milk are those published by the American Public Health Association, and are known as the standard methods for bacteriological examination. We use the plate method, dilutions being 1 to 100.

The problem that confronts us at present is to eliminate tuberculosis from dairy cattle producing market milk. This menace exists to a degree, which makes it a great economic factor confronting the whole livestock industry. It has been estimated by authorities that the reaction to this insidious disease would run wholly too high to obtain results by the weeding-out process. At present there is no workable law to indemnify owners for such losses as would accrue, therefore, it is impossible to obtain far-reaching results on the average dairy herd.

It is a well-known fact that calves born of tubercular dams are free of this disease, and if segregated, and kept on non-infected premises and fed on pasteurized milk, they will be raised free of tuberculosis. We have been instructing the dairymen along these lines for the past two years and the results to date have been gratifying. Through this system we hope to eradicate tuberculosis from market milk dairies by 1933—replacing the foundation stock with their clean, healthy off-spring.

The evolution of the milk industry in San Francisco, from a bad condition to its present status, can be traced to strict law enforcement and education. The dairyman of today is a very different individual from the one of yesterday. He has changed the conditions to meet the requirements of today, by producing a product that is satisfactory to the Health Department, the distributor and the consumer.

The distributor, being receptive to the public pulse, has met the situation by improving his conditions also, and is responsible for creating an incentive for the dairymen through a bonus system for clean milk. The distributor has likewise been stimulated through the publication of the results of a "surprise contest" which is conducted every four months. Public interest has resulted in such keen competition that the distributors employ either part or full-time bacteriologists who devote their efforts to improving the quality of the finished product.

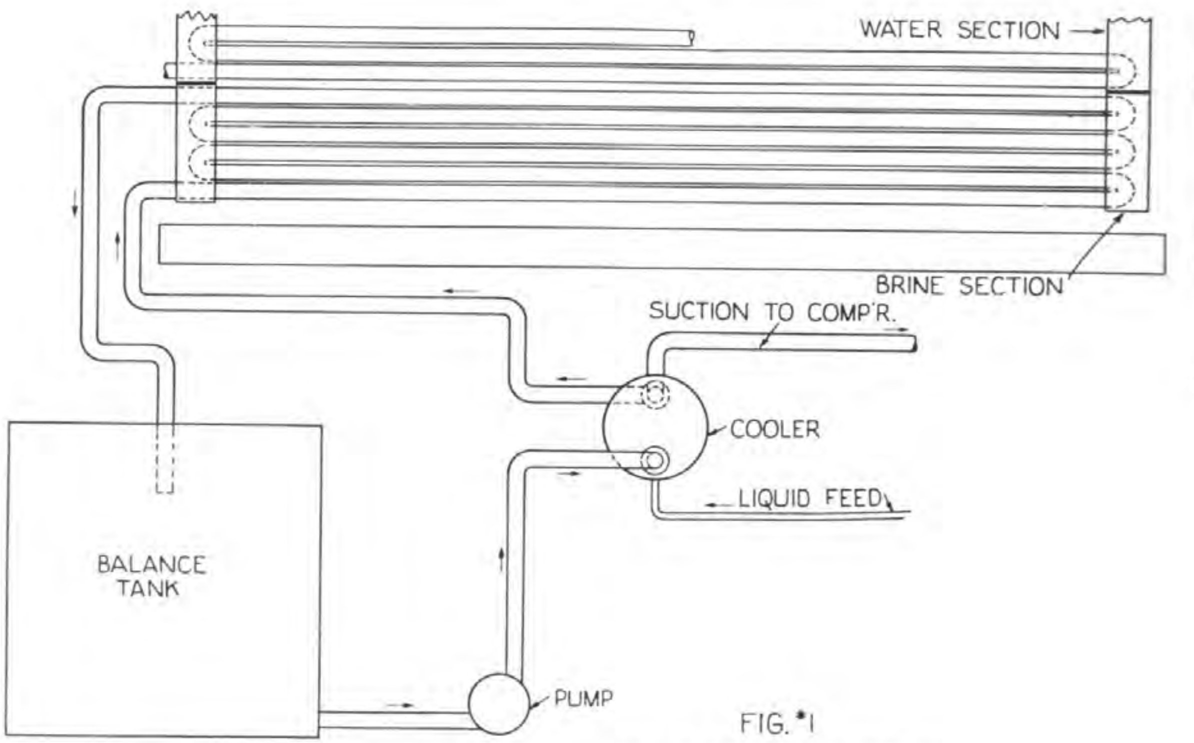


FIG. *1

BRINE COOLER SYSTEM

Tuesday, October 8

8:00 P.M.

PROPER APPLICATION OF DIRECT AMMONIA REFRIGERATION TO MILK-COOLING EQUIPMENT

W. L. HUTTON, *St. Louis Manager,*

Western Division, York Ice Machinery Corporation,

York, Pa.

The gentlemen in charge of the program limited this paper to twenty minutes, therefore the subject was made as specific as possible, and yet I believe that the proper application of refrigeration to milk cooling can be considered a broad topic.

In the allotted time, I can only expect to touch upon the high points, and I want to stay strictly with the refrigeration side of this problem. I thoroughly appreciate that the milk side of it is being capably handled by those who have made that a study. If there is a discussion following, I therefore trust that it can be confined to refrigeration application.

Prior to our Company's entry into the dairy equipment field a short time ago, we had confined ourselves for a period of 40 years or more to refrigeration and its applications. Our practice unfailingly was to experiment in our Research Plant and not upon the public. We determined to follow this precedent in connection with dairy equipment and to do no "plunging."

The points I will try to bring out, therefore, are the results of research, careful study and long and tedious periods of observation in the field, by our best staff engineers. Our conclusions to date are that proper metals and correct application of refrigeration play the big part in the dairy and ice cream game.

American industry is "on the jump" and processing of all kinds is being undertaken in an atmosphere of science with astounding results. We recognize this and have made investments in men and additional research facilities to keep abreast of the conditions.

Our Company has been afforded opportunities to analyze conditions in a few large dairies and ice cream factories, principally from the refrigeration end, and we have discovered such glaring errors in design and application that we can say, with experience and conviction, that if the majority of these plants could be invaded and re-vamped without restriction, from the standpoint of refrigeration application, that the savings in power, operation and maintenance per unit of production times the total production, over a 3-year period or less, would be perfectly satisfactory contract payment terms to us. We have said this to some clients who have taken us up, and we are gratified at the results.

It seems to us that brine refrigeration in the dairy and ice cream factory must of necessity give way to the more direct method of refrigeration, for if the latter is properly done, results favor it from every standpoint.

The initial investment is reduced materially. Power is of necessity reduced, because of the omission of one intermediate piece of equipment for heat transfer—the brine cooler. Operating cost is reduced by reason of power saving, and by the elimination of a brine system, maintenance is reduced by the very nature of the plant, because it cuts out equipment and investment.

The modern ice cream factory, for example, has so many places for application of refrigeration that the initial investment in a direct ammonia plant against the conventional brine plant, when properly designed, can be reduced, or is reduced in the ratio of 50 to 35, or 30% less. This reflects itself in all the fixed charges and in maintenance, because of less actual equipment, to say nothing of power saving and general reduction in operating costs. With the reduction in equipment comes the reduction in building space, which, especially in congested areas, is an important factor. The direct power saving in such an ice cream plant comparison, is in the ratio of 22 to 14, or 32%.

Getting on to the milk cooling system. Figure shows a purely diagrammatic sketch of the conventional brine cooled milk cooler and appurtenances. Our field observations have shown that an average of about 22½ lbs. of ammonia suction pressure is used for cooling brine to a proper temperature for milk processing. The same temperature inside the cooler can be obtained by direct application of ammonia at 35 lbs. suction pressure. This represents a saving of practically four-tenths horsepower per ton of refrigeration duty over the cooler, including brine pump power. This is better than a 30% saving in power, and possibly more if the refrigeration losses through the conventional brine system were accurately determined and added to the above saving. In addition to maintaining an ammonia charge, a brine charge must be kept up, which every dairy operator knows is an item.

Then there is the difficulty of short intervals of time between batches, when there is a slight frost accumulation resulting in a weaker product in the first bottles.

Another difficulty in many installations is the inability to drain the milk cooler of brine after the cooling period. It means that the brine temperature must be brought up to the sterilizing temperature, which is a slow process and not a wholesome one for the system.

Another point which is of first importance, is the fact that the same compressor capacity functioning on a milk cooler, through direct ammonia application, will do 37% more work than if the refrigeration must be transmitted first through brine.

Figure 2 shows the conventional so-called direct expansion ammonia cooled milk cooler. There have been many variations to this cooler, since it was first put on the market, and this diagram is intended simply for the purpose of illustrating the ammonia side of it. This shows the usual needle-point hand expansion valve for feeding the ammonia to the cooler at the bottom. This valve has been replaced in many instances by an automatic expansion valve, so called,. and the suction outlet from the cooler has been provided with a thermostatic chamber which functions directly upon this automatic expansion valve, the purpose being to control the rate of feed of ammonia to the cooler, paralleling the rate of work in the form of milk cooling over or through the cooler.

To take care of variations, suction traps have been installed on the cooler with drain-back connections to the liquid side of the cooler. The supposition is that these traps would gather up sudden liquid return from the cooler and save the compressor from such a shock.

At the outstart, in our Research Department we tried these schemes—every one of them that we could pick up on the market—and we tried hard to make

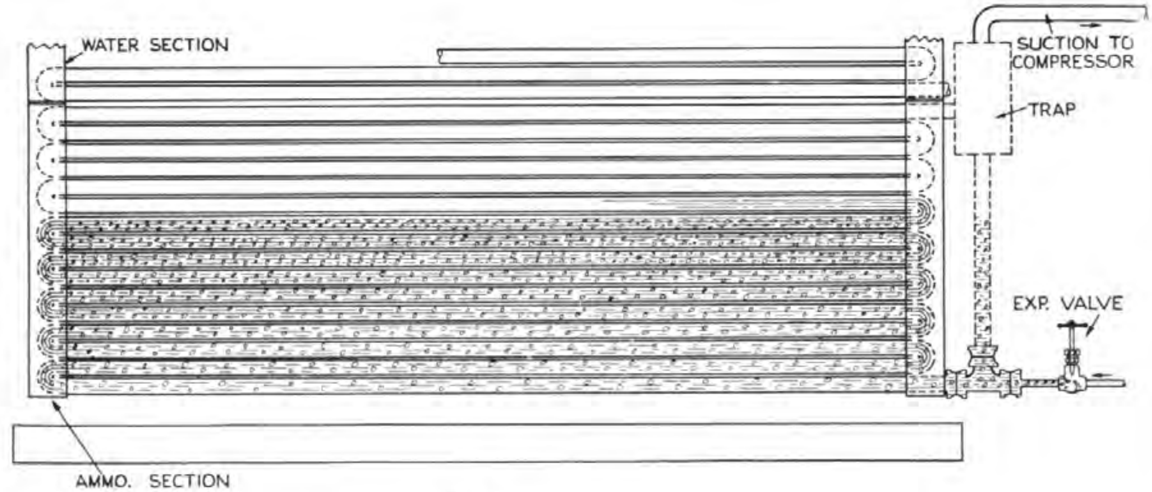


FIG. #2

OLD STYLE AMMO. SYSTEM

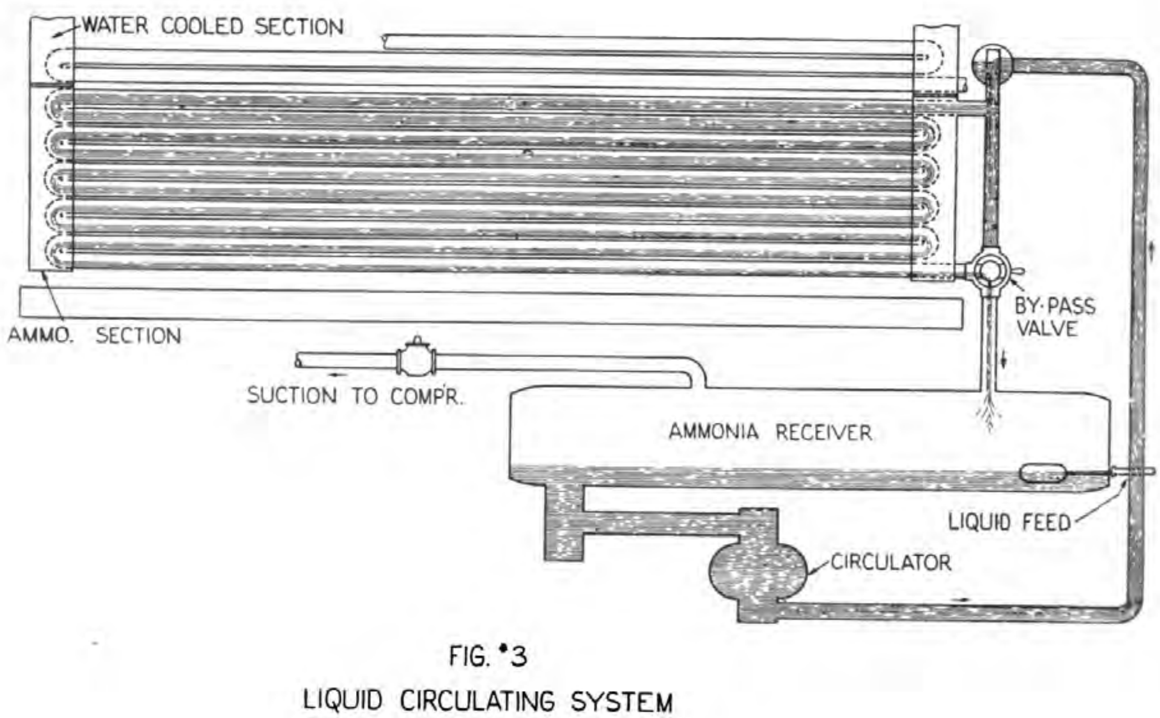


FIG. #3

LIQUID CIRCULATING SYSTEM

them work. Our intent was not to show their weaknesses, but to find the best means of putting ammonia through a milk cooler under the varying loads that are encountered, and at the same time make the cooler most efficient and least troublesome in operation.

When one considers the boiling temperature of ammonia at various pressures, it is not difficult to understand why a milk cooler is not a simple device to cool with ammonia. At 35 lbs. suction pressure the boiling temperature is about 21° F. and an increasing amount of milk over a cooler coming on at, say 90° F., boils off correspondingly increasing amounts of ammonia.

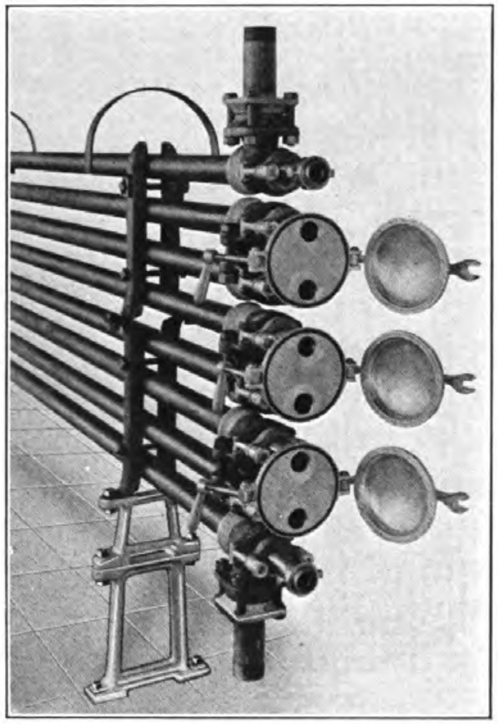
If a milk cooler were charged with ammonia to some level up in the trap, shown on Fig. 2, which is frequently the case, it is impossible, with any thermostatically operated regulating valve, to control the rate of boiling off with sudden changing loads, for it is apparent that the system is filled with ammonia due to the static head carried in such a trap, and any increased load over the cooler, in the form of warm milk, increases the boiling and volume of ammonia gas in the cooler correspondingly, and forces out of the cooler, by displacement, an equivalent volume of liquid. Our experiments showed that this condition is almost as sudden and severe as dynamite. The cooler will cough over liquid in spite of the most intricate and delicate devices that can be installed. Consequently, with the arrangement as shown in Fig. 2 it is only possible and practical to charge the cooler at all times to a lower liquid level about as indicated in the tubes. The upper tubes of the cooler are virtually dry pipes, involving enough storage space to take care of these fluctuations in load and not make the liquid floodback conditions too severe. This means that about six extra pipes must be provided with this type of ammonia application to take care of load fluctuations.

