SEVENTEENTH ANNUAL REPORT

OF THE

International Association of Dairy and Milk Inspectors

INCLUDING PAPERS READ AT THE ANNUAL
CONVENTION IN CHICAGO, ILLINOIS
OCTOBER 11, 12, AND 13, 1928

COMPILED BY

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

PROF. JAMES O. JORDAN
President, 1918
Died January 6, 1928

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

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OCTOBER, 1928

Price Two Dollars

International Association of Dairy and Milk Inspectors

CONSTITUTION AND BY-LAWS

CONSTITUTION

ADOPTED OCTOBER 16, 1911

NAME

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

OBJECT

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

MEMBERSHIP

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

OFFICERS

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

AMENDMENTS

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

BY-LAWS

ADOPTED OCTOBER 25, 1913

ORGANIZATION

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

ARTICLE 1

MEMBERSHIP

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

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

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

HONORARY MEMBERS[1]

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

ARTICLE 2

OFFICERS

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

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

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

ARTICLE 3

DUTIES OF OFFICERS

SECTION 1. It shall be the duty of the President to preside at all meetings of the Association. He shall examine and approve all bills previous to their payment, appoint all committees unless otherwise directed by vote

[1] Adopted October 29, 1915.

of the Association, and perform such other duties as usually devolve upon a presiding officer, or are required of him by the Association.

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

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

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

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

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

ARTICLE 4

MEETINGS

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

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

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

ARTICLE 5

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

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

International Association of Dairy and Milk Inspectors

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Third Vice-President, A. R. B. RICHMOND....Toronto, Ont.
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COMMUNICABLE DISEASES AFFECTING MAN.—Their Relation to the Milk Supply and to the Public Health.

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METHODS OF BACTERIAL ANALYSIS OF MILK AND MILK PRODUCTS.—CONT.

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Johnston, John F.	Inspector of Milk	Health Department, Newport, R. I.
Jordan, Prof. James O.*	Inspector of Milk	Boston, Mass.
Kagey, Dr. J. F.	Food and Dairy Inspector	Kingsport, Tenn.
Kelly, Ernest	Market Milk Specialist, Bureau of Dairy Industry, U. S. Department of Agriculture	Washington, D. C.
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Miller, Dr. John F.	Supervisor of Milk Pasteurizing Plants, State Department of Health	Albany, N. Y.
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Moore, Mrs. Edith L.	Bacteriologist and Chemist	City Hall, Houston, Texas
Morris, George C.	Assistant, Division of Milk Control, State Department of Health	834 Diamond St., Williamsport, Pa.
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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	324 Edgar Ave., Dayton, O.
Ocker, Harry A.	Meat and Dairy Inspector, Department of Health	Cleveland, O.
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.
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.
Prentiss, Russell I.	Milk Inspector, Town of Lexington	Lexington, Mass.
Price, Dr. Wm. H.	Detroit Creamery Co.	Detroit, Mich.
Putnam, Geo. W.		1243 W. Washington Blvd., Chicago, Ill.
Rath, Dr. Floyd C.	Assistant Health Officer, Dairy and Food Inspector	Madison, Wis.
Redfield, Dr. H. W.		Mendham, N. J. R. F. D. 1
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.
Romberger, Dr. E. E.	Milk and Meat Inspector	340 N. 6th St., Reading, Pa.
Rosenberger, Dr. Maynard	Superintendent, Adohr Stock Farm	R. 2, Box 105, Van Nuys, Cal.
Russell, Alfred M.	Agent, Board of Health, and Inspector of Provisions	P. O. Box 56, West Newton, Mass.
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	Director, City Division, Bureau of Dairy Products, Health Department	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.
Sibbald, A. D.	Assistant Dairy and Food Commissioner	Old Capitol, St. Paul, Minn.
Smith, D. R.	Hampton Roads Creamery, Inc.	Newport News, Va.
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.
Stevenson, A. F.	The Borden Company	350 Madison Ave., New York City
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.
Testerman, H. L.	Inspector of Milk and Foods	Colorado Springs, Colo.
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 v.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.
Voorhees, Dr. Louis 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 Cty
Walmsley, Dr. F. D.	Borden's Farm Products Company of Illinois	326 W. Madison St., Chicago, Ill.
Ward, Dr. A. R.	Assistant Chief, Dairy Research Division, Mathews 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, Prof. R. M.	Technologist, Liquid Dehydration Corporation	4750 Sheridan Road, Chicago, Ill.
Way, H. O.	Director, The Agricultural Laboratory	508 Blackstone Bldg., Cleveland, O.
Weld, Ivan C.	Investigator for Chestnut Farms Dairy	Washington, D. C.
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.
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. Raymond A.	President, University of Maryland	College Park, Md.
Van Norman, Dr. H. E.	President, American Dry Milk Institute	160 N. La Salle St., Chicago, Ill.
Woodward, Dr. Wm. C.	American Medical Association, Bureau of Legal Medicine and Legislation	535 N. Dearborn St., Chicago, Ill.

Seventeenth Annual Convention

HOTEL STEVENS

CHICAGO, ILLINOIS

THURSDAY, OCTOBER 11, 1928

FIRST SESSION

President I. V. Hiscock called the convention to order in the Stevens Hotel at 11 o'clock. He first introduced Dr. Isaac D. Rawlings, Director of Public Health of the State of Illinois, who welcomed the Association to his State. First Vice-President Howard R. Estes was called upon to respond for the Association, and he did so, expressing the pleasure of the members in again meeting together in Illinois.

Vice-President Estes was called to the chair, and President Hiscock then delivered the presidential address.

Mr. George W. Putnam outlined plans for the entertainment of the convention, with particular reference to the trip about the city for the purpose of visiting several milk pasteurizing and bottling plants on Friday afternoon, and also to the trip by automobile to southern Wisconsin on Sunday for the purpose of visiting some of the farms supplying Chicago with certified milk.

Second Vice-President Ralph E. Irwin and Third Vice-President Dr. A. R. B. Richmond were called upon and spoke briefly.

SECOND SESSION

The convention was called to order at 2 o'clock. Dr. H. E. Van Norman, president of the American Dry Milk Institute, Inc., presented a paper on "Dry Skim Milk—

Its Limitations." Mr. J. Y. Yates read a paper on "The Influence of the Individual Cow on the Bacterial Condition of Milk." Prof. W. H. E. Reid, of the University of Missouri, contributed a paper on "Efficiency of Sterilization of Dairy Farm and Milk Plant Equipment."

Dr. F. D. Holford read a paper on "The Care of Milking Machines at Market Milk Dairies." Dr. H. A. Harding, chairman, presented the report of the Committee on Milk Plant Practice.

THIRD SESSION

President Hiscock called the convention to order at 8 o'clock. Mr. Fred J. Widmayer, who for thirty years has served as milk inspector of Scranton, Pennsylvania, was introduced and congratulated by the Association.

Dr. H. C. Becker, Chief, Bureau of Dairy Products, Health Department, Chicago, contributed a paper entitled "The Control of Communicable Diseases Transmitted Through Milk." Dr. Herman N. Bundesen, President, American Public Health Association, Chicago, presented a paper dealing largely with the use and value of milk.

Dr. S. J. Crumbine, General Executive, American Child Health Association, presented a paper prepared by himself and Mr. Charles F. Chrisman, of New York City. The subject of the paper was "A National Cooperative Campaign for Clean and Safe Milk."

Dr. Paul B. Brooks, chairman, presented the report of the Committee on Food Value of Milk and Milk Products. The report of the Committee on Serving Milk in Schools, Factories, and Office Buildings, in the absence of the chairman, Mr. M. O. Maughan, was read by Mr. Otis Beeman.

FRIDAY, OCTOBER 12

FOURTH SESSION

The morning session was called to order by President Hiscock at 10 o'clock. "The U. S. Public Health Service Milk Control Plan" was the subject of a paper presented by Mr. Leslie C. Frank. Mr. C. A. Abele presented a paper entitled "The Results of Milk Control Work During the Past Five Years in Alabama."

Prof. R. M. Washburn presented a paper on the subject "Ye Lowly Thermometer."

FRIDAY AFTERNOON

Members of the Association left Hotel Stevens at 1 o'clock in busses for a trip through the parks and streets of Chicago. Visits were made to several milk pasteurizing and bottling plants and construction, equipment, and methods were observed. The experience was one that was keenly enjoyed, and the return trip to the hotel was completed at 5.15 P.M.

FIFTH SESSION

The evening session was called to order by President Hiscock at 8 o'clock. Reports were heard from Dr. Paul B. Brooks and Mr. Thomas Holt, Association delegates to the World's Dairy Congress.

Dr. Warren F. Fox read a paper prepared by himself and Dr. J. L. Pomeroy on the subject of milk grades. Dr. William C. Hassler, Commissioner of Health, San Francisco, Cal., contributed a paper having for its title "Milk-Borne Typhoid Epidemics."

Mr. Wm. B. Palmer, chairman of the Committee on Milk Ordinances, presented the report of his committee. Dr. J. P. Bushong read a paper on the subject "The Economics of Abortion Control."

Saturday, October 13

SIXTH SESSION

The morning session was called to order by First Vice-President Estes at 10 o'clock. Mr. George E. Bolling, chairman, presented the report of the Committee on

Methods of Bacterial Analysis of Milk and Milk Products. Mr. Ralph E. Irwin, chairman of the Committee on Sanitary Control of Ice Cream, presented the report of his committee.

Mrs. Sarah Vance Dugan contributed a paper on the subject "Improvement of Pasteurization Plants and Their Milk Supplies in Kentucky."

Dr. Arnold H. Kegel, Commissioner of Health of Chicago, was introduced and addressed the Association briefly. Dr. Kegel expressed his pleasure in welcoming the Association to Chicago and offered the facilities of his Department for the comfort, convenience, and pleasure of our members.

Mr. George W. Putnam, chairman, presented the report of the Committee on Dairy and Milk Plant Equipment.

President Hiscock made several announcements regarding the meetings, the method of obtaining reduced railway transportation, etc. He especially urged upon the members the desirability of the prompt payment of dues.

Dr. Haskell, of the U. S. Public Health Service, speaking for a group of members and visitors from several States, extended a most cordial invitation for the eighteenth annual convention to be held in the city of Memphis.

SEVENTH SESSION

The convention was called to order by President Hiscock at 1.50 P.M. President Hiscock called Vice-President Richmond to the chair. The report of the Committee on Educational Aspects of Dairy and Milk Inspection, prepared under the chairmanship of Prof. C. L. Roadhouse, was read by Professor McInerney.

The report of the Committee on Bovine Diseases—Their Relation to the Milk Supply and to the Public Health, in the absence of Dr. C. D. Pearce, chairman, was read by Dr. Grim. The report of the Committee on

Communicable Diseases Affecting Man—Their Relation to the Milk Supply and to the Public Health was presented by its chairman, Mr. Howard R. Estes.

Prof. T. J. McInerney presented a paper on "The Fat Distribution in Gravity Cream." Mr. Russell R. Palmer presented a paper on "The Effect of Incubation at 145° F. on Bacterial Plate Counts of Milk." This was followed by a paper by Doctors H. A. Harding and A. R. Ward and Mr. H. G. Harding on the subject "Conducting the Methylene Blue Test at 145° F."

BUSINESS SESSION

The business session of the Association was called to order by President Hiscock at 4 o'clock. President Hiscock referred to the activity of committee groups and expressed his appreciation of the work of the committees and officers of the Association during the past year.

First Vice-President Estes, Second Vice-President Irwin, and Third Vice-President Richmond spoke briefly regarding their activities in promoting the work of the Association during the past year.

The report of the Secretary-Treasurer was presented, as was also the report of the auditors.