We checked these research conditions in the field with our engineers, and found that exactly what occurred in the Research Plant was occurring in the field. There was no positive control of liquid and ammonia compressors were suffering as a consequence. When an ammonia compressor handles super-saturated gas, the capacity is materially reduced, and the horse-power requirements are materially increased beyond that required for the suction pressure at which they are operated. It represents a dead loss under those conditions. The wear and tear on a compressor under such conditions is enormous.

After making these investigations thoroughly and repeating our tests many times, to be sure of our ground, we evolved a system which we consider to be as nearly "fool-proof" as possible, which would make the operation practically automatic, provide for interruptions of load (which are necessary in the milk cooling business) and require the least amount of milk cooling surface for a given load condition.

Figure 3 shows, in diagrammatic form, the York ammonia liquid recirculation scheme (patented), adaptable to milk coolers of the surface or closed type, which, according to our Research Plant results and a great many actual installations in the field appears to be best for the purpose. This cooler requires 35% less tube surface than the conventional direct expansion cooler shown in Fig. 2.

Briefly, the ammonia liquid at evaporating temperatures corresponding to about 35 lbs. suction pressure is pumped to the top of the cooler from a receiver at a point below the cooler, as indicated. The ammonia circulates downward by gravity, and from the bottom pipe empties into the ammonia receiver without re-



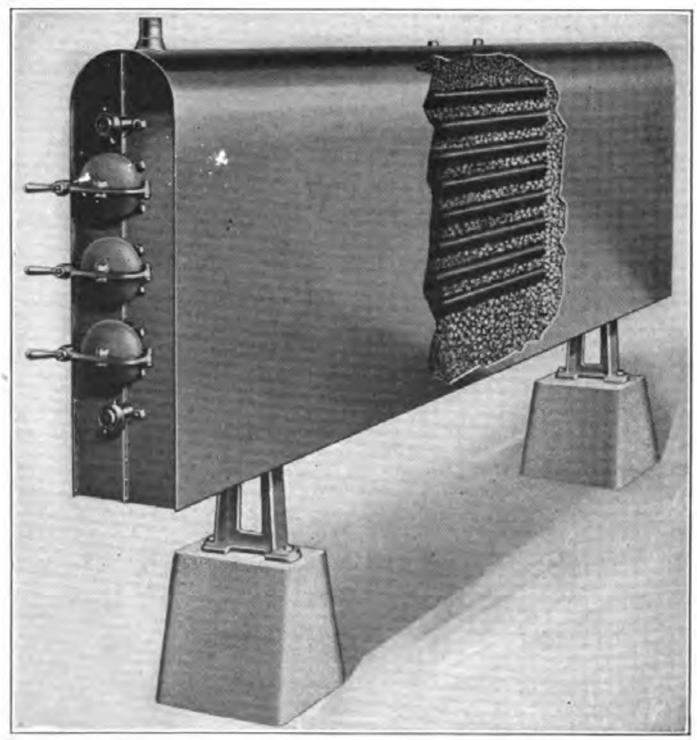


Fig. 4

striction. Thus it can be seen that every pipe is wetted to a pronounced degree, and while the gas volume as formed, displaces some of the liquid in the lower pipes, there remains a quantity of liquid necessary to completely wet the inside surface of the pipes, because the pump is designed and supplied to handle many times the volume of liquid which is evaporated in the cooler, due to the work done. Thus there is insured liquid in every pipe, under all conditions.

The ammonia liquid from the plant is fed to the ammonia receiver through a float, sending the "flash gas" directly to the compressor. In the conventional direct expansion milk cooler this gas must pass through the cooler and destroys at least 10% of its effectiveness. The liquid is kept at a level sufficiently low so that the remaining volume of space in the receiver will hold the entire charge of liquid in the milk cooling tubes and have some remaining gas space to protect the compressor. It must be apparent to all those who have handled ammonia systems, that this makes as safe a scheme as possible for fluctuating loads such as encountered in milk cooling.

Fluctuating loads on the cooler are handled by corresponding rates of liquid fed through the float valve, maintaining always the same level in the receiver when the pump is circulating ammonia through the cooler. During short intervals, when milk is not passing over the cooler, the operator can switch the hand by-pass valve, which allows the cooler to drain into the receiver, and with the pump operating, the liquid simply recirculates through the by-pass valve and no ammonia is contained within the cooler. Thus there is no frost formation on the coil, which would tend to weaken the first run of the next batch cooled. This is a point of importance.

By this same method, the cooler can be emptied of refrigerant immediately after the milk cooling period, whether it be an open cooler or a closed cooler. This permits steam or hot water to be used immediately, without any possibility of damage, and it saves time and gives the crew a chance to clean up the plant with the least possible delay. We have been told by many dairy operators that this is a highly important feature, and a necessary one, in connection with ammonia refrigeration.

To guard against freezing conditions on the cooler, due to fluctuating loads which would result in fluctuating ammonia suction pressures, we developed, after extensive testing, a York regulating valve, which is shown in Fig. 3 on the suction line to the compressor. This maintains a constant back pressure of about 35 lbs. on the ammonia system in the cooler, and allows any variation in the suction line to the compressor between the regulating valve and the compressor.

Figures 4 and 5 show an internal tube closed type milk cooler which we developed to meet an apparently increasing demand for that type of cooler, and for ammonia application. With liquid circulation as described and illustrated in Fig. 3 applied to this internal tube cooler in the annular space between the milk tube and the outer pipe, the results are highly satisfactory. The heat transfer rate between ammonia and milk is better than in any other type. These results seem to be evidenced by repeat orders from some large dairies.

Fig. 4 is shown to illustrate the pains taken to make this cooler a solid substantial job, and at the same time a repairable one. The milk tubes, which are of seamless pure nickel, are expanded into recessed heads, eliminating the undesirable idea of welding, in which case the head is lost when the tube is lost. With the expanded tube, it is simple to remove and replace a tube without destroying any other part of the cooler. The cooler can be taken down in sections, as indicated, because the usual double pipe type of heavy semi-steel ammonia fitting is used to make up the ammonia joints. This is the same type of fitting which has been used in ammonia condensers for many years under high pressures, and to make the cooler absolutely safe nothing has been taken off these fittings in the way of weight.

In concluding, I wish to say that direct application of ammonia, wherever possible in a process, is the "order of the day" but it is not simply a case of resorting to old conventional methods of expanding ammonia through a closed vessel over which certain fluctuating work is done. The characteristics of ammonia, or other refrigerants, will not permit careless handling without resultant damage. The problem must be approached along careful, scientific lines. The research must be done at the right place, because the public can not be fooled, and if direct ammonia refrigeration is done carefully, the time will not be far hence when it will be accepted whole-heartedly for all purposes.

IMPORT MILK CONTROL

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U. S. Department of Agriculture

With the passage of the Import Milk Act there was instituted a control program for milk and cream which is unique in dairy history. This is the first control over milk and cream production by a Federal agency where the standards set are strict enough to result in a definite and lasting improvement in quality and where the safety of the product from a health standpoint is very carefully guarded by efficient pasteurization.

The Federal Import Milk Act was passed by Congress and approved on February 15, 1927; it became effective ninety days later. The funds for its enforcement, however, did not become available until December, 1927. The active enforcement of the law began in the following spring, and by the first of June, 1928, it was in complete operation. The law provided that in the interim between its passage and its complete enforcement, the Secretary of Agriculture might issue temporary permits, upon application, which were to carry on until the necessary regulatory force could be organized. These permits were cancelled on June 1, 1928, and from that time the law has been enforced in accordance with the regulations as outlined in the Service and Regulatory Announcement on Import Milk issued July 21, 1929.

To enforce this law, the Food, Drug and Insecticide Administration established a field station at Rouses Point, N. Y.

This station is one of the eight stations comprising the Eastern Food and Drug Inspection District and is under the direction of W. R. M. Wharton, Chief of the District, with offices in New York. The Rouses Point force consists of fourteen people: the station chief, five veterinarians, four bacteriologists, two clerks, and two laboratory assistants.

The bulk of the importations of milk and cream from Canada comes from the Provinces of Ontario, Quebec and New Brunswick. These entries are made through ports along the international boundary, extending from Buffalo, N. Y., on the west, to Van Buren, Me., on the east—a distance of approximately 800 miles. The main laboratory is at station headquarters at Rouses Point which is about midway between the eastern and western limits. There are three sub-stations: Buffalo, N. Y., Richford, Vt., and Newport, Vt. At these points complete bacteriological laboratories are provided, so that analyses may be made within a very short time after samples are taken.

In presenting a brief picture of the operation of this law, I shall try to give you an idea of how this work is done, and sketch some of the changes and improvements which have been brought about up to this time.

The permits to import milk or cream under this act are issued by the Secretary of Agriculture. The original farm and plant inspections, upon which permit applications are based, are made by the staff of the Veterinary Director General of Canada.

Their reports give the results of the physical examination of all cattle on the dairy farm, the score card record of the dairy premises, and, in the case of an importer of raw product, the record of tuberculin test of the producing animals. Where the permit is issued to a plant, the patron records for each farm delivering to this factory are furnished as the basis of the plant permit, and, with these, the score card on the plant itself. These records and applications are approved by the Veterinary Director General's office and transmitted to the station for review. After careful check by the station, a recommendation is made to the Secretary's office. From time to time inspections are made by our veterinarians to see that the sanitary conditions are being maintained, both on the farms and at the plant, and that adequate records of pasteurization are being kept. The product of the permit is sampled at United States Customs' ports at the time of importation, and bacteriological analyses are made at the nearest laboratory. During the year the repeated plant and farm inspections, combined with the records of bacteriological analyses of importations, give a very complete record of the ability of the permittee to comply with all the provisions of the act.

In case of any violation, an indefinite suspension of the permit is issued by the station. The permittee may then correct the condition which caused the suspension and apply for reinstatement. Before issuing such reinstatement, the station must be assured that full compliance will be maintained in the future.

Experience has shown that the most usual violations on the part of the dairyman who imports his milk under individual permit are: failure to properly identify shipments with suitable shipping tags, as provided in Regulation 20; offering for entry milk or cream at a temperature in excess of 50° F.; shipping milk that exceeds the permitted bacterial standards; and failure to score the required fifty points upon dairy inspection by a field veterinarian. There have been other causes, such as presence of contagious disease in the family of the producer, diseased condition in the herd, and contaminated water supply.

In the case of the permits issued to pasteurization plants, the most usual forms of violation encountered have been: receipt of milk or cream from unapproved sources; failure to properly pasteurize the product or to keep accurate pasteurization records; contaminated water supply of the plant; and failure to maintain the sanitary condition of the plant or plant equipment. Some occasional forms of violation have been failure to properly tag shipments and failure to keep supporting patrons up to the passing score. The plant permittee is responsible for the maintenance of sanitary conditions on the farms from which milk or cream is received.

It is estimated that there are under inspection a total of 10,000 farms covered by about 1000 separate permits. This includes the farms that are operating as direct permittees, as well as those dairies which are producers of the product offered for import under plant permits.

One plant having about 700 patrons is the largest single unit. Others vary from near this figure down to the small plant using the cream from only 20 farms. In the Province of Ontario there are now operating 13 plants and one individual; in the Province of Quebec, 65 plants and 470 individuals; in the Province of New Brunswick, one individual. It will be seen from these figures that the product from Ontario is coming in as a pasteurized cream. Most of Ontario's production is for New York consumption. The one individual permittee in Ontario is on a Canadian island in the St. Lawrence River and sells raw milk to a neighboring island on the American side of the international boundary. From Quebec, with its 65 plants, comes pasteurized cream, which is part of the supply of Boston and other New England cities, only a small percentage of the cream going to New York City. Practically all of the direct importations of raw milk come from Quebec. The largest share of the milk imported enters the ports of northern New York and is destined for New York consumption. Two Vermont ports receive considerable raw milk, which is part of the city supply of Boston.

Without actually seeing the farms and plants as they were when inspection started, it is difficult to appreciate the remarkable improvements that have resulted from the enforcement of the Import Milk Act. The improvements in farm conditions, resulting from the inspection by Canadian veterinarians, and a follow-up inspection by our inspectors, have been revolutionary. It is estimated that there have been built on the farms supplying milk and cream to the United States during the past year at least 5,000 milkhouses. Nearly as many farms have provided their barns with adequate ventilation systems, increased the lighting of their stables, given a great deal more care to the cleanliness of their cows, and improved the sanitary condition of their milk-handling utensils. A large number of Canadian dairymen have harvested enough ice to effectually cool their milk throughout the year, whereas before inspection their cooling facilities were very unsatisfactory. Visits to these farms at the present time would reveal new and up-to-date milkhouses, sanitary and well-kept dairy utensils, whitewashed stables in well-ventilated and well-lighted barns, and general improvements in the sanitary condition of the barnyard.

The improvement in milk plants and creameries holding permit under the Import Milk Act has been even more marked than the improvement on the supporting farms. Plants which a year ago barely passed inspection are today in fine sanitary condition. The plants have modernized their equipment and have greatly improved their methods of pasteurization and cooling. At times the changes in a given factory have practically constituted rebuilding or re-arrangement of the entire plant. The elimination of unnecessary piping, the installation of better can-washing facilities and better cooling equipment have brought about an improvement in quality of product, which, if it could be expressed in terms of percentage, would mean that the quality of the product is at least a hundred per cent better than it was a year ago.

The last year has witnessed a very marked tendency toward the importation of a pasteurized product and a gradual elimination of the individual raw milk and cream imported, owing to the inability of the average individual to continuously meet the bacterial standard. The individual milk and cream importers who have remained, while not pasteurizing before entry, have delivered their products for immediate pasteurization or sterilization after entry. This concentration of imported milk and cream in centralized pasteurization plants in Canada has resulted in an increase in the efficiency of our control because of the smaller number of active permits involved. During the year the active plant permits have decreased as a result of consolidations of plants under one management and the elimination of some nine or ten plants because of failure to meet requirements or voluntary retirement from the exporting business.

The ideal of our field force has been to secure strict compliance with every provision of the Import Milk Act and to carry out this work in such a tactful manner as to win the whole-hearted co-operation of the foreign shipper. In supporting this program we have had the very finest co-operation from the Canadian Department of Agriculture and, particularly, from the office and staff of the Veterinary Director General. The Canadian officers not only made strict enforcement their motto, but carried on their inspection work in such a foresighted and constructive way as to raise the standards of milk production, which ordinarily would require five years of normal development, within about one year's time.

The first year's enforcement of the Import Milk Act has proved successful in eliminating low-grade products and assuring the United States consumer a safe, clean supply of milk and cream of excellent quality.

THE LEGAL PHASES OF MILK CONTROL

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Clean and safe milk can be secured in any community by the rigid enforcement of reasonable health regulations, by persuasive education of milk producers and dealers in the principles of sanitation, and by adequate payment to dairymen of bonuses for milk of high quality and purity. The effective application of any one of these measures will result in the production of a safe and wholesome milk supply. The proper combination of any two of them, whether based on law, education, or economics, will bring about a superior milk supply, while the co-ordinated use of all three methods will ensure the best results of all. This is not theory but fact, as already demonstrated by actual experience.

Importance of Legal Control

Although the legal supervision of milk is not the only significant factor in the production of a clean and safe milk supply, the employment of necessary police measures, so-called, always has been and probably always will be an essential element in milk control. There is, however, some misconception regarding the scope of legal control, many persons apparently believing that it begins and ends in the existence of restrictive, punitive legislation.

Not only must there be statutes commanding what is right and prohibiting what is wrong in dairy practice, but of equal importance is the careful enforcement by administrative officers of reasonable, strictly constitutional, legislative requirements and regulations, which have received or are likely to receive the judicial sanction of the courts. Law is not merely a matter of written legislation. Codes are of no permanent value unless they are drafted with due consideration to the rights and privileges of society as a whole, as well as to the immediate scientific aspects of the problem.

If legislative provisions do not conform to the constitutional immunities granted to individual citizens, so far as is consistent with public safety, such laws will not be sustained by the courts, whose function it is to determine the validity and to interpret the meaning of all legislation brought before them in legitimate causes of action (1). "The right to carry on a lawful and necessary business must be protected against unwarrantable invasion," said the Supreme Court of Alabama in a recent case (2), continuing, "and authority must be restrained within reasonable and proper bounds on the one hand; on the other, the health and safety of the people must be conserved."

It will be worth while, therefore, to review some of the legal principles laid down by the courts with respect to milk control. Although the judicial branches of our governments often apply different principles in the 50 or so federal and state jurisdictions in the United States, they have exhibited considerable unanimity on this particular subject. The courts have been unusually liberal in upholding the reasonable regulation of milk, for they seem to realize that this product is, when pure, the most nearly perfect of the foods of man (3).

Court Decisions on Milk

"The health of the citizens . . .," said the Supreme Court of Oregon recently, "to a very large degree depends upon the purity of its milk," (4) and the Supreme Court of Illinois pointed out some 15 years ago that, "There is no article of food in more general use than milk; none whose impurity or unwholesomeness may more quickly, more widely, and more seriously affect the health of those who use it." (5) Many other courts have rendered similar opinions, so that it is now an established principle of law that the regulation of milk supplies so as to prevent their contamination and secure their purity is a legitimate exercise of the police power in the interests of the public health and general welfare (6).

Nearly 200 court decisions on various phases of milk control have been reported in the United States. To attempt to abstract all of these is obviously not feasible within the limits of this paper, but it will be of value to indicate where more complete references to them may be found.

Not until 1924 was any attempt apparently made to bring together all of the decisions on milk supervision. In that year an article prepared by the author on the legal aspects of milk control was issued by the United States Public Health Service as Reprint No. 939. In it are listed 121 decisions of the courts of last resort in 30 states and the federal government. Court decisions on pasteurization up to the middle of 1927 were reviewed and discussed by the writer in another article issued by the Public Health Service as Reprint No. 1168. In 1928 another writer contributed an article on regulating the production, handling, and distribution of milk to *Public Health Reports* for August 10, 1928. This article lists about 150 decisions. Abstracts of single decisions appear from time to time in the weekly issues of *Public Health Reports,* published by the United States Public Health Service at Washington, D. C.

Since the compilation of the articles mentioned, which together give a fairly adequate picture of the legal phases of milk control, there have been reported about a score of additional cases on the subject. Most of them deal with tuberculin testing, though several are concerned with pasteurization and several with licensing and general regulation. The legal principles enunciated by all of the various decisions may, therefore, be briefly summarized under appropriate headings.

Milk Standards

The promulgation of milk standards which are reasonably calculated to protect public health and to prevent fraud is valid and proper, according to a long line of court decisions. In a recent Pennsylvania case (7) refusing a permanent injunction against a city milk ordinance, the court referred to a previous decision (8), in which it was stated, "The law and the ordinance are based upon the power of municipalities to protect the health of the people by providing for pure milk and such laws have been uniformly sustained by the courts."

Delegation of Authority

It has long been held that the State may delegate its authority over public health to its political subdivisions, particularly municipal corporations and their boards of health, and this principle holds good with respect to milk regulation. Such a proper delegation of authority has, in fact, been upheld by the United States Supreme Court in a leading case (9).

As a general proposition, health authorities may impose more stringent requirements than are contained in a state law so long as they are in no way inconsistent with the statutes. This has been held in a number of cases and is emphasized in a California decision of this year and a Wisconsin one of 1928. (See references 19 and 21.)

Licensing

The licensing by health authorities of dairies, milk dealers, and venders of milk after compliance with reasonable sanitary requirements, and the withholding or revocation of such permits by the authorities for proper cause is a valid exercise of the police power, according to numerous decisions, including a recent Connecticut case (10), and the Alabama decision already mentioned (11).

The courts will consider the merits of a milk dealer's position if he sues for a writ of mandamus to compel the issuance of the license, but will not grant the writ when there is ample reason for its denial. License requirements must, however, operate equally upon all persons, without discrimination. Thus, an ordinance compelling owners of milk wagons to secure a license, but not requiring other dealers to do so has been properly held invalid (12).

Dairy Inspection

In order to satisfy themselves as to sanitary conditions or the eligibility of a dairyman to receive a license to sell milk, health authorities have the legal right to inspect dairies, whether they are within the city where the milk is sold or outside of it. In a recent Florida case (13), it has been held, however, that provisions in a city ordinance requiring a fee of $25 for inspections of dairies more than 5 miles beyond the city limits, and no fee for dairies within the 5-mile limit, were unreasonable and void.

Tuberculin Testing

Prior to 1926 various statutory provisions having for their object the eradication of bovine tuberculosis and the production of milk free from tuberculosis infection had been upheld in nearly a score of court decisions, including one of the United States Supreme Court (14). This case, decided in 1913, sustained a city ordinance prohibiting the sale within the city of milk except from cows that had been tuberculin tested.

The decisions on this subject uphold the regular physical examinations of cattle, the use of the tuberculin test, the destruction either with or without payment of diseased animals, the establishment of accredited herds, the levying of taxes to carry out such procedures, and the delegation of the authority for their administration to local boards. The cases were admirably reviewed in an Iowa decision (15) handed down in 1926, where a bovine tuberculosis eradication law was sustained and the conclusion stated that, "It is clear from the foregoing cases that the legislature had the power to determine that the interests of public health required the testing of cattle for tuberculosis, and to determine, in the exercise of a reasonable discretion, what measures should be taken to that end, and whether, in the creation of the accredited area, within which such testing should be compulsory, notice and an opportunity to be heard should be given."

Since this time there have been additional decisions in Connecticut, Iowa, Nebraska, New York, and Ohio (16). In sustaining the constitutionality of a law providing for the examination, inspection, and testing of cattle for bovine tuberculosis, and their summary destruction under certain circumstances, the Supreme Court of Ohio stated, "these decisions uniformly hold that the summary destruction of the diseased animals does not constitute a taking of private property for public use, but is the abatement of a public nuisance under the police power of the states."

Testing Milk

Samples of milk may be taken by health authorities for testing in order to ascertain chemical and bacterial content and physical condition, according to a number of decisions.

Action on Impure Milk

Milk which is improper for human consumption and can be proven to be such, may be seized by health authorities and summarily destroyed, or a city may prevent unsafe milk from entering its borders. Both of these propositions have been upheld by the United States Supreme Court as a constitutional exercise of the police power (17). Penalties may also be imposed for the possession of impure milk.

Pasteurization

In the reprint on court decisions on pasteurization issued by the United States Public Health Service in 1927, there are discussed 6 cases in 5 states, all but one of which uphold requirements that milk shall be pasteurized in accordance with standards set by local health authorities, and that it is valid to require all milk except certified, or even all milk sold, to be pasteurized. The one decision contra is a Missouri one (18), in which it is held that raw milk is as good if not better than pasteurized and that it is possible to produce it in a sanitary manner.

In 1928 and 1929 there have been reported three additional cases on pasteurization, one each in California, Connecticut, and New York. In two of these (19), requirements that milk should be pasteurized within the city where it is sold were sustained, while the other (20) upholds a provision in a city ordinance making it unlawful to sell milk unless it is from tuberculin-tested cattle or has been pasteurized.

That the Missouri decision against pasteurization has no standing at law in New York is shown by the statement of the Appellate Division of the Supreme Court that, "Whatever may be said of other methods of insuring wholesomeness in milk, pasteurization in these days concededly tends to render milk wholesome."

Dipped Milk

The sale of milk only in sealed containers is a valid requirement, as is the prohibition of the dipping of milk. In a recent Wisconsin case (21) an ordinance of the City of Milwaukee requiring all milk to be dispensed in the original containers, well capped and sealed, was sustained.

Liability for Milk-Borne Epidemics

It is now a well established principle of law in this country that an individual or corporation, whether private or public, which supplies water for human consumption must exercise every reasonable effort to ascertain the quality of the water and to take every possible precaution to prevent its contamination and to render it safe (22). If it does not do this it is liable for injury caused by failure to exercise reasonable care in this matter.

It has been argued that a municipality should be liable for negligence in inspecting milk supplies and for failure to ensure a clean and safe supply, so that outbreaks of disease result. The dealer who furnishes polluted milk causing the disease would be liable for damages, as would a city if it were in the business of dispensing milk. In inspecting milk supplies, however, a city is acting in a governmental capacity and is not liable for injuries due to improper action by its officers or employees. Under certain conditions, the inspector as an individual might be liable, but not the municipality (23).

Undulant Fever

Due to the prevalent interest in undulant fever, which is definitely known to be spread by infected goat's milk, and in which cow's milk is suspected, though not yet conclusively proven to be a dangerous source of the disease in human beings, the aid of legislation against this malady will probably be invoked sooner or later. It should be borne in mind, however, that it is unwise to rush into an orgy of legislation until all of the pertinent scientific facts are known. While public health should be protected without undue delay, such legislation will be all the more sane and sound if it is based on proven and accepted facts.

In this case, they are not yet at hand and we should wait until they are.

Conclusion

From this brief review of the legal phases of milk control, it will readily be seen that the courts have been and continue to be liberal in upholding all reasonable regulation by public authorities of the most important and valuable of all the foods of man. The inevitable result of such proper supervision is to promote the sale and consumption of milk and thus to enhance the physical vitality of the people of this nation.

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6. 18 American Law Reports, 237, 42 A. L. R. 556, 58 A. L. R. 672.
7. Hoar v. City of Lancaster (1927), 290 Pa. 117, 137 Atl. 664.
8. Hill v. Fetherolf (1912), 236 Pa. 70, 84 Atl. 677.
9. Lieberman v. Van de Carr (1905), 199 U. S. 552, 50 L, Ed. 305, 26 S. Ct. 144.
10. State ex rel. Shelton v. Edwards (Conn. 1929), 146 Atl. 382.
11. Walker v. City of Birmingham. See (2). See also Korth v. Portland (4).
12. Read v. Graham (1907), 31 Ky. L. R. 569, 102 S. W. 860.
13. Root v. Mizel (Fla. 1928), 117 So. 380.
14. Adams v. Milwaukee (1913), 228 U. S. 572, 57 L. Ed. 971, 33 S. Ct. 610.
15. Fevold v. Board of Supervisors of Webster County (Ia. 1926), 210 N. W. 139.
16. State ex rel. Shelton v. Edwards (Conn. 1929), 146 Atl. 382.
    Phelps v. Thornburg (Ia. 1928), 221, N. W. 835.
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    State ex rel. Spillman v. Heldt (Neb. 1927), 213 N. W. 578. (Part of the law not covered by the title was held void).
    State ex rel. Spillman v. Wallace (Neb. 1928), 221 N. W. 712.
    Ryder v. Pyrke (1927), 224 N. Y. S. 289.
    People v. Teuscher (N. Y. 1928), 162 N. E. 484.
    Kroplin v. Truax (Ohio 1929), 165 N. E. 498.
17. Adams v. Milwaukee. See (14).
    Reid v. Colorado (1902), 187 U. S. 137, 23 S. Ct. 92, 47 L. Ed. 108.
18. Knese v. Kinsey (1926), 314 Mo. 80, 282 S. W. 437.
19. Witt v. Klimm (Cal. 1929), 274 Pac. 1039.
    Lang's Creamery, Inc., v. Niagara Falls (N. Y. 1928), 231 N. Y. S. 368.

20. State ex rel. Shelton v. Edwards (Conn. 1929). See (16).
21. Milwaukee v. Childs (1928), 195 Wis. 148, 217 N. W. 703.
22. Tobey, J. A.: Liability for Water-borne Typhoid. Public Works, April, 1928.
23. Tobey: Public Health Law: A Manual of Law for Sanitarians 1926. Chapter XII on Liabililty.

REPORT OF COMMITTEE ON SANITARY CONTROL OF ICE CREAM

RALPH E. IRWIN, *Chairman*

Last year the report of the Committee closed with the copy of a letter addressed to the Executive Secretary of the International Association of Ice Cream Manufacturers. In this communication it was stated that as yet but few states or municipalities have adopted legislation dealing directly with the sanitary control of ice cream and that now seemed to be the proper time for the International Association of Ice Cream Manufacturers to present to regulatory officials such regulations as are deemed necesssary for the distribution of a safe, clean, attractive ice cream.

Your committee offered to be of any service possible to a similar committee from the Manufacturers Association.

The following communication was received from the International Association of Ice Cream Manufacturers:

"INTERNATIONAL ASSOCIATION OF ICE CREAM MANUFACTURERS
"Office of the Executive Secretary, Telegraph Building
"HARRISBURG, PA.

October 31, 1929.

"Ralph E. Irwin, *Chairman*,
Committee on Sanitary Control of Ice Cream,
Department of Health,
Commonwealth of Pennsylvania,
Harrisburg, Penna.

"DEAR MR. IRWIN:

"The question of Sanitary Control of Ice Cream was discussed at our convention and the expression of the industry was to the effect that a committee of this Association take up the study of this problem with a view of outlining a Sanitary Code for the ice cream industry. It was also advised to co-operate with the Committee on Sanitary Control of the International Association of Dairy and Milk Inspectors.

"As you know, we already have a committee that for two years have made a study of bacteriological methods and how to produce ice cream with a low bacterial content. We will in all probability assign this committee to do the work on the Sanitary Code. We have on that committee men in charge of laboratories who have the responsibility for the quality of the product as it leaves their respective plants and they certainly have the experience to deal with this problem.

"Very truly yours,

"International Ass'n. of Ice Cream Mfr's

"SIGNED: Fred Rasmussen,
"Executive Secretary."

The committee appointed to represent the Manufacturers Association was as follows:

J. P. Buckley	Supplee-Wills-Jones Milk Co.	Philadelphia, Pa.
J. W. Clopton	Decatur Ice Cream & Creamery Co.	Decatur, Ala.
J. J. Phelan	H. P. Hood & Sons, Inc.	Boston, Mass.
Wm. H. Price	Detroit Creamery Co.	Detroit, Mich.
H. F. Zoller	Chm., Holland Crystal Creamery Co.	Holland, Mich.
Fred Rasmussen	Executive Secretary	Harrisburg, Pa.