The Committee on Resolutions—Dr. W. A. Shoults, chairman—reported, and the following resolutions were adopted:

1. Whereas, In His infinite wisdom, Almighty God has seen fit to remove from our midst our dearly beloved friend and associate, Past President Prof. James O. Jordan, an efficient and broad-minded official, a fearless executive, a man who gave unstintingly of his time to advise younger men from the knowledge of his rich experience, and a true friend; 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 real 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.

2. WHEREAS, This Association has been enlightened and greatly 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 Dr. Isaac D. Rawlings, Dr. Arnold H. Kegel, Prof. W. H. E. Reid, Dr. H. C. Becker, Dr. Herman N. Bundesen, Dr. J. L. Pomeroy, Dr. S. J. Crumbine, and Mr. Charles F. Chrisman.

3. *Resolved,* That this Association express to the Chicago Health Department, the Creamery Package Manufacturing Company, and the Cherry-Burrell Company, its thanks for the courtesies extended.

4. WHEREAS, Sanitation is necessary for the production of wholesome milk; and

WHEREAS, Present-day practices are frequently detrimental to the production of wholesome milk by the use of milking machines; and

WHEREAS, This condition frequently results from recommendations and instructions by milking machine manufacturers and representatives and by official and unofficial agencies and investigators who have based their conclusions and recommendations primarily on the bacterial count of the milk without due regard to the physical and sanitary condition of the machines; therefore be it

Resolved, That the International Association of Dairy and Milk Inspectors take suitable and prompt action to bring this matter to the attention of manufacturers of milking machines, official and unofficial agencies and investigators, with the object of securing corrective measures and the establishing of proper methods and standards for the care, treatment, and handling of milking machines.

The Association then proceeded to the election of officers for the ensuing year, as follows:

President, Howard R. Estes, New York City.

First Vice-President, Ralph E. Irwin, Harrisburg, Pa.

Second Vice-President, Dr. A. R. B. Richmond, Toronto, Ontario.

Third Vice-President, Wm. B. Palmer, Orange, N. J.

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

Auditors, Thomas Holt, Hartford, Conn.; Dr. F. D. Holford, New York City.

Dr. Holford moved and it was voted that the advisability of the appointment of a committee on methods and standards be referred to the Executive Board.

Dr. Hulquist expressed the belief that greater publicity is desirable for the Association, and in his absence referred to the opinion expressed by Dr. Brooks that a committee on publicity consisting of three members should be appointed to cooperate with the Executive Board in giving wider publicity to the activities of the Association.

Mr. Warner moved and it was voted to authorize the Secretary to employ stenographic service for future conventions.

The matter of an amendment to the Constitution and By-Laws providing for associate membership was discussed, as was also the advisability of changing the name of the Association. It was moved and voted that the Secretary take whatever steps may seem desirable in the above matters.

As no other matters of business were presented, the business session was declared adjourned.

EIGHTH SESSION

President Hiscock called the convention to order at 8 o'clock. Dr. J. H. Shrader, in the absence of his committee report, which was lost in the mail, discussed briefly the subject of remade milk.

Dr. Roy F. Leslie presented a paper entitled "Approved Dairies, and Some New Thoughts on Dairy Inspection Work."

"Powdered Milk and the Public Health" was the subject of a paper by Dr. James A. Tobey.

A GREETING

Dr. Isaac D. Rawlings, *Director*, Department of Public Health, State of Illinois,

Springfield, Ill.

As Director of Public Health of Illinois I am indeed happy to extend to each of you a most cordial welcome to Illinois, a State which during the past seven years has had the distinction of having kept a greater percentage of its population away from the undertaker and the cemetery than has any other State in the Union with a population of four millions or more.

It is especially fitting that this International Association of Dairy and Milk Inspectors should select Illinois for this meeting, as this State has in recent years made great strides toward a safe milk supply for her people.

I early learned as a health lesson that if we provide our people with a safe milk supply, a safe water supply, and also control communicable diseases, we will have solved seventy-five per cent of our health problem. And perhaps the greatest of these three essentials is a safe, clean milk.

When I went to the State Service in 1921, after over twenty years in the Chicago Health Department, I found down-state Illinois wofully lacking in a safe, clean milk supply.

Because of this fact, one of our first acts was to outline a practical milk ordinance for cities, with the aid of the Chicago Health Department, the State Department of Agriculture, and the University of Illinois. When this ordinance was tentatively complete we called in representatives of the milk producers, the milk distributors, and the milk consumers as represented by the health officers and the sanitarians, and in open meeting discussed the ordinance section by section until it seemed satisfactory to all interests concerned. Since 1923 over seventy of the larger municipalities in Illinois, outside of Chicago, with a combined population of over one million, have passed this ordinance.

In 1924 a certain down-state group of milk dealers got solidly behind a movement initiated by the State Health Department, looking toward rigid sanitary supervision over milk pasteurization plants in the State. The outcome of this project was a law enacted in 1925, which prohibits the use of the word "pasteurized" in connection with milk sold by any dealer whose plant has not been certified by the State Department of Public Health. Today practically every pasteurization plant in Illinois complies with the strict minimum requirements of the Department and has been certified.

Our State has extensive dairying interests. How great these interests are is indicated by the fact that of the 102 counties, the ten counties nearest where you now sit produced in 1927 over four hundred and thirteen million pounds of milk and over eight million pounds of butter.

Our State Department of Agriculture, by pushing the ten-year tuberculin testing program at an annual expenditure of over one million dollars, has also contributed much to a safer milk supply in Illinois. Over three million tests have been made and over one hundred and fifty thousand reactors killed. During the last fiscal year alone over nine hundred thousand cattle were tested. Today 23 counties are 100 per cent tested. Twenty-six other counties have 75 per cent tested to date and are working for 100 per cent. Twenty-six other counties are well on the way to being 75 per cent tested.

It is estimated that the two million dollars expected from our next legislature for the coming biennium will give us by 1931 a State free of bovine tuberculosis. We believe the greater per capita consumption of milk today is due to the fact that our people realize that now they can obtain a clean, tuberculin-tested, pasteurized milk.

We attribute a large measure of credit to this improved milk supply for the great decrease down state since 1920 in typhoid fever, scarlet fever, diarrhea and enteritis, and infant mortality, and for a reduction in the general death rate from 12.6 to 11.1 per 1,000. There were 10,300 fewer deaths in 1927 than in 1920, and the improved milk supply undoubtedly contributed its share toward this splendid record.

It must be obvious to you that because I am not the Governor of this great State, I cannot give each of you the proverbial "Keys to Illinois." However, in extending this cordial welcome to Illinois we can again assure you that we are happy to have you in our midst and sincerely trust that your visit to Illinois will be so enjoyable and instructive that you will want to return in the very near future.

"It is the surmounting of difficulties that makes heroes."

RESPONSE TO ADDRESS OF WELCOME

Howard R. Estes,
First Vice-President,
New York City

The members of the International Association of Dairy and Milk Inspectors appreciate the kind welcome which has been given. They appreciate meeting in a city in which so much constructive work has been done to make milk safe. Milk improvement people realize that through the combined efforts of the Chicago Health Department and the United States Public Health Service, information of immense value has been given the world—information which has exerted and will continue to exert a profound influence upon the health and happiness of the people in this and in other countries.

We are not unmindful of the fact that we are meeting in a State that has done so much to better milk conditions through the entire State—a State from which have issued many constructive and valuable suggestions.

Our organization has met before in this city, and we are pleased to return to it again and to become a unit in this great health conference. We know that from our meetings, those in attendance return to their routine duties inspired and with the will to carry on a bigger and better work in protecting and promoting the greater use of dairy products.

The addresses and papers presented at these meetings do more than inspire and instruct our own members, for we know they are eagerly received by many not members of our Association, whose ideals are similar to those which promoted the formation of the International Association of Dairy and Milk Inspectors. We are glad to meet again close to the birthplace of this Association. Each meeting reflects the foresight of the founders of this organization.

THE GOAL OF DAIRY AND MILK INSPECTORS

PROF. IRA V. HISCOCK, *President*,
International Association of Dairy and Milk Inspectors,
New Haven, Conn.

The seventeenth annual convention of the International Association of Dairy and Milk Inspectors marks another year of usefulness of our organization and of service by its members. The object of this Association, as stated in our Constitution, adopted October 16, 1911, is 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. It seems appropriate to consider the progress which has been made toward the fulfillment of this object and to consider future problems.

That noteworthy progress has been made along the lines indicated in the previous statement becomes apparent when one compares conditions of the present with those of 17 years ago when this Association was formed by a small group of sanitarians who saw the possibilities of organized activity. A study of the scope and volume of the contributions of members and friends of the Association, recorded in its annual Proceedings, is convincing proof of the constructive influence which this group, among others, has exercised.

The development of the dairy industry has created important problems for both health officials and those engaged in the production and handling of dairy products. The concentration of groups of people in cities and the increased recognition of the food value of milk and its products have made it necessary for the distributor to obtain milk from various types of dairies and to transport it for long distances. At the same time, the more progressive dairymen have been attempting to improve the quality of their herds and of their products. Many factors related to the dairy industry have received long and careful scientific study, from the standpoints of production and of distribution, while those who serve the public as inspectors have been concerned primarily with problems of sufficient and safe supplies.

Inasmuch as milk is a vital food for which there is no adequate substitute, it is imperative that safe milk in sufficient quantities be at all times available for the public. Being an excellent medium for bacterial growth, milk must be produced and handled under the most favorable conditions of modern sanitation. The increased use of dairy products, especially butter, cheese, and ice cream, and the development of the condensed, evaporated, and dried milk industries have added to the responsibilities of inspectors and producers alike, for the protection of human welfare. Realizing the importance of sanitary methods, the majority of dairymen are cooperating more fully each year with various agencies engaged in milk supervision. The phenomenal development of the ice cream trade suggests that somewhat more emphasis should be given to the supervision of this product. It is gratifying that the inspector is becoming recognized as an educator rather than as a police officer.

As pointed out by our esteemed friend, the late Professor James O. Jordan, and by Ernest Kelly, in their presidential addresses before this Association, the field of economics is so closely interwoven with our work as sanitarians that cognizance must be taken of such factors. Following the outbreak of the World

War, circumstances arose, with an increased market for dairy products, which directed attention to milk prices. Frequent conferences resulted between consumers, dealers, and producers, and several studies were made. It became clear that it was not possible to apply a universal formula for determining the cost of production in different localities because of the diversity of requirements in various sections. Factors of supply and demand are also most important considerations, and it is doubtful if the selling price of milk will be governed entirely by the cost of production. I am entirely in accord with Mr. Kelly, however, who says that generally speaking, the lower the price of milk, the better, provided the producers and the dealers are assured a fair profit. "Such conditions stimulate a greater consumption of dairy products, and provide for the operation of dairy plants at maximum capacity." Questions of milk prices still arise from time to time in different localities, but the price levels seem to be more nearly stabilized than was the case ten years ago. Furthermore, the public is gradually becoming educated to the fact that milk is not an expensive food in comparison with other nutritive products. The average American food supply has been one-sided through liberal if not excessive use of meats and sweets and insufficient use of milk, fruits, and vegetables in the diet. The daily per capita milk consumption figure is increasing, but is still far from the desired standard of one quart.

Early activities of the inspector related largely to the prevention of adulteration; and methods of laboratory control from a bacteriological standpoint were limited. The magnitude of the task has become more fully realized as our knowledge of milk bacteriology and chemistry has increased. Programs of dairy and milk inspection have been instituted as the attention of the public has been directed to conditions existing in the milk trade which need supervision.

When it became recognized that there was needed an agency to work for the interests of both consumer and honest dairyman, the municipal boards of health were usually considered the proper organization for cities and towns. On a state-wide basis, the work was developed either under boards of health, departments of agriculture, or dairy and food commissioners. The Dairy Division of the United States Department of Agriculture has exercised a most important influence through the country in the conduct of extensive research, and in stimulating the development of modern standards of milk production and a high type of milk inspection service.