During the summer the committee held two meetings in Harrisburg, one in Cleveland, Ohio, and one in Memphis, Tenn. The first three meetings were held in conjunction with the committee representing the manufacturers. An attempt was made to prepare regulations which this Association and also the Manufacturers Association could present to State and municipal officials interested in the preparation of State or municipal laws. The report of your committee is not submitted as one covering all of the requirements necessary for legislative guidance and is therefore considered a progress report.

PURPOSE

The purpose of these regulations is to safeguard human health and life by providing for the issuance of permits and the regulation of the manufacture and sale of ice cream for human consumption; conferring powers and duties on State Regulatory Officials, and otherwise providing for the administration of the regulations; and imposing penalties.

SECTION 1. DEFINITIONS

Be it enacted, &c., That for the purpose and within the meaning of these regulations the following definitions shall obtain:

"Ice cream" shall be construed as meaning and including any frozen product made from a combination of one or more of the following: milk, milk products, sugar, food stabilizers, flavoring, color, fruits, nuts, cocoa, chocolate, egg, cake, candy, confections or water regardless of the name by which such frozen product may be called and under which it may be sold.

"Ice cream plant" shall be construed to mean any place, premises or establishment, or any part thereof, where ice cream, as defined above, is collected, processed, manufactured, handled or prepared for distribution.

"Person" includes masculine and feminine, and any firm, co-partnership, institution, association, or corporation, and any agent, servant, assistant, employee or representative thereof.

"To sell," "for sale," or "sold," and similar terms means the selling, exchanging, delivering, or having in possession, care, control or custody with intent to sell, exchange, or deliver, or to offer or to expose for sale.

Section 2. Permits

No person shall operate an ice cream plant or manufacture ice cream or sell ice cream without first having obtained a permit annually under the provision for issuing permits in the State where the ice cream plant is located or where the ice cream is manufactured or sold.

Section 3. Premises

Buildings and Grounds:

1. Ice cream plants shall be so located as to insure proper shelter and drainage. Grounds shall be kept clean and no refuse shall be allowed to accumulate around or under platforms.

2. No basement shall be used as an ice cream plant unless approved by the State regulatory official.

3. No person shall reside or sleep in an ice cream plant.

4. No animals shall be stabled or kept in an ice cream plant.

Rooms:

Each room in which ice cream is manufactured shall be kept clean, free from dirt and flies and shall be well lighted and ventilated. Rooms in which employees use their hands to fill, remove or pack ice cream molds or wrap cut bricks or handle ice cream specialties shall be furnished with conveniently located washing facilities.

Walls and Ceilings:

Walls and ceilings shall be of suitable impervious material, which shall be tight and cleanable.

Floors:

1. The floors shall be of suitable impervious material which can be flushed and washed clean with water.

2. Floors shall be sloped sufficiently to drain to one or more outlets which shall be properly trapped.

Protection from Flies and Other Insects:

The products used in the manufacture of ice cream, ice cream and cleansed containers and utensils shall be protected from flies and other insects and vermin.

Toilet Rooms and Lavatories:

1. The number of toilet rooms and the number of toilets shall conform to the State regulatory laws.

2. No toilet room shall open directly into any room in which ice cream is manufactured, handled or stored.

3. Toilet rooms shall be equipped with an adequate number of washing fixtures or have such fixtures convenient thereto, and shall be supplied with soap, running water and single service towels.

4. The doors of toilet rooms shall open outward and be self-closing.

5. Placards prominently displayed shall remind employees of the requirements of Sanitation and Cleanliness and particularly the washing of their hands.

6. The disposal of wastes from floors and toilets shall be in accordance with State regulatory laws.

Waste Material:

Covered receptacles shall be provided for waste material and shall be daily removed from the work rooms.

Clothing:

Articles of wearing apparel and employees' food shall not be kept in the rooms where ice cream is manufactured or stored.

SECTION 4. EQUIPMENT

Equipment used in the manufacture of ice cream shall be constructed and operated so that the ice cream will not be contaminated.

SECTION 5. CLEANING EQUIPMENT

Steam and Hot Water:

Ice cream plants shall be equipped with facilities for supplying and using an abundance of hot water and live steam for cleansing and sterilizing purposes.

Equipment:

1. All wagons, trucks, drays, tubs, platforms, and other equipment shall be constructed so that they may be washed and kept clean.

2. Utensils shall be of smooth non-absorbent material and have all seams soldered flush.

3. The water supply for washing equipment, apparatus and containers shall be free from contamination.

4. Suitable facilities and equipment shall be provided and used for the proper cleansing and sterilizing

of freezers, vats, tanks, cans, racks, molds, slabs, forms, piping, and other equipment and utensils with which ice cream comes in contact during manufacture or preparation for sale.

All equipment used in the making or direct handling of ice cream shall be cleaned and finally scalded with water or sterilized with steam each day such equipment is in use.

All hand-washed equipment or apparatus shall be subsequently sterilized with steam or boiling water each day such equipment or apparatus is in use.

5. Pipe lines shall be disconnected and valves taken apart after use and thoroughly washed and sterilized.

6. Cleaning and sterilizing powders and solutions may be used in the cleaning and sterilizing of equipment and apparatus but these powders and solutions shall not be used as a substitute for scalding water and steam.

Section 6. Canning and Packing Ice Cream

Filling of Containers and Packages:

No partly filled cans or containers of bulk ice cream shall be delivered to the dealer.

Preparation of Ice Cream Molds, Forms and Specialties:

The operators filling, removing and packing ice cream molds and the operators wrapping cut bricks and ice cream specialties by hand shall wear clean clothes and keep their hands scrupulously clean.

Section 7. Shipping Containers, Packers, One Time Shippers and Shipping Bags for Ice Cream and Ice Cream Specialties

1. Shipping bags and containers shall be clean and dry when leaving the ice cream plant.

2. All cans and containers shall be washed and steril-

ized when returned to the ice cream plant. After sterilization all cans and other containers shall be stored in such a manner as to be protected from contamination.

3. All metal cans and containers shall be kept free from rust and corrosion. Paper, when used to line or cover all ice cream cans or containers, shall be stored, kept and handled so as to be free from contamination.

Section 8. Ingredients

1. All milk and milk products used in the manufacture of ice cream shall conform to the requirements of the State Regulatory Officials concerning the production and sale of milk and milk products.

2. All fruits, nuts, egg products, flavors, color, sugar and stabilizers shall be clean and wholesome and shall comply with the State and Federal Food Laws and Regulations.

Section 9. Pasteurization

1. The entire mix with or without flavor or color shall be pasteurized. Note: In the absence of specific requirements by State Regulatory Officials for pasteurizing the ice cream mix, pasteurization shall be defined as heating the ice cream mix to the temperature required by the State Regulatory Officials for the pasteurization of milk and milk products. After pasteurization the mix shall be cooled to at least 40° F. and held at that temperature until frozen.

2. All vats or other pasteurizing equipment shall be equipped with recording and indicating thermometers of a type approved by the State Regulatory Official. A recording thermometer record of each batch pasteurized shall be kept on file for at least six months.

Section 10. Personnel

1. Every person engaged in direct physical contact with ice cream during its manufacture shall be clean of

person and wear clean clothes. Immediately on occurrence of any case of communicable disease, either in himself or his family or within the ice cream plant the employee shall cease work and report to his employer who shall notify the local health authority. No employee shall touch the ice cream with his hands, except those specifically designated to cut and wrap brick and package ice cream and to fill fancy molds.

2. It shall be the duty of any person engaged in the manufacture of ice cream to cause a medical examination to be made by methods prescribed by the State Regulatory Official at the time of employment and at least semi-annually thereafter of all employees who come in contact with ice cream.

3. Spitting or the use of tobacco in the rooms of an ice cream plant is prohibited.

Sanitary Regulations for Dealers and Vendors of Ice Cream

1. Ice cream and the equipment and utensils used in serving ice cream, together with fruits and flavors shall be protected from flies, and other insects and dust.

2. No person suffering with any communicable disease and no person who is known as a "carrier" of a communicable disease, as defined by the State Regulatory Official shall be employed in any capacity where ice cream is sold.

3. Ice cream cabinets used by dealers and vendors shall be clean and present a neat appearance.

4. The ice cream cabinet, fountain holes, and wells containing bulk or package ice cream shall be clean. The holes and wells shall be kept covered when not in use.

5. Utensils and devices used in dispensing ice cream shall be kept in running water.

6. Crushed ice used in packing bulk ice cream shall not be utilized for cooling or serving drinks where such ice is added to and is dissolved in the drink.

7. Ice cream cans shall be used for no other purpose than to store ice cream. The cabinet or package receptacle or the ice cream compartment of soda fountains shall be used for no other purpose than to store ice cream.

8. It shall be unlawful to peddle or sell on the streets ice cream in any other form than the original package. However, these regulations shall not prevent the sale of ice cream in any form at a roadside stand or recognized concession provided the aforesaid regulations are adhered to.

Wednesday, October 9
10.00 A.M.

REPORT OF COMMITTEE ON MILK ORDINANCES

WILLIAM B. PALMER, *Chairman*

The Committee on Ordinances is in a position only to submit a progress report. This is true particularly in view of the action taken by the Association at this meeting regarding the personnel of the Committee.

Committee wishes to report that during the past year the Surgeon-General requested its opinion of the suggested amendments submitted by the American Public Health Association regarding the United States Public Health Service Standard Milk Ordinance. The request was complied with and written report submitted.

USING THE DIRECT COUNT TO IMPROVE PHILADELPHIA'S MILK SUPPLY

FLOYD R. EALY

Quality Control Department, Philadelphia Inter-State Dairy Service Council

The Philadelphia Inter-State Dairy Council in its educational program of improving public health and increasing milk consumption, soon realized the need of improving the quality of milk supplying the Philadelphia market. It has been proven that improved quality has increased the consumption of milk and this, in turn, has had a beneficial effect on the general health of the community.

Although Philadelphia has required the pasteurization of all milk sold to its inhabitants for twenty years, the need for a higher quality of milk for pasteurization is still a problem. Regardless of how effective the system of pasteurization, a high quality of milk cannot be made from raw milk of low quality.

In the beginning, we believed in improving, in a visible manner, on the supply of milk coming from our producers. The sediment test was used very effectively in lessening the amount of visible dirt in the milk supply. The number of sediment discs grading very poor has been decreased from 20 per cent to 1 per cent, notwithstanding the fact that the sediment score card has been made more difficult. Then, a set of regulations was drawn up jointly by producers and dealers to govern the production and distribution of milk. At the present time over 20,000 farms are under our inspection and each one must hold a permanent permit showing that the regulations have been met. While we realize that the methods used are more important in the production of a high quality milk than the equipment, we felt that every farm should first meet uniform regulations and then we could isolate the producer that was not properly using his equipment.

The different tests that have been used to determine the quality of milk, namely:—sediment, barn score, temperature, and bacteria, are dependent on each other in ascertaining accurately the quality of the product. Therefore, it is very necessary that one shall not be used too extensively while another is neglected. Milk of high bacteria count is frequently free of visible dirt and vice versa. Milk coming from a well equipped barn is not insured against high bacteria counts at all times. Even milk of a high temperature may be comparatively low in bacteria count if produced under very sanitary conditions. This is especially true of morning's milk if delivered before there is a chance of rapid multiplication of the microbes.

Therefore, in order to more accurately judge the quality of milk on the Philadelphia market, we started, in August 1928, to use the Direct Microscopic Method on the raw Grade B milk as it was received from the farms. This test was developed by Dr. Robert S. Breed of the New York Agricultural Experiment Station and has been used in several cities in milk improvement work. While we have really only started on our program of Direct Counts, we feel that it is proving very satisfactory.

In practice, the test is based on the actual examination of a definite, minute quantity of milk under the high power of the microscope. The samples are taken at the country receiving stations or at city plants where the farmer delivers his milk to the distributor. A .01 cubic centimeter sample is taken from a small dipper by the use of a capillary pipette. The milk is siphoned into the pipette by the use of the mouth and drawn down to the graduation mark on a clean towel. The milk is then spread evenly over one square centimeter area on a clean glass slide 2 x 4½ inches in size. This slide is laid over a paper guide containing sixteen white squares on a black background. The slide is etched along the top and bottom where the patron's number may be written.

The slide with the guide underneath remains on a gallon can filled with very hot water while the sample is being taken. Thus, the smear is dried at once and all bacteria growth is stopped. This eliminates the necessity of having all equipment sterilized. Cleanliness rather than sterilization is the watchword. The pipette is rinsed between samples in a bottle of clean water and dried on a clean towel. In this manner, smears can be made very rapidly. In fact, one man can take samples as fast as two men dump the milk. It is often necessary in some of our large country plants for one man to make one hundred smears per hour.

As soon as the milk is dumped, or while waiting between truck loads, the smears may be stained. First, they are immersed in a solution of Xylol for one minute to dissolve the butter-fat since globules of butter-fat would tend to hide some of the bacteria. The smear is dried and then put in a 70 per cent solution of methyl alcohol for three minutes in order to fix the smear on the slide. Then the smear is dipped in a saturated aqueous solution of methylene blue for staining. The length of time needed for staining varies from a few seconds to a minute, depending on the depth of blue required for reading. If the smears become stained too deeply they may be decolorized in alcohol. After rinsing in water and drying, the smears are ready to read.

We are now using three Bausch and Lomb microscopes with tube length of 160 m.m. and 97 x oil immersion objective; 6.4 binoculars are used and this gives a magnification of approximately 600 diameters. A mechanical stage used to move the slide under the objective greatly facilitates our work. An enclosed microscope reading light with a blue glass reflector has been found much easier on the eyes than direct sunlight or an exposed electric light bulb. Our microscopes are standardized so that the diameter of the field is .16 mm. Hence, the area of the field is approximately 1-5000 square centimeters and each bacterium seen per field means a count of 500,000 per c.c. since we started with .01 c.c. of milk.

The great value of the direct count lies in the fact that the morphology of the bacteria found can be ascertained. Thus, with a remarkable degree of accuracy, we are able to tell the producer the cause of high counts in his milk.

If the organisms are very small, occur in pairs or short chains and are scattered throughout the entire field, a lack of sufficient cooling is denoted. If the organisms are larger and grow in clumps, dirty or improperly constructed utensils are usually found to be the cause. If long chains of streptococci are found in association with a large number of leucocytes, cows in the herd are suffering from mastitis or some infection of the udder.

More detailed information on the direct microscopic count may be secured from New York Agricultural Experiment Station, Geneva, New York, in circular No. 58; Bulletins No. 566 and 567 and Technical Bulletin No. 120. This method of enumerating bacteria is also described in the 1927 edition of Standard Methods of Milk Analysis of American Public Health Association.

In giving the results to producers of Grade B market milk, we felt that a system of reporting by grades would be preferable to recording the actual count. For a laboratory controlling certified or Grade A milk the actual plate count is more valuable than to fieldmen engaged in controlling quality in an entire market. Also, actual numbers mean very little to most farmers who are not familiar with the technique of bacterial analysis.

Accordingly, the samples are divided into four classes as follows:

Class 1—Excellent—average of less than one bacterium per field.

Class 2—Fair—average of one to six bacteria per field.

Class 3—Poor—average of six to fourteen bacteria per field.

Class 4—Very Poor—average above fourteen bacteria per field.

As the factor of the microscope is 500,000 per c.c. for each bacterium seen per field our grades are numerically as follows:

Class 1—less than 500,000 bacteria per c.c.

Class 2—500,000-3,000,000 bacteria per c.c.

Class 3—3,000,000-7,000,000 bacteria per c.c.

Class 4—above 7,000,000 bacteria per c.c.

This classification was not arbitrarily set up, but was worked out after taking over 10,000 numerical counts when we started this work last year. We did not want to make the grades so hard that very few dairymen could make Class 1 in hot weather, or so easy that we should have very few in Class 4. By consistently using the same classification it is a fair measure of progress.

Of course, these figures look rather large, but in comparing the direct count with the agar plate count, we find that the direct count runs four to ten times as high as the plate count. This variation is due to the type and number of organisms found. Thus, if an average of four lactic organisms per field is found, the direct count may be four times as high as the plate count. On the other hand, if an average of one clump containing twenty organisms per field is found, the direct count may be ten times as high as the plate count. In practice, we examine twenty to thirty fields and secure the average. After some experience, sixty samples can be counted per hour.

In selecting the direct microscopic method for use in improving Philadelphia's milk supply its several advantages were noted. First, results are quickly secured, and farmers can be notified the same day the test is taken. Second, the type of organism found gives a clue to the cause of the trouble. This is a valuable aid to the fieldman. Third, the equipment can be used in the field, for the necessity for sterile equipment is eliminated. Fourth, time and labor are saved.

However, the method also has its limitations. It is not accurate enough for use on milk of very high quality, such as certified or Grade A milk, on which premiums are paid. Of course, it cannot be used on pasteurized milk.

Our educational work among the farmers has not gone as far during the first year as we expect to carry it in the future. We hope to hold more meetings during the coming winter, in order to explain more fully to the producers how to keep down the bacteria count, and to show them smears of high and low quality milk. During the past year we have proven to a number of producers that their milking machines were the cause of high bacteria counts by getting them to compare a part of the milking done by hand with part of the milking handled in the same manner but drawn by machine. By sampling night's and morning's milk separately, we have shown many producers that their cooling systems were at fault. Upon request, by taking samples from each cow at milking time and allowing them to incubate over night, we have helped to isolate cows in the herd that were giving milk of a high bacteria count.

During the past year we have sent out letters to those producers whose milk was in Class 4, telling them to what we thought the trouble was due and suggesting ways of remedying same. If a man persisted in sending milk of high bacteria count our fieldman located in that particular territory visited him and went over the situation with him. Often the man running the direct count would call on a producer who had been getting high counts on the same day that the last high count was made. To a very remarkable degree, conditions on the farms thus visited tallied with what was found by the use of the microscope.

In starting this work last year on Philadelphia market milk supply, we had neither enough men nor equipment to cover our entire supply. Therefore, the distributors were asked to pick out the country plants that had run the highest daily average of bacteria counts during the past year. Agar plate counts are made of the daily shipments from each county receiving station. Naturally, the plants selected were in one particular section of the Philadelphia milkshed where there are no springs, so that shallow well or cistern water must be used for cooling.

Seventeen country receiving stations, with over 3000 producers, have been tested twice a month since last year. As many tests as time will permit have been made over the remainder of the territory. We have not taken tests on the Grade A supply, which constitutes 35 per cent of the total Philadelphia consumption, because agar plate counts are run regularly five times a month at all the plants handling this grade of milk.

TABLE 1

NUMBER OF EXAMINATIONS MADE AUGUST 1, 1828 – FEBRUARY 28, 1929 (BOTH INCLUSIVE), BY CLASSES OF SAMPLES, AND ATMOSPHERIC TEMPERATURE GROUPS

Range of Atmospheric Temperature	Class I	Class II	Class III	Class IV	Total
0 – 39° F.	6,966	743	257	229	8,195
40 – 59° F.	3,524	985	246	250	5,005
60 – +° F.	1,765	2,041	1,054	1,853	6,713
Total	12,255	3,769	1,557	2,332	19,913

Table 1 shows the result of 19,913 direct counts made from August 1, 1928, to February 28, 1929, with the number of counts in each of the four classes at varying atmospheric temperatures. The direct correlation between atmospheric temperature and proportion of high counts is plain. Whenever the temperature is above 60° F., the number of high counts increases very rapidly. Therefore, it is most important to stress to the producers the necessity of prompt, efficient cooling. The atmospheric temperature is recorded by the worker at 6.30 A.M.

TABLE 2

NUMBER OF EXAMINATIONS MADE MARCH 1 – JUNE 30, 1929 (BOTH INCLUSIVE), BY CLASSES OF SAMPLES, AND ATMOSPHERIC TEMPERATURE GROUPS

Range of Atmospheric Temperature	Class I	Class II	Class III	Class IV	Total
0 – 39° F.	5,920	531	170	101	6,722
40 – 59° F.	10,360	1,962	694	700	13,716
60 – +° F.	5,144	2,547	1,474	2,164	11,329
Total	21,424	5,040	2,338	2,965	31,767

The 31,767 direct counts taken between March 1, 1929, and June 30, 1929, are recorded in Table 2.

TABLE 3

NUMBER OF EXAMINATIONS MADE JULY 1—SEPTEMBER 30, 1929 (BOTH INCLUSIVE), BY CLASSES OF SAMPLES, AND ATMOSPHERIC TEMPERATURE GROUPS

Range of Atmospheric Temperature	Class I	Class II	Class III	Class IV	Total
0 - 39° F.	281	130	23	10	444
40 - 59° F.	1,737	607	208	214	2,766
60 - +° F.	7,309	3,314	1,702	2,487	14,812
Total	9,327	4,051	1,933	2,711	18,022

Table 3 shows that 18,022 examinations have been made from July to September 30, 1929. Of this number, 14,812 were taken at atmospheric temperatures above 60° F. Only 2,766 were taken at temperatures from 40° to 60° F. On the morning of September 19, 1929, the temperature dropped to 38° F.; so only 444 counts were made at the temperature range 0 - 39° F. during this period. This is decidedly too small a number for comparison.

TABLE 4

PROPORTION OF SAMPLES FALLING IN EACH CLASS, WHEN ATMOSPHERIC TEMPERATURES WERE BETWEEN 0 - 39° F. DATA ARRANGED ACCORDING TO PERIOD IN WHICH EXAMINATIONS WERE MADE, AND EXPRESSED AS PERCENTAGE OF TOTAL EXAMINATIONS MADE DURING PERIOD WITHIN TEMPERATURE RANGE

ATMOSPHERIC TEMPERATURE 0 - 39° F.
(both inclusive)

Period	Class I	Class II	Class III	Class IV	Total
First August-February	85.0	9.1	3.1	2.8	100.0
Second March-June	88.1	7.9	2.5	1.5	100.0
Third July-September	63.3	29.3	5.2	2.2	100.0

The percentage of samples in each of the four classes when atmospheric temperature ranged between

0 - 39° F. is shown in Table 4. As previously pointed out in discussing Table 3, the number of samples in the third period, July to September 30 is, very small and the temperature was 38° F.

TABLE 5

PROPORTION OF SAMPLES FALLING IN EACH CLASS, WHEN ATMOSPHERIC TEMPERATURES WERE BETWEEN 40 - 59° F. DATA ARRANGED ACCORDING TO PERIOD IN WHICH EXAMINATIONS WERE MADE, AND EXPRESSED AS PERCENTAGE OF TOTAL EXAMINATIONS MADE DURING PERIOD WITHIN TEMPERATURE RANGE

ATMOSPHERIC TEMPERATURE 40 - 59° F.
(both inclusive)

Period	Class I	Class II	Class III	Class IV	Total
First August-February	70.4	19.7	4.9	5.0	100.0
Second March-June	75.5	14.3	5.1	5.1	100.0
Third July-September	62.8	21.9	7.5	7.7	100.0

In Table 5 with a range of atmospheric temperature of 40° to 59° F. we find that the number of samples in Class 4 has increased from 5.1 per cent in the second period to 7.7 per cent in the third period. However, I believe this is due to the fact that the mean average temperature during the period, July-September, was 55° F. while, during the first and second periods it was 45° F.

TABLE 6

PROPORTION OF SAMPLES FALLING IN EACH CLASS, WHEN ATMOSPHERIC TEMPERATURES WERE BETWEEN 60 - + ° F. DATA ARRANGED ACCORDING TO PERIOD IN WHICH EXAMINATIONS WERE MADE, AND EXPRESSED AS PERCENTAGE OF TOTAL EXAMINATIONS MADE DURING PERIOD WITHIN TEMPERATURE RANGE

ATMOSPHERIC TEMPERATURE 60 - +° F.
(both inclusive)

Period	Class I	Class II	Class III	Class IV	Total
First August-February	26.3	30.4	15.7	27.6	100.0
Second March-June	45.4	22.5	13.0	19.1	100.0
Third July-September	49.4	22.4	11.5	16.8	100.0

In Table 6 with an atmospheric temperature above 60° F. and with a mean average temperature of over 70° F. we find the results for the three periods. It is in this range of temperature where the vast majority of high counts are found (See Table 1). The number of samples in Class I has been increased from 26.3 per cent in the first period to 45.4 per cent in the second period and further increased to 49.4 per cent in the third period. At the same time the number of samples in Class 4 has been decreased from 27.6 per cent in the first period to 19.1 per cent in the second period and further decreased to 16.8 per cent in the third period. This is a very decided improvement in quality from a bacterial standpoint, and has been obtained solely by educational methods. However, we are working only on the poorest part of the Philadelphia milk supply; the improvement is not likely to be noticeable as quickly on the remainder of the supply.

In conclusion, we feel that the Direct Count is proving very satisfactory for our work on raw market milk. It creates confidence among the producers, for they can actually see the bacteria under the microscope at the time the tests are taken, or at country meetings. Literature, with illustrations of different types of organisms and with explanations of the common causes of the presence of each type, may be sent the producer.

Since this method locates the cause of high counts, the fieldman is enabled to point out in a definite way to the producer the methods needed to improve the quality of his product. Finally, this method isolates the consistently careless producer who is responsible for the vast majority of poor quality product of any commodity.

In the future, as the Direct Count is used more extensively, we hope to be able to show more improvement.

THE USE OF THE METHYLENE BLUE TEST IN ALABAMA AS A BASIS FOR THE CLASSIFICATION OF MILK SUPPLIES FOR MANUFACTURING PURPOSES

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District Milk Inspectors, State Board of Health,
Montgomery, Alabama

The methylene blue reductase test as a measure of milk quality has numerous advocates, some of whom go so far as to declare that it may well replace the more firmly established laboratory techniques, such as the plate count, the Frost little plate count, or the Breed count for grading milk supplies. There appears to be good reason to doubt if the reductase test is sufficiently accurate to distinguish, with uniform justice to the producers, between milk supplies with bacteria counts of 50,000 per c.c. or less and those with counts of more than 50,000 per c.c. However, this test does appear to have a very practical application in the classification of milk supplies for cheese-making or for condensing purposes, in which the line between good milk and undesirable milk is not so sharply drawn. In the hope that some features of the experience of the Alabama State Health Department may be of interest to the members of this Association, this paper has been prepared.

Description of the Milk-sheds in which Milk is Being Graded

Starting at the Mississippi-Alabama boundary, about midway between the north and south extremities and extending nearly across Alabama in an east-southeast direction, is a wedge-shaped area known as the Clover Belt. This area is about 50 miles wide at the base of the triangle, and its east-west length is approximately 180 miles. The soil of this area is a limey, black clay, exceptionally well suited to the production of alfalfa, clovers, Johnson, and Bermuda grasses, corn, sorghum, legumes, and certain grains. Because of its natural advantages, it has always been a cattle country, and during the last decade has rapidly developed into a dairy section. Practically every landowner and tenant farmer is milking from 2 to 100 cows. The Belt is now the seat of eight creameries, three whole milk receiving stations for the Birmingham market, three cheese plants, and one condensery.

History of Milk Grading Activities in this Area

About January 1, 1923, the Alabama State Board of Health, in co-operation with the U. S. Public Health Service, undertook the formulation of a milk quality control ordinance, the passage of which might be advocated for all Alabama communities. This ordinance provides for the grading of all milk supplies on the basis of the conditions under which they are produced and handled, and of the bacterial quality and temperature when delivered to the consumer, the grades to be determined by the health department, and the grade of the contents to appear on every bottle cap. This ordinance now applies in between 50 and 60 Alabama communities, and has come to be known as the U. S. P. H. S. Standard Milk Ordinance.

In March, 1926, Southern Dairies, Inc., requested the State Board of Health to formulate a system of quality control of the milk reaching their condenseries at Selma and Montgomery. The criterion adopted for these milk supplies was Grade B Raw Milk, as specified in the Standard Milk Ordinance. Two inspectors were placed in the field to interest and instruct dairymen in making the necessary improvements in dairy-building construction and milk-handling methods, and to sample the supplies of producers seeking a Grade B rating. In November, 1926, a 20c per cwt. premium was established for milk attaining a Grade B rating, and a number of dairymen promptly developed interest in the attainment of this rating for their milk supplies.

All samples to be examined for bacteria content had to be shipped, or carried with ice in insulated cases, to the State Laboratory at Montgomery, the distance from one cooling station being 97 miles. Since the Selma milk-shed was served by four cooling stations and the central condensery, the employment of a sample-taker, whose entire function was the taking of samples from Grade B producers at weekly intervals, was necessary.

The results of this effort at milk quality improvement were rather disappointing. The greater proportion of the milk producers of the Clover Belt are tenant farmers, who are not in a position to invest in physical improvements. This circumstance automatically limits the number of dairymen, and indirectly the volume of milk, which can be improved in quality by the establishment of a premium. The percentage of Grade B Raw Milk received by the condenseries rarely exceeded 35 per cent in any month. After the Kraft-Phenix Cheese Company took over the Selma milk-shed of Southern Dairies in November, 1927, the failure to materially improve the quality of the whole supply became evident in the quality of the finished cheese, and it became clear that some modification of the grading system then in use must be adopted.

Reductase Test Adopted

In November, 1928, the testing of all supplies from the Selma milk-shed by means of the methylene blue test was inaugurated. This method of testing was adopted for several reasons:

1 The test is simple and rapid, so that the apparatus can be set up at each cheese plant or receiving station, and every supply tested.

2 By this means each plant superintendent can be given data concerning the quality of milk delivered by his entire roster of patrons.

3 Results are available on the same day samples are taken, and can be posted, so that patrons can see them when the next delivery to the plant or station is made. This encourages the interest of producers, including tenant farmers, in the quality of their output, and develops a spirit of rivalry among them.

4 The cost per sample of milk examined is materially reduced. More samples can be examined, and less personnel and less expensive personnel is required.

In July, 1929, Southern Dairies, Inc., Montgomery condensery and the Hayneville receiving station also adopted the reductase test.

Equipment and Methods Used

Reductase testing was begun as an experiment. It did not seem advisable to purchase patented equipment, at considerable expense, which might be abandoned in a short while. Instead, the necessary equipment, including the test tube racks, and portable water baths, were constructed by the plant mechanics, and plant facilities for heating the incubator and operating sterilizers were adopted. In Montgomery the sterilization of test tubes is done at the State Laboratory.

The portable water baths consist of wooden boxes, provided with hinged lids, and lined with sheet metal, and provided with an opening into which a steam hose may be inserted. Test tube racks consist of square trays, 9″ x 9″ x 5½″ wired so that tubes are held upright. The test tubes used are ⅝″ x 5″, hard glass, and cork stoppers, No. 5, are employed. These tubes are calibrated and marked at the 10 c.c. level by means of a file or emery wheel.