The earliest laws relating to milk dealt with chemical adulteration, skimming, watering, and the addition of preservatives. Later, laws were enacted governing sanitary conditions and prescribing limits for bacterial counts. It is necessary from time to time to revise regulations and methods to conform to modern knowledge of sanitation and bacteriology.

There is at present a movement to establish a standard milk control code* aimed for adaptation to local needs in different sections of the country and which may produce a greater degree of uniformity than now exists. The research activities of the United States Public Health Service, as related to milk, like those in other fields, have been of a high order, and this attempt to devise a uniform milk code is the result of a long period of research and of field investigations. How fully the details of this code are applicable throughout the entire country remains to be tested, but the basic principles seem to have been carefully conceived and

* Prepared under the direction of the Office of Milk Investigations, U. S. Public Health Service.

to have proved satisfactory in several States. Certainly the preparation of this code has stimulated careful study of milk ordinances by local departments throughout the country for the purpose of determining their soundness from practical and legal viewpoints.

Unquestionably, one of the primary elements of a milk control program is an ordinance requiring the licensing of milk dealers and providing for the safeguards recognized as essential in the production and handling of milk. Such an ordinance should be carefully framed to conform with local conditions and current knowledge.

With the somewhat rapid development of dairy supervision programs by municipalities, counties, and States, it is perhaps not surprising that some confusion has arisen which has affected the dairymen as well as the different inspection forces. In different sections of the country, it is not uncommon to find that dairies of a given district are being inspected in the course of a year, and sometimes even of a month, by representatives of two or more State departments, and of from two to several city or county departments. In many instances there is no exchange of information by these different inspectors regarding the findings or the instructions given, and furthermore, there is often lack of uniformity of requirements as set down in the various milk ordinances. Regular inspection of dairy farms and of milk plants is essential, but would it not be possible for different inspection services operating in the same territory to cooperate more fully, to exchange reports and information, to secure greater uniformity in their requirements, and to confer on special problems? Should there not be a central clearing house of information, either State or county, depending upon local administrative plans, giving full rather than partial information regarding the types and condition of dairies in the locality? The establishment of milk commissions, or committees, representing the different agencies, for the purpose of conferring on various aspects of this problem might prove helpful.

The State Milk Inspectors' Associations are promoting a clearer conception of problems of this nature and are directing attention to the need of more uniform methods of inspection service. Through the courtesy of the Milk Inspectors' Associations of three different States, your President was privileged to attend the annual meetings of these Associations. He was greatly impressed with the progress which is being made in arriving at a better understanding of our mutual problems through the frank discussions which these opportunities afford.

It is well known that milk may become infected from human sources,* sometimes on the farm, or at the dairy, or in transportation, or even in the household. It may likewise become infected as a result of disease of the animal. Pasteurization prevents sickness and saves lives. It is the most practical method of securing safe milk on a commercial basis. It is not intended to replace sanitation but to serve as an added safeguard. The large cities are now reasonably well protected by this process, but small communities need equal safeguards, and their citizens must be awakened to this need. During the past two years, commendable progress has been made in the improvement of pasteurization methods and equipment, and the city in which we are now meeting has been the seat of many of the research studies which resulted in these improvements.

* Diseases known to be conveyed through milk are tuberculosis, typhoid and paratyphoid fevers, diphtheria, scarlet fever, septic sore throat, undulant fever, foot-and-mouth disease, milk sickness, summer complaints of children, diarrhea and dysenteric diseases, epidemic arthritic erythema, infantile paralysis.

The tremendous benefit of pasteurization of milk and milk products to the public health is becoming more generally recognized each year. The extension of pasteurization, and the education of parents regarding the proper care of milk and the feeding of infants have been very important factors in the remarkable reduction in the infant mortality rate.

In an attempt to secure information concerning methods of inspection of dairy products employed in different sections of the country, and to secure data upon which might be based standards of practice, the Committee on Administrative Health Practice of the American Public Health Association has surveyed a large number of cities and counties, as well as a few States, and has developed an Appraisal Form.* It is by use of this Appraisal Form that it is possible to evaluate the results in a given community and to compare them with those of other communities in the United States and Canada. This is a useful instrument for health officials. At the same time, a subcommittee has been engaged in studying record forms and their use and is attempting to prepare a set of practical record forms for milk supervision. These may be helpful to those engaged in this line of work, and may eventually lead to greater uniformity and better business methods in record keeping.

The success of a milk control program depends largely upon the employment of competent inspectors. As Kelly and Clement state: "Dairy inspectors should possess tact, perseverance, knowledge, energy, and courage. The bullying dictatorial type may enforce certain rules temporarily; but the greatest good and more lasting results are secured by the inspector who uses reason as a flame to light the path. For that reason, agricul-

* Copies may be obtained from the Field Director of the Committee, American Public Health Association, 370 Seventh Avenue, New York.

tural graduates and men who have lived and worked on farms are particularly useful; they can understand the farmers' problems, and offer practicable suggestions."

A committee of this Association has for several years been studying the problem of qualifications of inspectors, and their recommendations are worthy of careful consideration. Emphasis is rightly given to the importance of full-time service, to adequate salaries, to protection by civil service laws, to special education and training, and to practical experience in some branch of dairying.

Modern milk inspection service reaches from the source of supply to the point of delivery. Advice in sanitary methods is obviously the first aim and duty of inspectors. Opportunity may often be given inspectors to discuss with dairymen various economic problems, and better cattle and feeding practices. Information as to new developments in milk plant equipment is likewise often welcome to milk plant operators. The public not only needs to know the nutritive value, but also must understand its responsibility in protecting milk after delivery. The educational work which has been done through the schools, parent-teacher organizations, and other educational and welfare agencies has already borne fruit in a significant increase in milk consumption. The safe milk campaign inaugurated by the American Child Health Association in 1923 in cooperation with State health and food officials has done much toward securing "for every baby, child, and adult in America a clean and safe milk supply."

It is significant that the milk supervision programs which have been most successful have been those characterized by cooperative enterprises which featured educational methods. There are many sections of the country, particularly in the small communities, where there is still needed much pioneer work. We must be ever alert to meet new situations as they arise, as well as to hold the ground which has been gained. Past experience indicates that educational campaigns for adequate and safe milk supplies and for increased milk consumption bring their rewards in the promotion and preservation of public health, which is our goal.

"Health is the most admirable manifestation of right living."

REPORT OF COMMITTEE ON DAIRY AND MILK PLANT EQUIPMENT

GEORGE W. PUTNAM, *Chairman*

The Committee on Dairy and Milk Plant Equipment took as its subject for study last year the suggested standard specifications for pasteurizing plant equipment, developed by the United States Public Health Service, with the collaboration of other organizations.

The report was submitted with the following statement and appeal:

"The Committee submits the following tentative specifications for consideration and use by milk control officials and solicits criticisms and suggestions from the Association members."

Conferences and correspondence with various members of the Association develop very little criticism of these specifications, and in general they are regarded as a very praiseworthy attempt at standardization of such requirements.

Many States and cities are now enforcing many, and in some cases all, of these specifications, either identically or somewhat differently worded, but accomplishing substantially the same result. Among these are the States of Illinois, Kentucky, Massachusetts, Minnesota, New York, and Pennsylvania, and the cities of Boston, Baltimore, Chicago, Milwaukee, Newport, and practically all of those cities which have adopted the Standard Milk Ordinance. There are undoubtedly others of which we have no direct advice.

SUGGESTED MODIFICATIONS

Suggested modifications of the specifications contained in last year's report have been considered carefully and the following are recommended:

1. Add to paragraph (a) on open surface coolers the following:

On new installations the header faces above and below such gap shall be so shaped as to divert condensation away from the tubes.

2. Under "Milk Piping," change paragraph 2 to read as follows:

The milk piping and connections shall have a noncorrodible smooth surface or finish of approved material, and all sweated connections shall be smooth and flush.

3. Under "Construction of Equipment," change the last paragraph to read as follows:

The above requirements preclude: (a) the use of milk pumps which are not constructed of smooth, noncorrodible metal, all parts of which can be readily taken apart for cleaning; (b) the use of any type of equipment so designed as to permit milk routinely to come in contact with threaded surfaces.

4. Under "Pasteurization," change paragraph 4(c) to read as follows:

Leak-Protector Inlet and Outlet Valves, or Devices: Leak-protector inlet and outlet valves or devices shall be provided for each vat or pocket of vat and pocket-type installation, except in the case of single vat installations. Leak-protector outlet valves shall be provided with a sterilizing connection. In a single vat installation, the outlet piping shall be disconnected during the filling and holding period and the outlet shall be sterilized just prior to emptying.

Indicating and Recording Thermometers

The following thermometer specifications were tentatively formulated at a conference between the leading instrument manufacturers, the United States Department of Agriculture, United States Bureau of Standards, and United States Public Health Service, with the hope that the various organizations interested in milk control might agree and thus minimize the present extreme variation in specifications. Such agreement should make it possible to secure accurate, convenient thermometers at the lowest possible price. These specifications should be considered as advisory and not be interpreted as limiting the inspectors in the use of other equally accurate thermometers.

Indicating Thermometers for Pasteurization Apparatus:

Type: V-shaped brass or equally noncorrodible scale case, with removable glass front, mercury actuated, line etched in glass tube at temperature which the pasteurization definition requires the indicating thermometer to show, filling above mercury, nitrogen gas.

Magnification of Mercury Column: To apparent width of not less than 1/16 inch.

Scale Range: 130° to 210° F., extension either side permissive, protected against damage at 220° F.

Temperature Represented by Smallest Scale Division: Not more than 1° F.

Number of Degrees per Inch of Scale: Not more than 16.

Accuracy: Within ½ degree F., plus or minus, between 142° F. and 145° F.

Stem Fitting: Pressure tight seat against inside wall of holder or pipe. No threads exposed to milk. Location of seat in batch type pasteurizers to conform to that of standard I. A. M. D. wall type fitting.

(The local or state inspector shall check the accuracy of all indicating thermometers at the legally required temperature of pasteurization by means of a standardized thermometer reading to within 0.2° F. This may be done by lowering a standardized maximum registering thermometer to the position of the bulb of the indicating thermometer in the holder during the holding period, with the milk in agitation.

The inspector shall identify by number, seal, or otherwise the indicating thermometer when tested.)

Inspectors' Maximum Self-Registering Thermometers to be Used in the Testing of Indicating Thermometers on Pasteurization Apparatus:

Type: Maximum self-registering, mercury actuated, pocket type, readily cleanable.

Magnification of Mercury Column: To apparent width of not less than 1/16 inch.

Protection Against High Temperature Damage: At 155° F.

Scale Range: 138° F. to 148° F., with extension of scale on either side permissive, 138° point to be not less than 3/4 inch above contraction.

Temperature Represented by Smallest Scale Division: 0.2° F.

Number of Degrees Per Inch of Scale: Not more than 6.

Accuracy: Within 0.2 degrees F. plus or minus, between 142° F. and 145° F.

Case: Metal, provided with suspension ring and fountain pen clip.

Armor: Thermometers, if armored, to be easily removable for cleaning, armor to be fenestrated opposite thermometer bulb; scale to be visible without removing armor.

Bulb: Corning normal, or equally suitable thermometric glass.

(The inspector should check test thermometers against themselves occasionally for failure to hold reading when taken from the liquid in which they have been immersed. This may be done by holding them in clear water at approximately 142° F., reading the temperature while immersed, and then reading the temperature again after the thermometer has been removed from the water.)

Recording Thermometers for Pasteurization Apparatus:

Case: Moisture proof (under operating conditions obtaining in pasteurization plants), and provided with lock and key.

Scale Range: 100°–150° F., with extension of scale on either side permissive.

Temperature Represented by Smallest Temperature Scale Divisions Between 142° F. and 145° F: 1° F.

Length of 1° F. Scale Division Between 142° F. and 145° F.: Not less than 1/16 inch.

Time Represented by Smallest Time Scale Division: Not more than 10 minutes.

Chord or Straight Line Length of 10-Minute Scale Division Between 142° F. and 145° F.: Not less than ¼ inch.

Accuracy: Within 1° F., plus or minus, between 142° F. and 145° F.; the accuracy may be determined by the following mode of procedure:

(1) The instrument shall be adjusted to read correctly (if necessary) at some point between 142° F. and 145° F., while it is connected with the pasteurization apparatus, and as shown by the tested indicating thermometer after a stabilization period of five minutes at constant temperature with the agitation device in operation.

(2) The bulb shall be removed from the pasteurizer and immersed for not less than five minutes in boiling water.

(3) The bulb shall then be immersed for not less than five minutes in melting ice.

(4) The bulb shall be again connected with the pasteurizer and the temperature brought to a point

between 142° F. and 145° F., as shown by the tested indicating thermometer under the same test conditions outlined under number (1). At this time the deviation of the recording thermometer reading from that of the indicating thermometer shall not be more than 1° F. plus or minus.

Pen Arm Setting Device: Easily accessible, simple to adjust, and capable of being sealed.

Pen and Chart Paper: Designed to give line not over 1/40 inch thick when in proper adjustment, which shall be easy to maintain.

Pressure System: (Bulb, tube, spring, etc.): Protected against damage at bulb temperature of 220° F.

Stem Fitting: Pressure tight seat against inside wall of holder or pipe. No threads exposed to milk. Location of seat in batch type pasteurizers to conform to that of a standard I. A. M. D. wall type fitting.

Chart Speed: The chart shall make one revolution in 12 hours, and shall be graduated for a 12-hour record.

Checking Setting of Recording Thermometers Daily: The setting of recording thermometers shall be checked against the indicating thermometers daily by the plant operator, and at least bi-weekly by the health officer, and shall be kept adjusted so as at no time to read higher than the indicating thermometer.

General

The word "approval," when used in these specifications, is taken to mean action by the milk control official exercising jurisdiction.

The committee wish to emphasize that these specifications are submitted to the members for consideration and use by milk control officials. The committee desires that members offer criticisms and suggestions regarding them in order that the final specifications as formulated may represent the best thought and widest possible experience in milk supervision.

"In the multitude of counsellors there is safety."

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

GEORGE E. BOLLING, *Chairman*

DIFFERENTIATION OF STREPTOCOCCI

The early and frequent association of streptococci with suppurative processes in general has undoubtedly been largely responsible for the misapprehension that still persists regarding this particular group of microörganisms. The fact is that this group comprises a wide variety of species, both harmful and beneficial. Their universal occurrence, however, in all milk, usually represented by the normal lactic acid producers, but not infrequently by the pathogenic types associated with mammitis, with septic sore throat, and other diseases, constitutes a problem of real sanitary significance. Differentiation of species has therefore been the subject of investigation for a number of years. Any one who attempts to delve into the literature on the streptococcus group will soon find himself confronted with thousands of scientific papers dealing with a wide variety of problems related to this most important group.

Hence in the time available for this study of the literature it has been necessary to base conclusions on the results of those investigations which appear to most accurately reflect our present knowledge of the streptooccus group, so far as the distinguishing of species or types is concerned. The following conclusions are based on the work of Ayres, Brown, Davis, Evans, Jones, Kinsella, Mathers, Rogers, Sherman, Frost, Shaw, and Carr. It is fully recognized that many valuable contributions by other authors have been overlooked.

Morphology. Generally speaking, the normal lactic-acid-producing streptococci grow in short chains of two to four or six individuals, while those streptococci found in or on the body of animals tend to form longer chains. This characteristic is a help to the bacteriologist who is studying this group for the purpose of classification, but is so inconstant as to make it impossible to use the length of chain as a basis for differentiating. Some pathogens grow in short chains, while the short-chained lactic-producing streptococci can be induced to grow in long chains.

Fermentations. The streptococci as a group are normally vigorous carbohydrate fermenters. Practically all ferment dextrose, lactose, maltose, and saccharose. There is considerable variation in the fermentation, by different species or groups, of raffinose, insulin, mannite, and salicin. Some species normally ferment one or more of these, and this fact is an important aid to the bacteriologist in the classification of species. No correlation between pathogenicity and the fermentation of carbohydrates has yet been discovered.

The fermentation of sodium hippurate, as demonstrated by Ayres and Rupp, promises to aid materially in determining certain groups of streptococci as to sources. For example, 44 hemolytic streptococci of bovine origin hydrolyzed hippuric acid, while 33 hemolytic streptococci of human origin did not. This does not, however, differentiate the pathogenic from the non-pathogenic microörganism.

Acid Production. The results of several investigators agree that in the production of acidity the lactic-acid-producing organisms, found normally in market milk, uniformly produce a lower pH—in other words higher acidity—than do those streptococci that exist on or in the bodies of animals, such as the *Streptococcus bovis, Str. mastiditis,* and *Str. pyogenes.* The pH of *Str. lactis,* for instance, ranges from 4.5–5.0, while the pH of *Str. bovis* ranges from 5–5.4, *Str. mastiditis* from 5.5–6.0, and *Str. pyogenes* from 6.4–7.3. While low acid production by streptococci in milk cannot be taken as proof of the existence of pathogenic organisms, yet it can safely be taken as presumptive evidence of contamination from human or bovine sources.

Reduction Tests. Ayres found Janus green helpful in differentiating *Str. lactis* from *Str. bovis, Str. mastiditis,* and *Str. pyogenes,* the last three producing no change in color. Ammonium molybdate was equally as reliable. Sherman found that of the typical lactic-acid-producing strains isolated from milk which had been allowed to stand until the acidity had developed to about .2 per cent, 100 per cent reduced methylene blue within 24 hours and before curdling, which was not accomplished by any of the streptococcic strains which were isolated from the milk immediately as drawn from the udder.

Temperature Relationships. Differences in temperature requirements apparently constitute a reliable basis for dividing streptococci into groups. Sherman and Albus have shown this point, as given in the following table:

	50 Strains from Milk	
	After Acidity Developed to .2%, Per Cent Positive	Fresh from Udder, Per Cent Positive
Growth at 10° C. (50° F.)	100	0
Growth at 43° C. (109.4° F.)	6	82

Hemolysis (Blood Agar Plates). The discovery that certain bacteria associated with disease produced substances that hemolyzed red blood corpuscles led many who were particularly interested in differentiating pathogenic from nonpathogenic microörganisms to think that a method had been found which would solve the problem. Investigational work, however, has demonstrated that the phenomenon of hemolysis merely constitutes another valuable aid in differentiation of groups and species. According to Davis, so far as known all streptococci which produce epidemics are hemolytic. All hemolytic streptococci, however, are not necessarily virulent for animals or man. Neither are all nonhemolytic streptococci virulent. The nonhemolytic or feebly hemolytic streptococci may cause severe cases of mastitis in cows.

So far as known there is no single method which can alone be relied upon to differentiate pathogenic from nonpathogenic streptococci. Any differentiation must be based upon the combined results of several different laboratory methods, including inoculation of mice, though this test is regarded as less significant than others. Frost and Carr summarize the necessary steps for identification of *Streptococcus epidemicus* as follows:

Veal-infusion blood agar plates are made of the milk, which is usually diluted 1 to 20, and incubated about 24 hours at 37° C. All hemolytic colonies of the beta type are fished into veal-infusion broth and the next day tested for hemolytic power. Those which hemolyze in two hours are transferred, first, to blood agar slopes to be examined for capsules, and second, to veal-broth tubes containing the following test substances: dextrose, lactose, saccharose, mannite, salicin, and sodium hippurate. *Streptococcus epidemicus* produces a quite characteristic beta colony on blood agar plates; has a high hemolytic titre; is a low acid producer in dextrose broth (pH around 5.1); ferments lactose, saccharose, and salicin; does not ferment mannite nor does it hydrolize sodium hippurate. It shows a capsule when the growth from a young moist agar slope culture is examined in a wet India ink preparation.

The technique of making a wet India ink preparation is as follows: Fish a moist colony from a blood agar plate and mix with equal amount of broth on a cover glass. Add loopful India ink and observe as hanging drop preparation.

An article, "Variations of Streptococci with a Note on Hemolysin Production," by Frobisher and Denny, appearing in the *Journal of Bacteriology*, August, 1928, describes the distinguishing features of the alpha and beta types of this organism.

The *Streptococcus epidemicus* found to be the cause of the epidemic in Lee, Mass., during the summer of 1928, occasioning 1,000 cases and 40 deaths in a population of 4,000, conformed to the tests given above. This strain possessed marked virulence; one-millionth of a cubic centimeter of an 18-hour serum-broth culture injected intraperitoneally proved fatal to mice within three days.

In an article, "The Control of Raw Foods," appearing in the *Journal of the American Medical Association* of October 24, 1925, Dr. Herman N. Bundesen, then Commissioner of Health of Chicago, stated the following method of procedure as having been adopted for the safeguarding of milk containing streptococci:

"Hemolytic organisms found in certified milk should be regarded as of no significance unless conforming to the following characteristics:

"They should be streptococci of proper morphology, giving colonies of the beta type on blood agar.

"Production of hemolysin should be sufficient to produce full hemolysis of rabbit's blood corpuscles within two hours.

"They should kill both of two mice injected, acutely within forty-eight hours, and should be recovered from the animals and identified.

"Samples containing organisms conforming to these tests may be regarded as under suspicion, but these data are merely suggestive and not proof that the organism is dangerous to human beings. Any action which may be taken must necessarily be determined by practical circumstances. If, however, an absolute safeguard against the possibility of septic sore throat outbreaks is desired, pasteurization or a shut-off of the supply until subsequent samples prove negative is the only reliable procedure."

Some work was done by a few of the committee to ascertain how commonly hemolytic streptococci of the beta type occurred in normal milk marketed within their jurisdiction. The results are summarized as follows:

	Per cent of samples containing hemolytic streptococci		
	Florida	Massachusetts	Michigan
Raw milk	60	33	100
Raw milk (Certified)	—	20	58
Pasteurized milk	63	20	24

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.

"In science, the thing is to modify and change one's ideas as science advances."

THE INFLUENCE OF THE INDIVIDUAL COW ON THE BACTERIAL CONTENT OF MILK

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General Laboratories, Madison, Wis.

It is generally accepted that the number of microorganisms in raw milk is an index to the sanitary conditions under which the milk was produced and its care after production.

Observations and studies reported in this paper show that some cows regularly deliver milk having an excessive number of bacteria, and that others deliver such milk spasmodically. This report embodies results of tests of two herds of cows, both under supervision of the same official and adjusted to the same sanitary code. Each herd was carefully observed by approved veterinarians and reports were made regarding the condition of each individual animal. Studies were made of the individualities of the cows, udder infections, lactation period, breed, age, history of abortion, and feeding. None of these conditions, after careful study, was considered a factor in influencing the bacteria count.

Table No. 1 presents the counts in milk from individual cows from June 1, 1926, to April 5, 1927. A sample was taken from each individual in the milking herd as the milk bucket was poured into the receiving vat.

During the study of Herd A, 1,411 samples were taken; 186 showed counts above 2,000, while 1,225 samples showed counts below 2,000. From Herd B, 725 samples were taken, 352 of which showed counts above 2,000, while 373 showed counts below 2,000. The average bacteria count in milk from Herd A was 1,304, while in milk from Herd B the average count was 5,820.

Table No. 2 presents a representative series of counts in milk from Herd A and Herd B.

Table No. 3 shows the variation of the bacterial content of milk at the bottle filler, due to the variation of the bacterial content of milk from the individual cows. These samples were taken from the same filler barrels after each ten gallons of milk, or 40 quarts, had been run through the filler. The milk was poured into a hopper and permitted to run over a surface cooler, cooled to 45° F., and allowed to flow into a 20-gallon bottle filler. The amount of milk in the bottle filler varied from one to 15 gallons.