The sample taking, testing, and reporting procedure is as follows:

1 Sterilized tubes and stoppers and the water bath are taken to the receiving platform of the plant at which tests are to be made.
2 The tray is immersed in the water-bath, into which several pieces of ice are placed.
3 Samples (10 c.c.) are caught in the tubes in which the test is made as the cans are emptied into the weigh-tank, approximately aliquot parts being taken from each can. (If the patron has more than 5 cans, two samples are taken.)
4 The samples are immediately placed in the tray immersed in ice water, in such order that their identity is known.
5 The number of the patron whose milk was sampled is recorded to correspond with the number of the tube used.
6 When all the milk has been received, 1 c.c. of standard strength methylene blue solution is added to each sample.
7 The ice water is emptied from the water bath, warm water added, and the steam hose inserted. A temperature of 98° F. is maintained by controlling the admission of steam.
8 Observations of decolorization are made at intervals of 20 minutes, I hour, 2 hours, 3 hours, 4 hours, and 5 hours. All samples not decolorized after 5 hours are recorded as having stood up 6 hours.
9 Results are posted on a bulletin board where they may be seen by patrons at their next delivery.
10 Cards are mailed to those patrons whose milk was reduced in less than 3 hours.
11 A permanent record of the results is made in the office of the inspector.
12 All milk supplies are classified according to the average reduction time obtained by averaging the results of the last four samples, as follows:

Class	Average Reduction Time
I	Grade B inspection and 5 hours or more
II	3 to 5 hours
III	Less than 3 hours

Results in the Kraft-Phenix Cheese Company Milk-shed

The Kraft-Phenix Cheese Company operates four cheese factories, located at Selma, Gallion, Marion, and Uniontown, and receives milk from a total of 665 patrons.

At the Gallion and Marion plants milk is delivered largely by patrons. The supplies at the Uniontown and Selma plants are in part collected by truck. All plants receive milk only once daily, thereby forcing patrons to hold milk over night.

The differential for Class II milk is 10 cents per hundred above the basic price, the price of Class I milk is 5 cents above the Class II price. This small differential does not justify the use of ice for cooling the night milk, which is kept, therefore, in well water which is rarely cooler than 65° F.

Grading of milk on the basis of this test has been in effect since January 1, 1929. Although it appears that a large percentage of this milk has lately been of poor quality, it may be said that the quality of cheese turned out to date in 1929 has been far superior to that made in 1927 and 1928.

The Kraft-Phenix Cheese Company began the grading of their cheese in this area on April 1, 1929. From that date to August 15 over 50 per cent of the cheese manufactured has graded as Elkhorn, which is the best grade, while only about 10 per cent has been under grade the other 40 per cent being Plains. The cheese manufactured in 1927 and 1928 was not graded, but the management doubts if *any* of the cheese made during that time would have graded as Elkhorn, while a considerable percentage would have rated under grade, in spite of the fact that during the summer months of 1927 and 1928 milk was received at the plants twice daily, whereas during 1929 milk has been received only once daily throughout the summer.

It is not claimed that the inauguration of the methylene blue test has been solely responsible for this improvement in the manufactured product. There have been a number of contributing factors, of which the methylene blue test has, however, probably been the major one.

Results in Southern Dairies Milk-shed

The Southern Dairies, Inc., operates a condensery at Montgomery with a total of 350 patrons and a cooling station at Hayneville with a total of 160 patrons. The Montgomery plant receives during the summer months an average of approximately 3600 gallons of milk a day, approximately 1200 gallons of which is collected at the Hayneville cooling station. The greater portion of the milk received at the Montgomery plant is shipped by regular truck routes by patrons living from 10 to 20 miles from Montgomery. At Hayneville, all the shippers live within a radius of 5 miles of the cooling station. Both the condensery and the cooling station receive milk twice daily, and as a consequence a very small number of patrons hold their milk over night. At Montgomery the milk reaches the condensery from 1 hour to 5 hours after the time of milking, whereas, at the Hayneville cooling station all the milk is delivered within two hours after the time of milking.

In July, 1929, Southern Dairies, Inc., adopted the methylene blue reductase test as a means of determining the quality of the milk delivered to its plant and cooling stations. On August 1 a bonus or price differential for Class I and Class II milk was established. Class III milk receives the basic price. Class II milk receives a bonus of 20 cents per hundred pounds above Class III, and Class I receives a bonus of 10 cents per hundred pounds above Class II.

The Methylene Blue Reductase Test has been employed for so short a period in Montgomery that no interpretation of the practical value of the results obtained can be made. Mr. T. A. Horsley, Manager of Southern Dairies, makes this statement in regards to the value of the reductase test:

Although prior to July 1, 1929, the proportion of Grade B Raw Milk in our total receipts frequently reached 35 per cent. the degree of acidity in the condensed milk made it impossible to keep it in storage as long as we would sometimes have desired. The average acidity of the fresh milk received under these circumstances usually ranged above 18 per cent.

Since the methylene blue method of testing has been in effect the average acidity of the fresh milk ranges from .15 per cent to .18 per cent, and we are able to hold the condensed milk in storage for longer periods.

This improvement is attributable to the fact that all patrons' supplies are now tested, and instances of poor quality are promptly called to their attention.

The principal result of the inauguration of the methylene blue test is the clear indication that two men trained for this work can test all the supplies received and still have leisure to visit dairy farms and instruct those dairymen who seek advice concerning milk sanitation. These men can be employed at lower salaries than trained and experienced dairy inspectors. The saving effected amounts to approximately $5,000 annually.

LOCAL MILK CONTROL

L. M. Graves, M. D.

Superintendent of Health, Memphis, Tennessee

In March, 1928, a survey was made of the Memphis milk supply by a representative of the Tennessee State Department of Health for the purpose of ascertaining the local conditions and to make such recommendations as might be deemed necessary to provide more efficient control. Inspections were made of all pasteurizing plants and many dairies. Approximately 600 dairies were supplying Memphis with milk at this time, not including 11 pasteurizing plants scattered throughout the country. Not all of these premises were visited during the initial survey, but a sufficient number were seen to give an accurate idea as to general conditions.

The report made to the City Health Department at the conclusion of this survey was summarized as follows:

Your present milk ordinance is deficient in the following essentials:

1 It contains no provisions for the protection of water supplies at dairies.
2 It allows the sale of bulk milk in restaurants, drug stores, etc.
3 It does not provide for health examinations.
4 It permits hand capping.
5 It does not contain provisions for proper operation of pasteurizing plants.
6 It omits provisions for proper care of the hands, milk stools, etc.
7 The present method of scoring dairies and milk plants gives no accurate idea as to the conditions and is unfair to the industry.
8 Many provisions of the present ordinance are not being enforced.
9 No method is provided for the interpretation of the provisions of the milk ordinance.

The problem of adopting a new milk ordinance did not at first seem easy. Many things enter into a change of this character. The governing or legislative body of the city must be satisfied and the dairy industry with its retail raw milk and pasteurization exponents must be considered.

We took several months in making up our minds as to the best course to pursue. After much investigation and thought it was finally decided to adopt the Standard Milk Ordinance recommended by the U. S. Public Health Service and the Tennessee State Department of Health. A meeting of the retail raw milk men was called and eighty per cent of them attended. At this meeting every detail of the ordinance was explained in full and ample opportunity was given for asking questions and general discussion. At the conclusion of this meeting the dairymen by a unanimous vote asked the city to adopt the Standard Milk Ordinance. At a meeting of the pasteurizing plant operators, the same results were obtained. The City Commission was next approached and after proper explanation and the usual legal procedure the Standard Milk Ordinance was adopted on September 11, 1928, effective in thirty days. A period of three or four months after the passage of the ordinance was spent in visiting dairies and milk plants in order to acquaint each individual with the changes necessary to comply with the ordinance. The industry as a whole expressed a desire to produce Grade "A" milk. An examination of the records will show an average of eight to ten inspections per dairy for the period between October 1, 1928, and June 1, 1929. Extra trips were made to most of the dairies to answer requests for advice. These trips do not show on the records. During the month of January, 1929, work was interrupted by the influenza epidemic. In February, 1929, systematic work was resumed and has been pursued ever since. A study of the charts will give an estimate of what has been accomplished. The charts do not fully picture the conditions at the beginning of the work because the pre-enforcement figures are of January, 1929, while the actual field work was begun in October, 1928. Many defects evident in October had been corrected by January, the time of the pre-enforcement survey.

In collecting the survey data, actual visits were made to at least fifty retail raw, fifty raw to plant dairies and all the pasteurizing plants. The surveys occupied about ten days each. It is felt that this gives as accurate a picture of existing conditions as is possible to secure. The method of determining the milk sanitation rating is described in United States Health Service Report No. 1098.

Table 1 is a composite picture of the pre-enforcement (January, 1929) and the last survey (August, 1929) conditions surrounding the production, handling and sale of retail raw milk. Table 2 is a composite picture of the pre-enforcement (January, 1929) and the last survey conditions (August, 1929) of the raw milk delivered to pasteurizing plants. A comparison of Tables 1 and 2 will show that with the exception of cooling and bacterial counts, conditions are about the same as on the retail raw milk dairies. As stated before these surveys are tabulated on a Grade "A" basis and bacterial counts over 50,000 and temperatures over 50° F. are counted as defects, while under actual operation of the ordinance, raw milk with an average count of 200,000, cooled to 60° F., or delivered to the milk plant within two hours from time of production, may be legally used for Grade "A" Pasteurized milk. As a matter of fact, most of the dairies producing milk for pasteurization are under the 200,000 colony count.

Table 3 is a composite picture of the pre-enforcement (January, 1929) and the last survey (August, 1929) conditions of the pasteurizing plants. The improvement in the pasteurization process shows that many changes that are vital to the proper operation of a milk plant have been accomplished. Screening of the plants was being neglected, milk surfaces were not protected, toilet facilities not provided, disinfection of equipment was faulty and at the time of passage of the ordinance not one milk plant was equipped with the proper time and temperature control or proper valves. No examinations of milk handlers had ever been made. A study of Table 3 will show these defects to have been practically all corrected.

Increase in Milk Consumption

An increase in the consumption of fluid milk possibly is as essential from a public health standpoint as its sanitary control. One of the most satisfying accomplishments in the enforcement of the Standard Milk Ordinance in Memphis has been the response of the milk consumers to the grading system. The grade announcements in the public press, labeling of each bottle with the grade and the placarding of all milk dispensing establishments with grade placards, has done much to instill confidence in the milk supply. The result has been a marked increase in milk consumption, an increase of approximately 50 per cent since September, 1928.

Increase in Use of Pasteurized Milk

During the period of Standard Ordinance enforcement another very gratifying result has been the increased use of pasteurized milk. In our opinion the faulty processing of milk in milk plants is the chief reason for lack of its use. With the changes in plant equipment, better control of time and temperature and the marked improvement in the raw milk supply, the quality of pasteurized milk has shown a very material improvement and its use has increased accordingly. In September, 1928, 57 per cent of our supply was pasteurized, while in August, 1929, this had increased to 67.2 per cent, an increase of 18 per cent.

Summary

This paper may be summarized briefly thus:—

The enforcement of the Standard Milk Ordinance in Memphis for a period of approximately nine months has accomplished:

1 An increase in the compliance of retail raw milk from 60 per cent to 92 per cent, or 53 per cent.

2 An increase in the compliance of raw milk for pasteurization from 51 per cent to 87 per cent, or 71 per cent.

3 An increase in pasteurization process compliance from 65 per cent to 99 per cent, or 69 per cent.

4 A marked increase in the amount of fluid milk consumed, 50 per cent.

5 An increase in the per cent of the total milk supply. Pasteurized 18 per cent.

6 A much better feeling between the dairy industry and the City Health Department.

7 Not a court case against any member of the industry.

TABLE 1

RETAIL RAW MILK

		Pre-Enforcement	August 1929	Per Cent Improved
Cows	Tuberculin Tested	100.0	100.0	0.0
Dairy Barn	Light	96.7	100.0	3
	Air Space	98.3	100.0	2
	Floor Construction	93.9	100.0	6
	Floor Cleanliness	80.0	98.6	23
	Walls and Ceiling	54.6	97.0	78
	Barnyard Drainage	89.5	99.2	11
	Barnyard Cleanliness	70.6	99.0	40
	Manure	74.8	96.8	29
Milk House	Floor	89.1	100.0	12
	Walls and Ceiling	38.6	97.1	151
	Light	97.5	98.4	1
	Screens	25.2	88.0	249
	Miscellaneous Requirements	51.4	99.0	93
	Cleanliness	53.0	89.8	88
Toilet	Construction, Etc.	83.6	99.2	19
Water	Quality, Etc.	90.1	100.0	11
Utensils	Construction, Etc.	76.6	93.1	21
	Cleaning	78.8	92.9	19
	Disinfection	48.8	92.7	90
	Storage	26.6	99.0	272
	Handling	94.8	100.0	5
Methods	Udders, Teats	93.0	100.0	8
	Flanks	95.5	100.0	5
	Hands	7.8	95.9	1129
	Clothing	88.4	100.0	13
	Milking Stools	16.0	99.5	522
	Removal of Milk	94.1	98.9	5
	Cooling	0.0	37.5	—
Bottling	Method	15.0	97.3	549
Employees	Health Certificates	.99	97.4	8718
Bacteria	Bacterial Counts	39.5	77.0	95

TABLE 2

RAW MILK FOR PASTEURIZATION

		Percentage Complying		
		Pre-Enforcement	August 1929	Per Cent Improved
Cows	Tuberculin Tested	97.7	100.0	2
Dairy Barn	Light	77.9	98.5	25
	Air Space	91.8	100.0	9
	Floor Construction	84.1	97.8	16
	Floor Cleanliness	48.9	98.5	101
	Walls and Ceiling	16.4	94.3	468
	Barnyard Drainage	87.7	96.7	10
	Barnyard Cleanliness	41.5	100.0	140
	Manure	67.2	100.0	47
Milk House	Floors	73.7	100.0	36
	Walls and Ceiling	3.2	98.5	2977
	Light	88.4	100.0	13
	Screens	8.1	96.2	1087
	Miscellaneous Requirements	47.0	96.9	104
	Cleanliness	61.6	98.7	60
Toilet	Construction, Etc.	55.1	91.4	66
Water	Quality, Etc.	65.1	98.7	52
Utensils	Construction, Etc.	44.9	98.7	120
	Cleaning	58.8	97.0	65
	Disinfection	22.1	95.2	331
	Storage	6.0	100.0	1566
	Handling	98.0	100.0	2
Methods	Udders and Teats	24.4	100.0	309
	Flanks	93.8	100.0	7
	Hands	23.2	98.5	325
	Clothing	96.5	95.7	9
	Milking Stools	7.8	95.8	1128
	Removal of Milk	86.7	100.0	15
Cooling	Cooling	0.0	28.9	—
Bottling	Method	—	—	—
Employees	Health Certificates	0.0	100.0	—
Bacteria	Bacterial Counts	44.9	47.9	7

TABLE 3

PASTEURIZATION PROCESS

		Percentage Compliance Pre-Enforcement	Percentage Compliance August 1929	Per Cent Improved
Building and Equipment	Floors	71.3	100.0	40
	Walls, etc.	100.0	100.0	0
	Doors, Windows	40.9	98.8	141
	Light	100.0	100.0	0
	Ventilation	100.0	100.0	0
	Protection from flies	40.9	98.8	141
	Toilet Facilities	43.9	100.0	128
	Water Supply	100.0	100.0	0
	Washing Facilities	68.9	97.3	41
	Milk Piping	91.2	100.0	9
	Equipment	100.0	100.0	0
	Waste Disposal	100.0	100.0	0
Methods	Cleaning	100.0	100.0	0
	Disinfection	13.6	100.0	635
	Storage	91.1	100.0	9
	Handling	88.3	100.0	13
	Bottle Cap Storage	88.3	100.0	13
	Two Thermometers	40.9	100.0	144
	Thermo Charts	40.9	100.0	144
	Valves	40.9	100.0	144
	Foam	100.0	100.0	0
	Vat Covers	40.9	100.0	144
	Preheating holders	100.0	100.0	0
	Cooling	100.0	100.0	0
	Bottling	94.6	100.0	6
	Overflow Milk	100.0	100.0	0
	Capping	94.6	100.0	6
	Delivery	100.0	100.0	0
Personnel	Health	0.0	100.0	—
	Cleanliness	100.0	100.0	—
Bacteria	Bacterial Counts	79.2	100.0	26

Wednesday, October 9
8.00 P.M.