Conclusions

From our observations, we believe that the bacteria count in raw milk is not always a true index to the sanitary condition under which the milk is produced.

We believe that in the grading of milk, all of the factors—equipment, methods, and bacteriological content—should be given equal consideration. The individual cow in the herd can, and sometimes does, influence the total count in the composite milk of the herd.

Acknowledgment and appreciation is hereby expressed to the Food and Dairy Division of the Kansas City Health Department for supplying the data which furnishes the basis of this paper.

TABLE 1

Bacterial Tests of Milk of Each Cow on Two Farms From June 1, 1926, to April 5, 1927

Herd A

Cow No.	Over 2,000	Under 2,000	Cow No.	Over 2,000	Under 2,000
124	18	1	141	1	18
65	12	2	144	1	20
47	9	13	149	1	13
125	9	8	153	1	14
159	9	10	157	1	15
92	7	2	161	1	19
122	7	12	171	1	10

TABLE 1—*Continued*

Cow No.	Over 2,000	Under 2,000	Cow No.	Over 2,000	Under 2,000
5	6	16	172	1	10
133	6	10	202	1	21
80	5	12	204	1	14
100	5	14	206	1	22
142	5	7	211	1	14
85	4	13	22	1	7
143	4	1	165	1	18
152	4	16	215	1	8
163	4	9	174	0	7
166	4	11	93	0	6
15	3	18	106	0	6
98	3	15	108	0	19
99	3	17	111	0	9
104	3	10	112	0	23
119	3	14	118	0	1
137	3	17	120	0	20
138	3	18	134	0	18
160	3	16	140	0	19
168	3	18	145	0	20
69	2	16	150	0	22
77	2	17	158	0	23
130	2	9	162	0	16
147	2	15	169	0	17
155	2	20	173	0	10
167	2	18	175	0	9
170	2	10	176	0	7
183	2	5	177	0	10
207	2	17	178	0	9
209	2	19	179	0	9
18	1	7	180	0	10
42	1	19	181	0	9
49	1	17	182	0	9
107	1	19	184	0	5
123	1	21	185	0	6
129	1	17	186	0	6
132	1	16	188	0	3
135	1	19	210	0	9
136	1	15	216	0	3
139	1	17			
			Herd B		
84	21	0	17	5	12
90	18	3	82	5	10
76	17	4	1	4	14
93	16	0	10	4	15
94	16	3	25	5	4
92	15	1	21	4	15
95	15	3	39	4	4
3	13	3	59	4	14
105	13	3	88	4	0
98	12	5	97	4	5
36	11	10	16	3	13
70	11	8	52	3	16
37	9	1	73	3	2

TABLE 1—*Continued*

Cow No.	Over 2,000	Under 2,000	Cow No.	Over 2,000	Under 2,000
71	9	12	53	2	11
78	9	5	74	2	0
80	9	6	85	2	12
99	9	12	96	2	17
75	9	4	100	2	1
31	8	8	81	4	4
106	8	11	20	1	15
48	7	12	41	1	3
55	7	8	58	1	2
79	7	13	49	0	16
101	7	10	62	0	20
89	6	3			

TABLE 2

REPRESENTATIVE SERIES OF BACTERIAL COUNTS IN MILK SAMPLES FROM FARM A

January 19, 1928.

Sample No.	Count per c.c.	Cow No.	No. over 2,000	Milker No.
1	Sterile	Control Vial	..	..
2	750	122	6	5
3	200	209	1	2
4	550	150	2	4
5	50	165	..	6
6	200	162	3	7
7	600	120	..	5
8	1,300	147	1	3
9	50	167	2	2
10	100	158	..	6
11	250	123	1	5
12	200	119	1	7
13	500	108	..	4
14	250	135	1	3
15	300	47	7	6
16	1,100	172	..	2
17	600	125	10	5
18	400	207	2	3
19	1,400	152	2	6
20	150	107	..	7
21	200	129	..	2
22	300	204	1	5
23	900	99	..	2
24	200	177	..	4
25	1,000	132	..	3
26	350	15	2	6
27	250	112	..	7
28	150	157	..	2
29	100	98	..	4
30	150	136	1	2
31	1,850	159	..	4
32	250	5	6	2
33	150	182	..	4

TABLE 2—*Continued*

Sample No.	Count per c.c.	Cow No.	No. over 2,000	Milker No.
34	400	155	..	2
35	750	69	..	4
36	250	180	..	3
37	250	138	4	2
38	150	171	1	5
39	150	141	..	6
40	400	137	3	7
41	1,250	168	..	4
42	100	160	1	2
43	100	215	..	3
44	600	169	..	5
45	550	173	..	7
46	150	178	..	6
47	150	186	..	6
48	150	211	1	5
49	100	77	..	2
50	100	202	..	4
51	50	111	..	3
52	1,000	139	..	3
53	100	133	1	2
54	150	133*	..	2
55	Sterile	149	1	4
56	200	179	..	7
57	50	80	..	5
58	250	80*	..	5
59	100	206	..	4
60	50	181	..	7
61	Sterile	161	1	2
62	1,050	85	..	5
63	550	85*	..	5
64	50	175	..	6
65	400	100	..	3
71	150	185	..	2
72	250	144	..	4
73	900	183	..	7
74	Sterile	170	2	6
75	200	140	..	2
76	50	140*	..	2
77	100	210	..	5
78	350	176	..	4
79	Sterile	174-left half	..	6
80	100	174-right half	..	7
81	50	42	10	4
82	150	84	..	2
83	——	vial	..	2
66	Sterile	empty bottle		
67	100	total count on empty bottle		
68	13,500	finished Guernsey		
69	1,100	sanitary pipe		
70	1,000	finished product		

* Strippings.

TABLE 2—*Continued*

REPRESENTATIVE SERIES OF BACTERIAL COUNTS IN MILK SAMPLES FROM FARM B

March 8, 1928.

Sample No.	Count per c.c.	Cow No.	No. over 2,000	Milker No.
16	13	empty bottle		
17	1,450	106	8	1
18	2,900	55	4	2
19	3,100	75	8	1
20	550	62	–	2
21	2,600	71	8	1
22	1,800	10	2	2
23	3,200	93	3	1
24	800	79	5	1
25	2,200	31	1	2
26	2,750	80	7	1
27	700	1	3	2
28	2,800	105	3	1
29	4,600	76	8	1
30	1,450	49	–	2
31	10,300	95	14	1
32	1,100	82	–	1
33	1,100	53	–	2
34	250	96	–	1
35	17,000	90	17	1
36	2,000	70	5	1
37	35,000	59	1	2
38	2,400	101	6	1
39	4,550	36	10	2
40	350	98	11	1
41	2,400	17	3	2
42	100	16	3	2
43	7,900	89	2	1
44	17,000	48	1	2
45	17,500	84	19	1
57	6,100	105—teats cut		1
46	1,400	sanitary pipe		
47	850	cooler		
48	1,350	strainer		
49	3,200	tube No. 1 bottle filler		
50	3,300	tube No. 2 bottle filler		
51	4,150	tube No. 3 bottle filler		
52	4,100	tube No. 4 bottle filler		
53	3,500	drain		
54	3,700	finished product first milk through		
55	3,200	finished product last milk through		
56	sterile	control		

TABLE 3

REPRESENTATIVE SERIES OF BACTERIA COUNTS OF MILK SAMPLES TAKEN AT THE BOTTLE FILLER *

Sample No.	Bacteria per c.c.	Sample No.	Bacteria per c.c.
1	5,000	11	4,000
2	14,000	12	8,000
3	3,000	13	6,000
4	9,000	14	9,000
5	9,000	15	12,000
6	11,000	16	2,000
7	2,000	17	4,000
8	3,000	18	8,000
9	75,000	19	7,000
10	20,000	20	7,000

* Sample taken after each ten gallons of milk run through filler.

DISCUSSION

DR. SHRADER: Was variation in number of bacteria due to cows or to laboratory methods?

MR. PALMER: Was the milk drawn in pails or by milking machines?

MR. YATES: The milk was drawn by hand.

DR. SHOULTS: Had the udders of the cows been examined?

MR. YATES: Yes, clinically.

MEMBER: Why were samples of milk taken from buckets rather than direct from the cows?

MR. YATES: This was done in some cases, but no special significance was noted. Some counts were highest in fore milk, some counts were highest in middle milk, some counts were highest in strippings. Seven cows were removed from the herd, with a definite reduction in the total bacterial count. Milk was cooled mechanically to 45° within from two to five minutes after it was drawn. The work was done on a certified farm.

"One meets with difficulties often in the road he takes to avoid them."

THE CARE OF MILKING MACHINES AT MARKET MILK DAIRIES

Dr. F. D. Holford, *Chief Veterinarian,*
Borden's Farm Products Co., Inc., New York City

The milking machine, we all realize, has gained a place in the dairy farmer's business as a labor saver. It, however, has created many problems which have to do with its care and cleaning. Many experiments have been made and much money expended in an effort to devise efficient and practical methods to enable a dairyman to produce clean and sanitary milk by the aid of these machines.

There are many types of machines on the market. The type selected generally depends upon the ideas of the individual who buys it, and also upon the persuasive powers of the salesman. To the sanitarians, the simplest type appeals; that is, the type which can most readily be cleaned and sterilized.

A common practice in treating milking machines is to flush the machine immediately after use with cold water, hot alkaline solution, and hot water, and then store it in a chemical solution, or in some other way. As a rule, the machine is entirely disassembled at least once or twice a week, and all parts brushed and sterilized. By following such a method, there is no doubt but that in most cases a low-count milk can be produced. This method is also recommended by some experiment stations, milking machine manufacturers, and agricultural colleges. However, we would not consider for a moment recommending that the equipment in a milk plant be cared for in such a manner, notwithstanding the fact that sanitary piping and similar equipment can be more easily treated by such methods than can the rubber tubings of a milking machine.

I have often wondered if there has not been too much stress placed upon the bacterial content of milk, after it has passed through the milking machine, without considering the physical condition of the machine itself. Nearly every milking machine has a head, but unfortunately it is not endowed with brains and these have to be furnished by the operator. Of course it is only natural that the supposition would be, if we obtained a low-count milk, that the methods employed in the care of the machine were of a sanitary nature. It is to be regretted that this is not always the case. We all know that it is possible to obtain low-count milk with considerable foreign matter in it.

During a recent survey I visited several dairies where milking machines were being used in the production of low-count milk. These dairymen were delivering their product to a market that was paying a premium on the bacterial content of the milk as delivered to the factory. At this factory samples of milk were taken from each dairyman twice a week, and the dairyman's premium depended upon the average bacterial content of the two samples. The inspector who took me around to some of these dairies assured me that he could point out some dairymen using milking machines who took proper care of them. His opinion was based on the fact that these dairymen hardly ever failed to secure the high premuim paid when the bacterial count of the milk was below 10,000 per c.c.

The barn, stable, milkhouse, etc., of the first dairy visited were clean and sanitary. The operator of this farm was an agricultural graduate and he informed us that he believed he had solved the problem of producing a low-count milk with the aid of the milking machine.