COORDINATING MUNICIPAL MEAT AND DAIRY INSPECTION IN ALABAMA COMMUNITIES

H. J. THRASHER, *Assistant Director*
Bureau of Inspection, Alabama State Board of Health

Milk quality control without inspection personnel is inconceivable, except in the minds of dreamers. No legislation is automatic in its enforcement. It follows, therefore, that inspection personnel, whether it include only one or a score of inspectors, is a fundamental element in every milk-quality control program, be it municipal, county, or state-wide in scope.

In the larger communities, it seems to be taken for granted that dairy inspection personnel should be provided. This personnel may be woefully inadequate in number; it may be dismally deficient in training and experience for its function of teaching dairymen what to do, and when, and how; and it may be scandalously impotent because of political obligations and obstacles. The fact remains, however, that in the majority of cases the health department is provided with personnel of some kind for dairy inspection.

In the smaller communities, this is so rarely the case that it may be termed unusual. The reason is not far to seek. First, the incomes of municipalities of this size are limited. They must provide for interest on bonds for civic improvements (frequently a considerable item), in addition to the salaries and expenses of a city clerk, school teachers, fire departments, and police departments in the smaller towns, and, in addition to these, engineers, jailers, janitors, garbage removal departments, welfare workers, city court judges and attendants, a librarian, and employees of other offices in the larger cities in this group. It is usually difficult to squeeze another hand into the treasure box; those with their hands already in it are sometimes the chief obstacle to the division of any surplus with another. Secondly, the number of dairies supplying a community of from 5,000 to 25,000, and the number of inspections and milk samples necessary for a reasonable measure of quality determination, is not nearly sufficient to occupy the full time of an active man, at least not in that part of the country with which the writer is familiar and deals with in this paper.

In an effort, therefore, to provide dairy inspection personnel for the enforcement of the U. S. P. H. S. Standard Milk Ordinance in communities ranging in size from 5,000 to 25,000 or more, the Alabama State Board of Health some years ago began to encourage the adoption of meat inspection ordinances and the construction of central abattoirs, either privately or municipally owned and operated, in this manner securing the employment of a veterinarian inspector, who could also inspect dairies and enforce the milk ordinance.

In order that the relation of the State Board of Health to municipal meat and milk inspectors whose employment was secured in this manner may be clear, a brief outline of the Alabama public health system seems appropriate.

Fifty-two of the sixty-seven counties in Alabama are provided with full-time health departments. Most of these are subsidized to some extent by a State appropriation. All health officers must be approved by the State Health Officer before their election is legal, and during the last two years all new health officers receive a course of training at a training station before taking office. This is also true of all nurses and sanitary inspectors. The result of this is that county health officers consider themselves important cogs in a large machine, and realize the importance of meshing accurately with all other cogs.

Whenever, therefore, there is the slightest ripple of popular interest in a system of meat inspection, or a demand for dairy inspection in one of the larger cities, the matter is promptly brought to the attention of the State Board of Health, and the local health officer lends the weight of his influence to the activities of the agent from the State Department toward the fruition of our mutual desires.

Our procedure is somewhat as follows:

1 Having received a request to assist in presenting the subject of a full-time meat and milk inspection service to the City Council, a survey of all the meat markets is made to obtain an estimate of the number of meat carcasses used in the course of a year, and the revenue from inspection fees which may be anticipated.

2 If it appears that the service can be financed, leading citizens and council members are canvassed for support of the proposal, and feeling with respect to the manner in which a central abattoir is to be financed and operated is gauged.

3 According to the nature of public sentiment formed, an ordinance providing for (a) a municipally owned and operated abattoir, (b) a privately owned and operated abattoir, or (c) merely market and street inspection of carcasses is presented to the Council for passage.

In any case, the inspector provided for must be a graduate veterinarian, nominated by the county health officer, but who must be approved and elected by the City Council. He receives a salary based upon the estimated annual income from inspection fees.

4 If one of these ordinances is adopted, all animals are slaughtered and inspected in one or more abattoirs which meet certain specifications included in the ordinance, or the inspector must visit every market every day. The fees collected by the inspector are deposited with the City Clerk, who at the end of each month, pays into the budget of the county health department the sum provided in the ordinance. The inspectors' salary and expenses are then paid by check through the health officer, as are the salaries of all other members of the health department. In this manner the inspector is made to feel that he is an integral part of the health department, and the health department is provided with this additional inspector without readjustment of its budget arrangements with the state or the county appropriating body.

In practice, the State Board of Health usually selects these inspectors, in that it furnishes the county health officer with the names of several which it recommends, and he nominates one. The man nominated is given to understand that dairy inspection is one of his principal functions, and that he is responsible to the health officer as his employer.

The results of this program in Alabama have been highly satisfactory. Thirteen such full-time inspection services, serving twenty-two municipalities, have been established, most of them within the last four years, and the establishment of others is in early prospect.

Those communities, or groups of communities, in which this service has been established are, in the approximate order of their establishment:

	Town or Towns	Population
1	Selma	20,000
2	Anniston	25,000
3	Huntsville	35,000
4	Tuscaloosa	26,000
5	Gadsden-Alabama City-Attalla	40,000
6	Florence	13,000
7	Sheffield-Tuscumbia	10,000
8	Jasper-Carbon Hill-Cordova-Parish	12,000
9	Lanett-Shawmutt	7,500
10	Decatur-Hartselle	21,000
11	Opelika	6,500
12	Tuskegee-Union Springs	10,000
13	Andalusia-Opp	7,000

The populations of 16 of these 22 municipalities are less than 7,500, yet by means of this system they are provided with constant inspection service by a man, selected in most instances without respect to or in spite of political influence or pressure, who is qualified by schooling, and frequently by experience for the work for which he is employed. The small cities in Alabama are receiving milk inspection service as effective as that in the larger communities.

REPORT OF COMMITTEE ON COMMUNICABLE DISEASES AFFECTING MAN

HORATIO N. PARKER, *Chairman*

Readers of this report should understand that there is no question but that milk is one of the most excellent foods we have, that it is our most complete food, and that as compared with other articles of our diet it is one of the cheapest. Still, there are certain diseases that may be acquired from raw milk, and also from imperfectly pasteurized milk, or from properly pasteurized milk that has become infected after pasteurization in the course of bottling, or at other stages in course of its delivery to the consumer. This report then is not of alarmist character but is a statement of certain factors that must be reckoned with if the public is to have safe milk.

The report of the U. S. Public Health Service, listing the milk-borne outbreaks of communicable disease in 1928 clearly delineates this problem. The findings are summarized in Table I.

TABLE I

MILK-BORNE OUTBREAKS AS REPORTED BY STATE AND CITY HEALTH OFFICERS IN 1928

Disease	No. of Epidemics	No. of Cases	No. of Deaths	Per cent of Deaths
Typhoid Fever	26	448	48	10.7
Scarlet Fever	8	369	6	1.6
Undulant Fever	5	21	0	0.0
Diphtheria	2	48	0	0.0
Septic Sore Throat	3	1,080	49	4.5
Dysentery	1	126	17	13.5
Enteritis	2	104	0	0.0
Total	47	2,196	120	5.5

Of the outbreaks listed in Table I, four were due to pasteurized milk, of which two were of typhoid fever, one of septic sore throat and one of dysentery, and together they totalled 342 cases with 16 deaths. Forty-two of the outbreaks were due to the use of raw milk which was responsible for 2300 cases with 55 deaths. In one of the outbreaks, which consisted of three cases with no deaths, it is not reported whether the victims used raw or pasteurized milk.

Dr. A. R. Ward has obtained the following facts about the four epidemics due to pasteurized milk.

The outbreak of typhoid fever in San Francisco, California, caused by pasteurized milk was traced to a bacillus carrier who worked on the bottling machine. This epidemic was regarded as due to infection of the milk after pasteurization and is discussed in last year's report of the Committee.

Doctor Clarence L. Scamman, Director, Division of Communicable Diseases of the Department of Public Health of Massachusetts, has kindly furnished the following information about infection after pasteurization, causing the epidemic of dysentery at Worcester Massachusetts:

> The outbreak of dysentery at Worcester was in an institution where about 125 cases occurred among the employees and patients. There were two pasteurized milk supplies. The supply concerned with the outbreak consisted of about 1,000 quarts produced on a farm, located some three miles from the institution, where it was pasteurized. The farm was owned and maintained for and by the institution. After pasteurization, the milk was sent in cans of 20 and 40 quart capacity to the institution. Upon arrival at the institution it was placed in a refrigerator. The infection of this milk occurred through a kitchen worker, who during the prodromal symptoms of illness, distributed it from the ice box to the various eating places. This individual was evidently the source of the outbreak and infected the milk after pasteurization and during its handling and distribution to the eating places throughout the institution.

We are indebted to Doctor Harold B. Wood, Epidemiologist of The Department of Health of Pennsylvania, for the following information about the two epidemics attributed to pasteurized milk in Pennsylvania:

> At Pottstown, Pa., from January 29th to March 1st, 1928, there was an outbreak of septic sore throat consisting of one hundred known cases with one death which was traced to a pasteurized milk supply. I did not make the investigation on this outbreak, but understand there was some faulty technique in regard to the method of handling the pasteurizing machine.
>
> At Avella, Pa., which is southwest of Pittsburg, in October and November, 1928, there was a typhoid outbreak definitely traced to a milk supply. This town received its milk entirely from a pasteurizing company located within the town and collecting milk for pasteurization entirely from one farm. One of the five men working on the farm, who had had typhoid fever four

years before, was definitely proved by two bacteriologists of two different laboratories to be a typhoid carrier.

Doctor Wood explains that this milk was taken to a plant for pasteurization. The outlet valve of the pasteurizer leaked continuously into a pail, and this leakage was reported as having been dumped back into the vat with the milk that was undergoing pasteurization. Thus, there was a violation of the requirement that all milk be heated for the proper time and temperature. The vat was not equipped with a recording thermometer so that it was impossible to check the pasteurizing runs. It is not unlikely that some raw milk was sold.

So, of the four outbreaks attributed to pasteurized milk, two were found to be the result of infection of the milk after pasteurization, and one to milk that was improperly pasteurized if at all. It is significant in this case that recording thermometer records were not available to substantiate the claim of the operator that he had in fact pasteurized the milk. In the Pottstown epidemic the details are not clear, but apparently were believed to involve faulty pasteurization.

The foregoing instances of the serious consequences of faulty pasteurization, and of failure to protect milk from infection after it has been pasteurized are specific. Less definite, but nevertheless of grave importance, is the evidence that milk of high bacteria count is unsuitable for pasteurization, because milk pasteurized therefrom seems to have an unfavorable reaction on the death rate of infants under two years of age, as Schrader pointed out was the case in Baltimore. Health departments should be assured that all milk as it goes into the vats for pasteurization is clean and of low bacterial content. It is important that proper methods of dairy sanitation shall be used on the farm and that the milk shall be promptly and commendably handled from the time that it reaches the city to the time that pasteurization is begun.

It should be noted that typhoid fever, as usual, leads in the number of epidemics, and septic sore throat in the number of cases. Undulant fever, a newcomer in the list of milk-borne diseases, is third in the number of epidemics reported. In the future, as it becomes better known, and physicians become accustomed to submitting blood specimens from obscure fever cases to laboratories for diagnosis of this disease, it will very likely occupy a still more prominent place in lists such as Table 1.

In the report of the Public Health Service it appears that of the 26 outbreaks of typhoid fever, 13 or one-half of them were caused by typhoid carriers or by suspected typhoid carriers, three were due to active cases, and in the 10 other cases the infective agent does not appear. The importance of the typhoid carrier in relation to milk infection is what might be expected from studies that have been made on the prevalence of carriers among recovered typhoid patients. Thus, Leach and his co-workers studied 156 individulas, residents of small country towns, who were reported to the State Board of Health of Alabama as having had typhoid fever from six months to two years previous to the examination. Among the 156, sixteen or 10.3% of carriers were found. Six of the 16 carriers excreted typhoid bacilli in the urine, which indicates the importance of urinary examinations in the search for carriers. Ten of the carriers were fecal.

Health officials should be keenly alive to the menace that the carrier is to the milk supply. While the mention of a carrier suggests the typhoid germ to most of us, it should be borne in mind that there are carriers of other diseases; recently in the course of routine health examinations, a diphtheria carrier was discovered bottling milk in a pasteurizing plant in Florida. The Illinois Health Messenger of April 15, 1929, reports 87 typhoid carriers are under contract that they will not engage in work that brings them in contact with food. Of these, five were in the dairy business before detection. Ten new carriers were discovered in 1928. The Health News published by the New York State Board of Health in the issue of March 18, 1929, reports 20 carriers, of which six were connected with the dairy business, discovered in 1928. The total carriers in New York State outside of New York City now stands at 167, and 31 more are in State Institutions. The Monthly Bulletin of the State Department of Health of Maryland listed 84 carriers compiled by the department. The 10 carriers among milk handlers were nearly 12% of all the carriers, and 155 out of 346 cases of disease traced to carriers were caused by the group of milk handlers.

Probably the most scrutinizing tests for the detection of carriers are carried out in California, with the cooperation of the State Department of Health, in connection with the production of Certified Milk. To be of real value, the complicated task of locating carriers must be competently and thoroughly done. It is an expensive job.

Of the 26 typhoid fever outbreaks listed, 19 occurred in the period from July to October which Arnold has explained as due to the fact that chronic carriers become more menacing because the discharges from the liver and gall bladder on entering the small intestine do not find the high acid condition that obtains in winter, and consequently if they carry typhoid germs, these may survive passage into the lower bowel.

The eight outbreaks of scarlet fever recorded in Table 1 make up about one-sixth of all the 47 epidemics recorded. Millard Knowlton in the Connecticut Health

Bulletin for July, 1928, tells of an outbreak of scarlet fever in which it was found that the man who milked the cows had a sore throat a few days before the outbreak started, and one of the cows in the herd was found to have mastitis at the time of the investigation. From the throat of the milker, from the throat of the patients, and from the milk of the cow, streptococci were isolated that proved to be the streptococcus of scarlet fever. The new point is, that a cow may be infected with the streptococcus of scarlet fever and the germ discharged in the milk and carried to consumers. This experience indicates that when epidemiological evidence points to a milk supply as the probable source of scarlet fever, the sale of milk should be immediately stopped unless arrangements can be made to pasteurize the milk properly. A complete change of the milking crew is not sufficient protection, for a cow that is discharging the infectious organism might be in the herd. Under such circumstances the sale of the raw milk should be stopped until the cows have been tested for the microbe causing the outbreak. The same procedure should be followed in milk-borne outbreaks of septic sore throat and diphtheria. Because infection may be carried from one cow to another in the herd by milkers, it is best to slaughter animals infected with the scarlet fever streptococcus. Since typhoid bacilli are not known to be carried by the cow, a change of milk handlers in a milk-borne typhoid outbreak may be permissible.

With regard to undulant fever, it may be said that the work of Alice Evans focussed attention on the malady and caused its importance to be recognized. Practical breeders have long known contagious abortion in goats, cows, pigs, and mares, and have long dreaded it because of the economic losses the disease entailed, but Miss Evans was the first to show the close relationship between the germ that caused Malta fever among the drinkers of goat milk on the Island of Malta, and the abortion bacillus of Bang, and she was the first to recognize that an important public health problem was involved. The organism is now called Brucella after Bruce, who worked out the cause of Malta fever, and the caprine, bovine and porcine types or strains are recognized. The caprine strain causes true Malta fever. Undulant fever may be caused by either the bovine or porcine strains. Evans insists that it is important to determine the type of organism involved in every case of undulant fever, the fact that the milk involved may for instance come from the cow does not make it certain that the germ is of the bovine strain; it may be, or it may be one of the other strains. It seems to be the opinion that the porcine strain is most likely to be infectious to man, that the caprine strain is not commonly met within this country outside of the goat raising states, and that the bovine strain is perhaps only mildly infectious. Very little has been done studying the relation of the abortion germ of mares to the city milk supply. The views of Theobald Smith who has carefully studied the undulant fever problem are given here.

Undulant Fever

"The following article is an abstract of an address by Dr. Theobald Smith before the Annual State Health Conference at Saratoga Springs, June 25, 1929."

> Malta or undulant fever prevails chiefly in countries bordering the Mediterranean Sea. It occurs as an uncomplicated fever of varying types and duration with localization, usually ephemeral, in joints, bones and male genital organs. Recognized since the early eighties of the last century as a distinct disease in the countries of southern Europe, and appearing wherever

milch goats from such countries had been introduced, it has within six years been recognized as occurring in the northern United States and central and northern Europe. This discovery raises several questions. Has this disease prevailed for several generations and has the medical profession failed to distinguish it from other febrile states? Or, has the general and specific resistance of the population declined? Or, has the microbe of this disease undergone recent changes or a redistribution owing to the vastly increased and world-wide commercial activities? These questions cannot be answered and they may seem academic but they have fundamental significance in epidemiology.

Bacteria closely related to the original Malta fever bacillus as isolated from the human patient have been found in goats, cattle, swine, sheep and horses. In cattle they produce the so-called infectious abortion which is world-wide in its distribution. It is safe to state that in this country and perhaps in other countries, five or ten years ago few large herds were free from this disease. The bacillus frequently lodges in the udder and is shed in the milk, though in small numbers, for months and years even when abortion does not occur. In swine it produces abortion and it may also be in the udder. To date the United States and Hungary appear to be the only countries where the swine disease has been definitely known to exist. We have no information concerning its occurrence in sheep in this country. The goat disease has been found in some of the southwestern states and in Utah. Its significance in horses is not clear. Only a few cases have been traced, chiefly in France.

The problem confronting the health officers is the particular source of the bacilli found in human patients. The solution of this problem is made difficult on account of the great similarity of the bacilli from the different animal sources. While slight differences may be brought out by bacteriological technique, and animal inoculation they are neither sharp nor constant. In this country the problem has probably narrowed down to two sources, cattle and swine. In view of the prevalence of infectious bovine abortion in this country for some thirty or forty years with a peak, probably ten years ago, the question arises why not more cases, and even local epidemics. The tentative explanation resulting from studies of human strains of the bacilli is that the genuine bovine type is relatively harmless to man and that the swine type is largely responsible, either directly in the handling of swine or raw pork or indirectly when the swine bacillus is introduced into the cow's udder in one of several ways.

Geographical varieties of the bovine type may, however, exist which favor human infection. In Denmark the human strains appear to be identical with the true bovine type.

The bacillus is destroyed in the process of pasteurization. In view of this fact it may be that the gradual extension of this process during the past decade has deprived man of a certain vaccinal protection given by the bovine against the swine type of bacillus. E. T. Burnett has shown that the bovine bacilli when injected into human volunteers have little or no disturbing effect. They, however, give rise to protective antibodies. This possible explanation of the increase in undulant fever does not justify any relaxation in the movement for more pasteurization, but it does indicate the need for more investigation into the swine disease and other non-bovine types of Brucella abortus.

All of the foregoing discussion of undulant fever makes it apparent that much research will be necessary to solve the problems it presents, and that in working them out the cooperation of practising physicians is needed.

Diphtheria caused only 2 epidemics with but 48 cases and no deaths. The disease has not the devastating record that typhoid fever and septic sore throat have as regards infection of public milk supplies, but that the milker or bottler who may have a mild form of the disease or who may be a carrier thereof is always a potential menace to the milk supply, every Health Officer knows.

Of septic sore throat there is little new to be said. The disease is likely to be passed from an infected milker to the cow which may develop a mastitis without glaring symptoms, and massively infect the milk. The disease is also spread to some extent by contact infection. The three epidemics that appear in Table 1 caused 1080 cases and 49 deaths. The studies of the Lee epidemic by the State Department of Health of Massachusetts have been thorough.

Of the general relation of animal diseases to the public health much valuable information may be had from a paper by Theobald Smith, and from one by V. A. Moore.

With regard to the disease milk sickness or the trembles which was a terror of pioneer days, it should be noted that it has been determined that it is caused by cows feeding on white snakeroot, and apparently also by feeding on the rayless goldenrod. Thus the causes of an ailment that has been regarded as most mysterious have been found at last.

In conclusion it may be said that the chance of incurring infection from drinking raw milk is greater, much greater than from drinking pasteurized milk. That properly pasteurized is safe milk, that carelessly pasteurized milk is perhaps every whit as unsafe as raw milk, and that the safety of milk pasteurized without the close supervision of an efficient health department is questionable.

Finally, the procuring and control of a public milk supply is a grave responsibility and those charged with it should be adequately trained to undertake it, and should be free from interference from commercial American politics.

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THE RELATION OF UDDER INFECTION TO HUMAN HEALTH

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The hygienic qualities of milk depend very largely upon the conditions existing at the source of supply, and the problem and dangers that threaten are two-fold, for not only is milk subject to contamination from outside sources but also from internal influences for the milk may leave the cow's udder in the condition of a dangerous product—the carrier of pathogenic or disease producing organisms.

The most important part of the dairy cow from a public health standpoint is the udder. It is very important that this organ should be in a healthy condition, for it is the fountain head of nature's most wonderful food upon which many infants and children are wholly dependent for their sustenance. The infections of the udder which are considered to be pathogenic to man may be classified under three headings; (1) those infections which have to do with the external surface of the udder and teats, such as, foot-and-mouth disease and variola (cowpox); (2) those infections which have to do with the internal udder and brought about by the blood or lymph, such as, tuberculosis, Brucella infection and anthrax; (3) the infections of the internal udder which have been brought about by specific organisms working themselves into the udder by the way of the teat canals and milk ducts, such as, scarlet fever, septic sore throat and possibly some of the Brucella infections.

Foot-and-mouth disease is not prevalent in this country and in cases where we have sporadic outbreaks the quarantine placed around infected areas prevents any of the milk being consumed. Then again, due to the nature of the disease the secretion of milk soon ceases after infection starts.

Variola (cowpox) is not a serious infection to man but there are cases on record where milkers, who had become infected from cows suffering with this disease, have later proven to be immune to the dreaded disease—smallpox. Therefore, we do not have much to fear from the external infection of the udder of the cow that may infect man.

INTERNAL UDDER INFECTIONS

Tuberculosis: The information at hand tends to show that cows with tuberculosis of the udder are by far the greatest factors in infecting market milk and next in order are those with apparently healthy udders yet showing clinical symptoms of advanced tuberculosis in other parts of the body. This is very important when we stop to consider that a great majority of the municipalities have not passed pasteurizing ordinances and, in a great many instances, the milk fed to infants in smaller towns might contain the germs of this disease.

Where milk is consumed in the raw state it is very essential that the herds be tuberculin tested at least once a year and careful, frequent physical examinations be made by competent veterinarians. Special attention should be given to the udder and super-mammary lymph glands.

Brucella infections are presenting a problem very much discussed at the present time and one which needs considerable investigation before definite conclusions can be determined. Most of the Brucella infections of the udder may be, in the opinion of Prof. J. Howard Brown of Johns Hopkins University, either of the bovine or porcine strain. No doubt most of the infection in cows is caused by the bovine strain and it is the opinion of some of our authorities that man is not susceptible to this strain. Due to the large quantities of raw milk consumed and to the small number of people who appear to be susceptible to Brucella abortus infection, is it not logical to advance a theory that something must have developed an immunity in us against an infection of these organisms? As yet, very little is known in regard to undulant fever in man and until authorities furnish us with more knowledge of this disease we should go slow in developing regulations to control it.

Recently, there appeared an article in one of our leading publications referring to the dangers from raw milk. The obvious effect of this article no doubt has tended to frighten many users of both pasteurized and raw milk by picturing to the lay mind that there lurks in milk a terrible wasting fever. It is only natural that the first reaction to a casual reader would be to discourage the use of any kind of milk. Provided this article has a tendency to discourage the use of good milk, is it not logical that it may have a detrimental effect upon public health?

Anthrax: Animals infected with this disease may give off the organisms in the milk; however, milk secretion generally ceases as soon as the animal becomes infected. The danger to public health from this disease is reduced to a minimum.

Udder Infection Through Teat Canals and Milk Ducts

Scarlet fever: There are but very few cases on record where scarlet fever has been traced to udder infection. Examination of employees and milk handlers no doubt has considerable to do with the prevention of this infection.

Septic sore throat: We are told that man is not susceptible to the bovine strain of hemolytic streptococci but is susceptible to the human type (hemolytic streptococci epidemicus beta type). Several epidemics of septic sore throat have been traced to udder infection. The source of infection in nearly every case being the milker or caretaker. One of the most serious epidemics of this nature occurred in Lee, Mass., in 1928, and there were about 500 cases with 40 deaths. The source of infection was traced to a cow in a dairy where raw milk was being dispensed to the municipality. The same type of organism that was found in the udder was also isolated from the throat of the man who was in the habit of milking this cow. For some time this animal had been suffering with an infection in one quarter of her udder but the milk from this infected quarter had not been included in the supply. After the outbreak started it was discovered that another quarter of the udder was giving off hemolytic streptococci and the milk from this quarter was being included in the supply. Had the milk from this cow been excluded as soon as the mastitis infection appeared in the first quarter, no doubt the epidemic would not have occurred. This brings up the question of the importance of frequent physical examinations, by competent veterinarians, of dairy herds and excluding the product from such animals whose udders show any signs of mastitis.

Brucella: It has been found by certain investigators that the milk from certain cows contains abortive organisms in one quarter of the udder, while the milk from the remaining quarters show negative results. This might indicate that the organisms in the infected quarter were brought about through infection by the way of the teat canal and milk ducts.

The milk from the greater percentage of cows suffering with mastitis generally contains long chain non-pathogenic streptococcus organisms. Investigators have found that the long chain streptococci are more likely to be present in large numbers in milk from cows in the early stages of the mastitis inflammation, and that as the infection progresses the streptococcus organisms diminish in number to the point of entirely disappearing. These long chain streptococci are very easily detected by using the Breed Direct Microscopic Method and can be detected in the very first stages of mastitis, a time when it is extremely difficult to detect it physically.

The microscope may fail to reveal long chain streptococci in milk from a cow in the advanced stages of mastitis, but in most of these cases the physical examination leaves no doubt as to the actual condition. Is it possible for milk taken from a cow suffering from an infection of the udder from a non-pathogenic form of streptococci to effect the health of persons consuming this milk? In answer to this question, I would like to quote a report of an outbreak noted in the *Health News,* published by the New York State Department of Health, December 24, 1928:

Another Milk-borne Gastrointestinal Outbreak Among Children

A sudden outbreak of illness occurred on October 29th among children who attended a school in Cornwall just outside the incorporated village. Between ten and eleven o'clock on that day eighty children and one teacher were served milk delivered by a dealer and about one o'clock seventy children and the teacher were taken ill. On the same day two other pupils who had drunk milk at home and another teacher who had drunk milk at a lunch room were taken ill. In both instances the milk was obtained from the dealer mentioned above.

The symptoms consisted of acute pain in the "pit of the stomach" followed by what a nurse described as "projectile vomiting" of stomach contents and bile. The children appeared to be greatly prostrated. Diarrhea was not a prominent feature. So far as could be ascertained the children had no elevation of temperature.

The milk, labeled "raw grade A," was delivered in half-pint bottles each morning to the schoolhouse and was kept outdoors until used.

Dr. Laidlaw, district state health officer, visited the dairy and found that the milk delivered to the school on October 29th had been produced the day before. It was kept until the following morning, then bottled in half-pint bottles. The dealer estimated that about 160 of these bottles were filled, which would be equivalent to a forty-quart can of milk. Ninety-five of these bottles or a little over sixty per cent. of the milk was delivered to the school, therefore, some of the same milk must have been delivered to other customers on the dairyman's milk route. A house to house investigation was then made of the milk route of this dealer, comprising one hundred and fifty families, restaurants, lunch wagons, etc. This survey revealed that thirteen persons had had the same symptoms, this number including but two or three adults. In view of the small number of cases outside the school it is probable that only one can of milk was involved, and that children had a greater susceptibility than adults. However, one of the hired men on the dairy who drank some of the milk was so ill that he was unable to go on the milk route.

An examination of the apparatus and methods employed at the dairy gave no clue to the cause of the outbreak. A physical examination of the men handling the milk and laboratory examination of fecal specimens obtained from them were equally devoid of results. One cow in the herd of forty was found to have mastitis and laboratory tests showed non-hemolytic streptococci in its milk.

This is the third instance within the last four years in which children have been made acutely ill by drinking raw milk which contained pus and non-hemolytic streptococci from cows with chronic inflamatory conditions of the udder.

The rapid development of symptoms in each of these outbreaks suggests that the cause of the trouble was a toxic substance in the milk rather than a true infection.

I have failed to find any literature on the effect of pasteurization upon toxins. No doubt, the effect of heat upon any toxin which might be present due to the action of non-pathogenic streptococci and the degree of dilution which such milk would receive, would reduce to a minimum any dangers to public health from this source.

In summing up the danger to human health from udder infection, we are concerned mainly with three diseases: tuberculosis, brucella and septic sore throat. Where the milk is efficiently pasteurized the danger to human health from the live organisms ceases. Where the milk is consumed raw we have a different problem. In order to prevent the above diseases from affecting human health, it is essential that dairy herds be tuberculin tested at least once a year unless the herd has become accredited and in this case a longer period may elapse. Herds should have frequent physical examinations not exceeding thirty-day intervals. They should be made as free from Brucella infection as far as our present knowledge of diagnosis and treatment is concerned.

Milkers and handlers of milk should be free from all diseases that might infect the udder of the cow and frequent physical examinations should be made; also, laboratory tests of the throat and body secretions. Milk should be frequently examined by the Breed microscopic method in order to detect the presence of long chain streptococci. Milk should also be tested at intervals on the blood agar media to detect any hemolytic streptococci that might be present.

It is essential that all cows furnishing milk for human consumption have healthy udders, whether milk is to be consumed in the pasteurized or raw state. Protecting health is an important topic of the day. Protecting milk, vital to protecting health, is a very important part of this health program. Publicity is valuable if directed in the right channels, and is equally harmful if broadcast in such a way as to discourage consumption.

When an outbreak of disease occurs and is traceable to a specific milk supply, there is danger of the public becoming panicky, resulting in a decreased consumption of milk. Human health can be protected by encouraging the consumption of good, safe milk even in outbreaks of milk-borne epidemics.