The following table gives a complete account of the product from this dairy, covering a period from January 7 up to and including October 2:

DAIRY No. 1

Date	A.M.	P.M.	Average
Jan. 7	3,200	2,000	2,600
Jan. 14	4,700	4,800	4,750
Jan. 21	3,100	3,300	3,200
Jan. 31	2,000	3,200	2,600
Feb. 7	6,600	3.000	4,800
Feb. 14	5,100	2,600	3,850
Feb. 21	2,400	2,700	2,550
Feb. 29	2,100	1,700	1,900
Mar. 7	3,500	13,700	8,600
Mar. 14	4,400	3,300	3,850
Mar. 21	2,200	2,600	2,400
Mar. 31	2,200	2,500	2,350
Apr. 7	1,100	500	800
Apr. 14	3,500	2,400	2,950
Apr. 21	3,500	2,900	3,200
Apr. 30	3,100	2,500	2,800
May 7	4,100	3,200	3,650
May 14	9,700	1,600	5,650
May 21	1,900	1,300	1,600
May 31	2,800	3,400	3,100
June 7	2,000	2,200	2,100
June 14	1,400	1,600	1,500
June 21	1,100	1,700	1,400
June 30	4,100	6,600	5,350
July 7	66,000	6,000	36,000
July 14	3,500	8,500	6,000
July 21	21,000	5,200	13,100
July 31	5,400	1,400	3,400
Aug. 7	14,700	5,100	9,900
Aug. 14	4,400	1,300	2,850
Aug. 21	4,700	3,500	4,100
Aug. 31	3,600	1,100	2,350
Sept. 7	7,000	1,100	4,050
Sept. 14	3,400	4,800	4,100
Sept. 21	4,200	1,300	2,750
Sept. 30	6,300	2,100	4,200
Oct. 2	1,800		

It will be noted there were 73 samples of milk taken, and 69 samples, or 94 per cent, gave a bacterial count of less than 10,000 per c.c. In fact, some of these samples were as low as 500 and 800 per c.c. There was only one sample out of the four samples above 10,000 which gave a count as high as 25,000. This count was 66,000.

We asked the owner of this dairy to give us in detail his methods of caring for the machine. He stated that it was his custom to force cold water through the machine immediately after use and then a hot alkaline solution. After this, hot water was passed through. The teat cups and rubber parts were then immersed in chloride of lime solution. He stated that he finally disassembled the machine about once every six weeks and thoroughly brushed out the rubber tubing. On the morning when we visited this farm, a sample of the milk taken to the factory gave a bacterial count of 1,800, and we were anxious to find out the condition of his milking machine when disassembled. After taking the long tubings from the teat cups, a cleaner tube was passed through the rubbers, and it was surprising to see the amount of foreign matter and decomposed milk removed by these tubes. Other parts of the machine were also found in a very dirty condition.

The next dairy visited was also using a milking machine and producing very low count milk. The bacterial counts of the milk from this dairy covered the same period as those recorded for Dairy No. 1—from January 7 to October 2, inclusive.

DAIRY NO. 2

Date	A.M.	P.M.	Average
Jan. 7	3,200	600	1,900
Jan. 14	6,300	300	3,300
Jan. 21	2,700	5,100	3,900
Jan. 31	5,000	2,800	3,900
Feb. 7	3,800	200	2,000
Feb. 14	400	3,500	1,950
Feb. 21	2,800	1,000	1,900
Feb. 29	1,000	800	900
Mar. 7	3,100	1,700	2,400
Mar. 14	3,300	2,000	2,650
Mar. 21	3,400	3,700	3,550
Mar. 31	2,900	3,900	3,400
Apr. 7	700	3,400	2,050
Apr. 14	5,700	2,600	4,150

DAIRY NO. 2—*Continued*

Date	A.M.	P.M.	Average
Apr. 21	1,700	1,000	1,350
Apr. 30	3,900	1,700	2,800
May 7	2,200	1,100	1,650
May 14	2,000	1,300	1,650
May 21	3,700	2,100	2,900
May 31	2,300	3,100	2,700
June 7	1,400	3,900	2,650
June 14	3,700	3,600	3,650
June 21	3,400	9,800	6,600
June 30	4,000	6,100	5,050
July 7	4,500	2,800	3,650
July 14	1,900	5,400	3,650
July 21	5,900	3,900	4,900
July 31	5,300	3,900	4,600
Aug. 7	9,100	10,000	9,550
Aug. 14	5,100	15,400	10,250
Aug. 21	2,200	1,800	2,000
Aug. 31	1,900	30,100	16,000
Sept. 7	4,700	1,300	3,000
Sept. 14	3,000	47,000	25,000
Sept. 21	2,700	1,800	2,250
Sept. 30	1,700	29,400	15,550
Oct. 2	2,500	7,000	4,500

There were 74 samples taken at this dairy, and 5 samples were above 10,000 bacteria per c.c.; in other words, approximately 93 per cent of the 74 samples taken were below 10,000 per c.c. One of these samples was as low as 200.

The sample taken on the morning we visited this farm gave a count of 2,500. Other utensils, stable, milk-house, etc., were found clean and in a sanitary condition. The milking machine was stored in a large earthen crock in the milkhouse. Not even the head of the machine was being removed from the rubber tubing which connects with the teat cups. In fact, the whole machine, with the exception of the pulsator, was immersed in the chloride of lime solution. The outside surfaces of the tubings, teat cups, and heads were in a very dirty condition; in fact, there was some fresh cow feces on the external part of one of the teat cups. We inquired of this dairyman his method of cleaning the machine. His procedure was approximately the same as that of the other dairyman, with the exception that his machine was entirely disassembled only once every six months.

When we attempted to remove the rubber tubings from the metal parts, there was no question in our minds as to the truthfulness of the owner as to the intervals at which the milking machine was taken apart. The inside of this machine was not found in as bad condition as the machine at the first dairy, with the exception of the rubber gaskets attached to the heads. These were in very bad shape.

The third dairy gave counts not nearly as good as the other dairies. However, the methods employed at this dairy were those recommended by some of the experiment stations and milking machine manufacturers. The bacterial counts of milk from this dairy also covered the same period—January 7 to October 2, inclusive.

DAIRY No. 3

Date	A.M.	P.M.	Average
Jan. 7	2,000	2,900	2,450
Jan. 14	5,800	3,600	4,700
Jan. 21	3,300	2,200	2,750
Jan. 31	1,000	2,700	1,850
Feb. 7	2,800	25,900	14,350
Feb. 14	2,000	700	1,350
Feb. 21	2,700	200	1,450
Feb. 29	1,600	3,900	2,750
Mar. 7	2,400	4,100	3,250
Mar. 14	4,200	1,600	2,900
Mar. 21	11,200	3,400	7,300
Mar. 31	32,200	36,000	34,100
Apr. 7	37,800	96,000	66,900
Apr. 14	54,000	186,000	120,000
Apr. 21	3,300	1,900	2,600
Apr. 30	7,000	3,000	5,000
May 7	2,200	6,300	4,250
May 14	2,000	1,900	1,950
May 21	2,500	42,000	22,250
May 31	3,600	1,600	2,600
June 7	800	13,300	7,050
June 14	2,500	5,700	4,100
June 21	2,700	12,600	7,650
June 30	648,000	5,300	326,650
July 7	42,000	7,400	24,700
July 14	4,100	5,100	4,600
July 21	4,400	8,200	6,300

DAIRY NO. 3—*Continued*

Date	A.M.	P.M.	Average
July 31	22,400	7,000	14,700
Aug. 7	4,200	7,200	5,700
Aug. 14	15,400	8,700	12,050
Aug. 21	6,300	11,200	8,750
Aug. 31	11,500	5,900	8,700
Sept. 7	4,300	400	2,350
Sept. 14	3,300	3,200	3,250
Sept. 21	4,300	2,500	3,400
Sept. 30	300	1,000	650
Oct. 2	1,000		

The milking machine at this dairy was entirely disassembled twice a week and the parts thoroughly washed and sterilized. Seventy-six per cent of the counts from this dairy were under 10,000 per c.c.

We visited several other dairies and in most instances found the milking machines far from satisfactory. However, we did find certain machines equipped with a small amount of rubber tubing. These were found clean and in satisfactory shape, and were equipped with the short rubbers which were being disassembled after each milking and thoroughly cleaned and sterilized. Our experience on the inspection trip convinced us that it was possible to produce a low-count milk from a milking machine that was, in a way, in a very unsanitary condition. We concluded that the decomposed milk in the milking machines was apparently sterile, although a certain amount of this could not help but get into the milk while the machines were being used.

It has also been found by experiment stations and factory operators that in many instances, where milking machines were only taken apart once or twice a week, invariably the count would run higher immediately after the machines were disassembled. No doubt this condition was brought about by stirring up the decomposed milk within the machine and not properly sterilizing it.

The rubber parts of milking machines tend to deteriorate very rapidly, and I believe these rubber parts should be changed in every milking machine frequently, for as soon as the rubber becomes checked it is practically impossible to properly clean it. In my opinion, the ideal way to care for a milking machine is to take it entirely apart after each milking and thoroughly wash and sterilize all parts which come directly in contact with the milk. This may not be practical with all makes of milking machines, but I do feel that it is entirely practical to entirely disassemble the machine at least once a day. This should be done after the morning's milking, when sufficient time can be allowed for the care of the machine. After the night's milking the machine may be flushed out with cold water, hot alkaline solution, and hot water, and immediately stored in a way to protect it from contamination. Although this practice may not be ideal, it would be far ahead of the average practices of today.

Our experience has taught us that it is very difficult for the average dairyman to keep his chemical solution at proper strength to be effective at all times. In fact, we have taken samples of solutions at different dairies and found the bacterial content of these solutions ranging anywhere from 0 to 2,000 bacteria per c.c.

A very practical and satisfactory method for the care and cleansing of milking machine parts is to place them in a covered copper boiler, or in some other properly protected receptacle with a rack in the bottom, having sufficient water therein so that all parts are completely covered. The water in this boiler should then be heated to a temperature of at least 185° F. The parts should remain in this water until next milking. We have found that a machine handled in this way can be kept clean and can also be used in the production of low-count milk.

While there are many other methods which can be satisfactorily employed in caring for milking machine parts after they have been sterilized, we cannot emphasize too strongly the importance of disassembling the machines at least once a day, or still better, after each use.

Another feature closely associated with the use of milking machines, and one which I believe is being overlooked in far too many cases, is the health and cleanliness of the cows' udders before the machine is attached for milking. Considerable contamination no doubt would be eliminated if greater use were made of the strip cups at dairies where milking machines are operated. By the use of the strip cup signs of garget can be observed. There are many cases recorded where infectious mastitis has been carried from one cow to another by milking machine teat cups.

There is no doubt that the milking machine is here to stay, but I believe that it is time for careful consideration of its uses and abuses by those who act in the capacity of milk sanitarians, if the public is to be supplied with clean, safe milk.

Discussion

Mr. Irwin: I have heard of one man who discontinued a practice of treatment of his milking machine because it removed a lot of stuff that would otherwise have remained in the machine.

Dr. Harding: In one instance high bacteria counts from machine-drawn milk occurred regularly on Tuesdays, the day on which milking machines were "cleaned" —an interesting sidelight on bacterial counts which I have from time to time brought to your attention.

Dr. Holford: Should we not take into consideration and pay more attention to physical conditions of milk equipment in paying premiums for milk of low bacteria count?

"Never despair; but if you do, work on in despair."

REPORT OF COMMITTEE ON MILK PLANT PRACTICE

DR. H. A. HARDING, *Chairman*

There has come to be a fairly general agreement that the quality of a milk supply can be judged by its richness, safety, cleanliness, and sweetness or keeping quality. Accordingly, it may be helpful to consider the changing elements in milk plant practice which bear upon each of these qualities.

RICHNESS

The richness of the milk supply depends fundamentally upon the breed of cattle supplying it. The relative proportion of cattle of the different breeds varies in different parts of the country, with the result that north of the latitude of the Ohio River the raw milk supply tends to average about 3.5 per cent of fat, while along the Atlantic Coast and in the South and Southwest the average fat content rises. In portions of Texas and some of the other Southern States milk supplies carrying 5 per cent of fat are common.

In practically every community market conditions have resulted in local milk supplies of two distinctly different fat contents, usually differing by one-half to one per cent of fat.

The maintenance of two milk supplies of differing richness necessitates special plant practices.

Blending:

There is a common use of large storage tanks for cold milk, and by the use of such tanks it is practicable to blend milk from a number of dairies and thus obtain a more uniform supply. So far as we can learn, no objection has been raised to this practice, which is widespread.

Standardization:

Evidently blending is not an entirely satisfactory answer for the need of definite composition of milk supplies, and standardization by the adding of cream or skimmed milk is necessary to bring the milk to the desired composition. While not universal, the practice of standardization is very widespread. This situation exists notwithstanding the fact that in some instances laws have been worded with the purpose of making such practices illegal and in many other instances the phraseology is such as to seem to forbid such practices.

Standardization evidently possesses merit or it would not be so widely used by so many reputable firms. At the same time there are undoubtedly abuses connected at times with the practice. This question is worthy of careful consideration and recommendation.

A practice which is gaining ground slowly is that requiring a statement on the bottle cap of the fat content of the milk, together with the proviso that the milk in the bottle must conform fully to the statement upon the cap. It would seem that such a requirement would protect the consumer and the industry against most of the misuses of standardization.

Importance of Cream Layer in Milk:

The depth of the cream layer in the milk bottle is used by the consumer in judging the richness of the milk. It enables the detection of surprisingly small variations in richness. Accordingly, the accuracy of this generally used test should be protected.

Plant Practices Decreasing the Cream Showing:

The creaming ability of milk may be reduced by plant practices, and such milk has its richness underestimated by the consumer. These practices are pasteurizing at or above 145° F., agitating cold milk, and developing the cream layer in warm milk.

The damage to the creaming power of the milk increases with the temperature of pasteurization, the loss at 145° F. being about 10 per cent of the volume of cream which would develop after pasteurization at 142° F. Pasteurization at 148° F. results in a loss of approximately 40 per cent of the cream which would have appeared at 142° F.

The damage from agitation is proportional to the violence and duration of the agitation of cold milk. This occurs most commonly when a storage tank is between the cooler and the bottler.

Loss in cream showing due to high temperature during the formation of the cream layer arises in part from occasional failure to cool the milk as much as practicable, but comes more commonly from putting cold milk into warm bottles. Unfortunately, the warmest milk in such bottles collects at the point where the cream layer will be formed. Attention to cooling of bottles, including the use of refrigerated water, is a growing custom in progressive milk plants. There is increased attention to low temperatures in the bottle storage rooms, but such low temperatures do not act upon the warm bottled milk with sufficient rapidity to prevent the decrease of the cream showing, since the cream layer is usually formed within an hour and a half after bottling.

Falsifying the Cream Showing:

Various practices have been suggested for artificially increasing the cream showing. So far as studied these have failed to accomplish this result except in the case of the homogenization of the cream, which is later returned to the skimmed milk and the mixture pasteurized and bottled. Under such treatment it is possible to extend the cream layer almost indefinitely.

Legal actions in Ohio and in Pennsylvania put a stop to such practices, and the International Association of Milk Dealers some years since denounced this practice in their Code of Ethics. However, the practice still continues in restricted regions in Canada and in the United States.

Safety

Any discussion of the safety of the milk supply would be incomplete without reference to the struggle against bovine tuberculosis which is going on in Canada and the United States.

There is also a growing appreciation of the importance of infectious abortion of cattle as a health problem.

The spread of septic sore throat through the infection of the udder of the cow by the causal organism has long been recognized. A similar spread of scarlet fever resulting from infection of the udder by the germ of this disease has been reported during the past year.

The recognition of these varied animal diseases, together with the ever-present menace of the bacillus carrier, makes it imperative to insist upon pasteurization and medical supervision of milk plant employees as the major protection to the safety of the milk supply.

Due to the improvement in valves, temperature-indicating instruments, and air-heating attachments, it is now practicable to insure the complete heating of all the milk to the required temperature for the required length of time. The responsibility rests upon the inspector and upon the plant operator to see that these facilities are properly utilized. There are still many plants where such is not the case.

Attention should be drawn to the cases where the milk filter is located between the pasteurizer and the cooler. Any infection from the hands of the operator tends to find its way into the milk in the case of such installation.

Hand capping of bottles improperly capped by the mechanical filler presents a problem. This will not be fully met until a form of installation is devised whereby it will be simpler to treat these bottles properly than to cap them by hand.

Medical examination of plant workers and laboratory tests of their bodily discharges are as yet only in their beginning stages. While we should be thankful for the progress which has been made, it should be recognized that present efforts are but pioneering in an important field.

A plant practice which is worthy of increased attention is that of the heat treatment of milk bottles. The evidence at hand suggests that neither chlorine nor alkali in the concentrations which are commonly used can be depended upon for rendering milk bottles safe. The studies at the Research Laboratories of the New York City Department of Health indicate that heating for some minutes at 150° F. will probably render milk bottles safe with regard to pathogenics, but some State departments of health are insisting upon a minimum temperature of 160° F. in bottle treatment in order to insure a desirable margin of safety. Increasing attention to the problem of safe bottles is desirable, and more exact data should be available as a basis for minimum requirements.

Plant practice with regard to the location and protection of milk regenerators and milk coolers should likewise receive increased consideration. When such apparatus is inclosed in small rooms the milk tends to get upon the walls and is removed with difficulty. In many cases the resulting odors have been offensive.

Where metal covers were provided in sections, these are often bent and broken in handling so that they fail to fully protect the milk. Evidently the development of apparatus for fully meeting this situation is a necessary step to the development of proper plant practices for the protection of the cooling milk.

Cleanliness

The attempts of the management to secure a cleaner supply of raw milk are hampered by the lack of proper standards by which the milk may be classified with regard to cleanliness. Your committee has been at work on this problem and can merely report progress. It seems probable that sediment pads are the best basis for such standards. Carbon seems the most promising substance with which to prepare such pads. Your committee has located a supply of carbon from which it hopes to insure material of constant density and size of particles. Methods have been elaborated by which it is practicable to prepare closely comparable sediment pads in different laboratories. It is hoped that more clear-cut results may be presented another year.

Much is being accomplished in stimulating the delivery of a cleaner milk supply, and the present supply in many cities averages well. What is needed is a plan by which the more dirty raw milk may be eliminated. It is believed that this undesirable grade of milk can be changed most readily under a financial stimulus, and it is believed that this plan of payment for milk can be developed when proper standards for measuring the cleanliness of the milk are at hand.

Clarifiers and filters:

After the milk reaches the plant, dependence for removing any dirt in it is placed upon the action of clarifiers or filters. Earlier the practice seemed to be toward an increasing use of milk filters. At present the tide seems to be turning slightly toward the increased use of clarifiers. With a satisfactorily clean raw milk supply, either will deliver a satisfactorily clean product. It is not desirable to depend upon mechanical devices to produce a clean product from dirty milk.

Mechanical cleanliness of apparatus:

Milk which is cooked or dried upon dairy machinery can be considered as dirt and has no place in the finished milk supply. The growing use of water, but slightly hotter than the milk, as a heating medium is rapidly doing away with the problem of milk stone. Proper attention to heating conditions, followed by proper attention to mechanical cleanliness, should be insisted upon in milk plants.

Covered bottle conveyors:

Protection of the washed bottles from falling objects and especially from flying glass has been insisted upon in some cases. This is accomplished by the installation of a roof over the bottle conveyors.

Foreign sediments in milk:

The extensive use of the bristle brushes in mechanical bottle washers is accompanied by the presence of occasional bristles in the bottled milk. The increased use of steam in the finishing treatment of milk apparatus results in inorganic residue from boiler scale and fragments of rubber finding their way into the milk. Rust from water pipes and steam lines sometimes leads to discoloration of apparatus and sediment in the milk. Where steel wool is used for cleaning, particles of this material may sometimes be left in the sterilized bottles. These items are undesirable minor accompaniments of progress in major matters. It may be necessary to endure them, in part at least, while the industry is finding means of eliminating them, but the inspector should stimulate efforts toward their elimination.

Sweetness or Keeping Quality

Encouragement should be given to the increased use of the methylene blue reductase test as a means of determining the keeping quality of the raw milk as delivered at the milk plants. The data at hand indicate that this is the most reliable available means of measuring this important element of quality in raw milk.

The industry should be encouraged in its efforts to develop a method of utilizing these measurements in modifying the wholesale price of milk, much as the results of the Babcock test are now used. Paying for milk on the basis of its real quality is an economically sound method of stimulating the production of better milk supplies.

Particularly during the warmer months, considerable growth of bacteria takes place upon the surface of the milk-handling apparatus after washing and before the beginning of the daily operations. If this growth is not removed before the milk is handled it will pass into the milk, with the result that the first milk through the apparatus is heavily seeded with bacteria which tend to to reduce the keeping quality of the product. Prompt souring of the milk first bottled has been repeatedly traced to failure to give the apparatus the customary preparatory treatment with steam, hot water, or chemicals. Inspectors should stress the importance of removing bacterial growth from the milk line immediately before beginning the handling of milk for the day.

The use of chlorine compounds for destroying bacterial life on plant apparatus is widespread, but the practice of determining the amount of available chlorine at the close of such treatment is unusual. The available chlorine is reduced by such use and may fall to the point where the bactericidal property is practically absent. Statements as to the proportion of available chlorine necessary to insure proper destruction of germ life vary between 30 and 100 parts per million. Titration of solutions as used in milk plants indicate that under present conditions solutions are frequently being relied upon when the amount of chlorine present in them is markedly below even the lower of these figures. The use of chlorine solutions of known strength is a necessary beginning to their rational application to milk plant practice.

Various modifications of milk plant practice have been suggested as the result of the discovery in pasteurized milk of large numbers of bacteria so resistant to heat that they grow readily at pasteurizing temperature.

Evidence at hand indicates the common if not universal presence of bacteria of this type in raw milk supplies of both ordinary and certified milk. There is also considerable evidence that these bacteria tend to accumulate in the milk regenerative systems and on the walls of the milk holders and, as they grow, seed up the passing milk. The result is an accumulation of these germs, particularly in the product toward the close of the pasteurizing period. Thus far, no practicable method of procedure has been found for preventing this development.

The repasteurization of dairy products is commonly forbidden by ordinance. On the other hand, plant experience has shown that it is unwise to retail pasteurized milk or cream returns or that which has been held at the plant until the second day. The value of this food material requires that it shall be handled in some way and safety requires that it be repasteurized in connection with this new use. A study of this problem with the object of finding an ordinance treatment which will harmonize with proper plant practices seems desirable.

The demonstration that the flavor of market milk is seriously impaired by the action of light and the suggestion that the changes which result in disagreeable flavors may be connected with the presence of metals in the milk should lead to added care in the protection of the milk from light during all the steps of processing and delivery.

This same observation should increase the interest in the study of the effects of different metals upon this action, particularly as the milk industry is now much interested in the relative merits of a variety of metals which can be used in the fabrication of milk-handling apparatus.

Discussion

Mr. Parker: In Jacksonville we have required a statement of fat content in milk. The public by preference bought milk with the highest percentage of fat. The plan also identifies standardized milk, and has driven standardized milk off the market. The bottle cap tells the story.

"More important than any piece of equipment is the organization back of that equipment."

ADDRESS

Dr. Herman N. Bundesen, *President,*
American Public Health Association, Chicago, Ill.

It is a real pleasure and privilege to me to address this organization, made up exclusively of dairy and milk inspectors and milk sanitarians, for, as you may know, the problem of pure milk is one in which I am intensely interested. I am particularly happy that your officers decided to hold this meeting just prior to that of the American Public Health Association, for it seems to me we have a community of interest and that we will be mutually benefited by the convenience of time and place in attending each others' sessions.

A group such as yours, whose entire efforts are concentrated on protecting the safety of milk supplies and in grading up and improving their quality, is performing a service second to none in safeguarding the public health.

I have always believed that a pure milk program should be a positive one; first, insuring the public safe, wholesome milk through agressive, firm, though cooperative enforcement of all the essentials to purity and safety; second, actively encouraging every one, grown-ups as well as children, to drink and use a quart a day of this health drink. The job is not well done with only efficient inspection. The public must be told about it and urged to use more milk to benefit their physical well-being. To be convincing leaders in this great campaign, we must "practice what we preach."

However, I have seen on numerous occasions groups leave sessions lauding the value of milk and dairy products, and sit down to a banquet at which not a single dairy-products enthusiast would ask for milk to drink, and the dessert would be some indigestible rich pastry instead of ice cream.

It is hardly necessary to point out that the increased use of milk and dairy products means better health and consequently greater prosperity for the public, greater responsibilities and compensation to those charged with the protection of these supplies. You will be interested in the statement mailed out with dividend checks to the stockholders of a certain large firm as illustrating this point. It reads:

"The Dairy Cow produces more than one-fourth the agricultural wealth of the United States. For 1926 her share amounted to over four and one-third billions of dollars.

"No longer does the dairy cow contribute merely pin money. She is the greatest single source of cash the composite American farmer has.

"She produces the best food known to mankind. Of every dollar spent for food by the average American almost twenty-five cents goes for the products of the dairy. Nutrition experts say it ought to be more, for both economy and good health.

"Through your ownership of stock in this company you are participating in the basic and essential dairy industry. You will advance your own interests by using dairy products freely in your diet."

Considering the first step in our positive milk and health program, just what are the essentials which must be enforced to insure a safe, wholesome supply? You can answer that probably better than I. In Chicago, we have considered the essentials to be:

1. All milk from healthy cattle free from tuberculosis.

2. Production and handling of milk under clean sanitary conditions.

3. Pasteurization in approved equipment of all milk except certified.

The pure milk campaign in Chicago has been a splendid victory for the cause of tuberculosis prevention. It has an intimate relation to a nation-wide program for the control of tuberculosis in live stock which is transmissible to man through milk.

As a result of this campaign, Chicago now has a milk supply which we believe is unsurpassed in quality, healthfulness, and purity by that of any other large city. Every day our citizens have available 1,500,000 quarts of milk obtained from healthy cows, produced under supervised sanitary conditions, and properly pasteurized in tested equipment.

To appreciate what has been accomplished we must recall that in 1919 Dr. Austin made a thorough survey of a group of children suffering with bone, gland, and joint tuberculosis and found that in 29 per cent of the cases the infecting organism was the tuberculosis germ of the bovine type, carried through milk from tubercular cows. Searching for the reason for this, special tests were made during 1924-1925 on the raw milk supply and it was found that of the raw samples from cows in an area where the cattle were known to be heavily infected with tuberculosis, seven per cent were heavily contaminated with tuberculosis germs. Three and one-half per cent of the raw milk samples from the entire Chicago milk-producing area was found to contain tuberculosis germs.

Scientists found in the Endicott tests, reported in Public Health Bulletin 147, that pasteurization, as carried out prior to 1925, was not a perfect barrier against these tuberculosis germs, so it was decided that the Department of Health would in a reasonable time require all milk to be obtained from healthy cattle free from tuberculosis. This was the beginning of a long, hard battle. Opponents attempted to prevent us from putting this requirement into effect by a court injunction. The City Council promptly passed an ordinance, doing so unanimously, and on April 1, 1926, the requirement went into effect that all milk must come from healthy cattle free from tuberculosis as certified by veterinarians testing under State and Federal supervision.

Over two years have passed since this ordinance went into effect. What are the results?

Rumors of "bootleg" milk have been checked up promptly and carefully and found to be untrue. The cooperation of the milk dealers has been practically one hundred per cent. Tuberculin test certificates are on file for all herds from which milk is shipped into Chicago.

An ample supply of milk from healthy cattle has been available in spite of dire predictions of a milk famine and resulting heavy loss of infant life.

The price of milk to the consumer has not increased as predicted, but remains at 14 cents per quart.

Surveys show that the consumption of milk has increased materially.

Farmers and dealers report that they are now securing more milk per cow from their healthy herds than before from diseased cattle and are fully convinced that the elimination of diseased cattle was necessary and beneficial to the dairy industry from a financial standpoint alone.

The improvement in Chicago's milk supply evidently contributed toward a marked reduction in deaths of infants under one year of age. The records show that there were actually 532 fewer baby deaths during the year following the enforcement of the tuberculin test than in the preceding year. This amounts to an 11.5 per cent decrease. Deaths from diarrhea and enteritis among children under two years of age were reduced 33.2 per cent during the same period, resulting in 274 fewer deaths from this cause.

After insuring that all of our milk comes from healthy cows and is produced and handled under reasonably sanitary conditions, we still cannot consider that we have a safe milk supply unless it is properly pasteurized. "Proper pasteurization" has been defined as that conducted under the "regular supervision of and in apparatus approved by a competent health authority."

There can be no question of the tremendous rôle pasteurization has played in the reduction of milk-borne diseases in the past. However, its beneficial effects have lulled us into regarding it as a perfect barrier to disease germs, whereas, in reality, many defects in pasteurization equipment, permitting the by-passing of raw or imperfectly pasteurized milk, have been detected and corrected by pasteurization plant owners and dairy equipment manufacturers.

In cooperation with the United States Public Health Service, an extensive survey was made to determine the efficiency of milk pasteurizing and other dairy equipment in the 500 establishments handling Chicago's milk supply. The survey revealed serious mechanical and thermal defects of some character in every one of the plants, resulting in quantities of milk reaching consumers which was not properly pasteurized. One hundred per cent of the pasteurizer holder outlets and 52 per cent of the holder inlets were found defective.

Ninety-one per cent of the coolers were of the open surface type, subjecting the pasteurized milk to dust and fly contamination. A definite program was promulgated and measures taken for the correction of these conditions, in order to assure Chicago's citizens a safe and wholesome product.

The United States Public Health Service, realizing the importance of proper pasteurization, located their pasteurization equipment testing station at Chicago, and have sought to develop new facts and improved administrative practice on pasteurization supervision for the information and guidance of milk inspectors and health officers.

The second part of our positive milk and health program is simply this:

Tell the public what you are doing to improve and protect the milk supply. Use bulletins, newspaper articles, and radio talks. Tell them without hesitancy to drink milk for better health; that it contains practically all the elements of a well-balanced diet: protein for brawn; sugar and fats for the body's fuel supply; mineral salts, such as lime, for the teeth and bones; and a rich amount of the important vitamin necessary for proper growth and nutrition; that milk is an all-purpose food ready for use without preparation of any sort. It is both a food and a beverage unexcelled. The supervision and service back of each bottle of milk, together with its wonderful food value, make it the most economical and healthful single food.

I sincerely trust you may leave these meetings and return to your most important tasks with renewed and increased determination to solve your problems and more completely improve and protect the milk supplies under your jurisdiction. I want to extend to you as President of the American Public Health Association a most cordial invitation to attend our sessions next week and enjoy any of the many regular or special inspection trips scheduled in the program.

"The man who grasps principles can successfully select his own methods. The man who tries methods, ignoring principles, is sure to have trouble."

A NATIONAL COOPERATIVE CAMPAIGN FOR CLEAN AND SAFE MILK

S. J. Crumbine, M. D., *General Executive,*
American Child Health Association, and
Charles F. Chrisman, New York City

The American Child Health Association is primarily interested in the promotion of the health of the children of America. Among the many means for the promotion of positive health of children, one of the most important is that of diet, adequate both as to quantity and quality.

No diet can be considered adequate for the growing child which does not provide a sufficient quantity of safe, wholesome milk, for milk is universally conceded to more nearly qualify as an adequate food than any other single article of diet. Therefore the American Child Health Association is committed to the policy of advancing the cause of safe milk, clean milk, and more milk for the children of every community in this country.

This program logically divides itself into two distinct, separate, although related, projects: First, securing effective milk control—that is, the production and distribution of clean and safe milk; second, the promotion of the increased per capita consumption of milk once there is reasonable assurance of its safety.

We have long known that milk may become the medium by which serious diseases are distributed, but only of recent years have we had a proper appreciation of the potential danger of disease distribution in uncontrolled and ineffectively supervised milk supplies. One cannot contemplate with fortitude the hundreds of recorded epidemics of serious communicable diseases that have been definitely established as milk-borne and the unknown other hundreds that have not been recorded in the epidemiological history of these diseases. That greatest of typhoid fever epidemics of modern times, occurring in Montreal in 1927, involving 5,002 cases* and 533 deaths*; and that serious septic-sore-throat epidemic of Lee, Massachusetts, occurring this present year, in which there were about 1,000 cases and 45 deaths, are sad but challenging conditions to which milk producers and distributors as well as health agencies will have to give their best thought and efforts if the great consuming public will have the confidence to believe that the increased consumption of milk carries with it no increased hazard to safety.

That these considerations are abundantly supported by trustworthy data has been repeatedly shown, yet tragedies of milk-borne disease recur with ghastly frequency and the deaths from diarrheal diseases of bottle-fed babies, due in the main to contaminated milk, continue to be an important factor in our annual mortality. One of the most striking phenomena in public health administration is the immediate reduction of cases and fatalities from diarrhea and enteritis of infants when a city's milk supply is effectively pasteurized. When we consider that approximately fifty per cent of our population are still dependent on milk supplies which have no continuous or effective supervision or control, we should not be surprised at the inevitable results which follow such neglect.

That effective milk control does greatly reduce that factor of infant mortality due to diarrhea and enteritis is shown by the experience of a number of American cities, such as New York, Detroit, and Cincinnati.

The striking reduction in the deaths of children under two years of age from diarrhea and enteritis since 1910

* From February to August, 1927; U. S. P. H. S. Report.

in the United States Death Registration Area is undoubtedly due in large measure to the increasing amount of pasteurized milk available for infant feeding. This decline, at five-year intervals, is given below:

AVERAGE DEATH RATES FROM DIARRHEA AND ENTERITIS (UNDER 2 YEARS) FOR 5-YEAR PERIODS FROM 1906-1925. U. S. DEATH REGISTRATION AREA

Years	Death Rates from Diarrhea and Enteritis (under 2 years) per 100,000 Population U. S. Death Registration Area
1906—1910	96.2*
1911—1915	69.8
1916—1920	55.4
1921—1925	33.2

* Average figure from Mortality Reports. For other years average was calculated from rates for individual years.

Rates from Mortality Statistics, U. S. Bureau of the Census, 1906-1925.

While other factors, such as improved sanitation, increased knowledge of personal hygiene through general public health education, and, more specifically, through the teaching of the public health nurse, have affected this decline, they are probably subordinate in importance to the increasing practice of pasteurization which has been taking place since 1910.

The Medical Officer of Health of Toronto makes the following statement in his report for September, 1927:

> "One of the most striking decreases in the past fourteen years is the number of infant deaths from gastro-intestinal diseases. In 1913, 27 per cent of all deaths under one year of age was due to this cause. In 1926, this figure was reduced to 9 per cent.
>
> "Chlorination of the city water, which was begun in March, 1910; the introduction of compulsory pasteurization of all milk on June 1, 1914; accompanied by the ever-widening instruction of mothers as to the dietary requirement of their children, marked the turning point."

That much yet remains to be done in minimizing the hazards in relation to milk-borne epidemic disease is emphasized by the record of milk-borne diseases for the past four years.

MILK-BORNE EPIDEMICS—1924-1927

REPORTED BY STATE AND PROVINCIAL HEALTH AUTHORITIES

Disease	Number of Epidemics				
	Total 1924-1927	1924	1925	1926	1927
Total—All milk-borne diseases	194	43	44	69	29
Diphtheria	9	2	2	3	2
Scarlet Fever	20	6	6	4	4
Septic Sore Throat	10	1	5	4	—
Typhoid Fever	143	33	30	54	26
Malta Fever	3	—	—	—	3
All others	9	1	1	4	3

In addition to the danger to which milk is subjected by contamination from human sources in the course of its production, distribution, and sale, there is another potential danger—the dairy cow, considerable numbers of which suffer from tuberculosis.

In an address at the Cleveland Academy of Medicine, in 1925, the late Dr. E. C. Schroeder, Superintendent of the Experiment Station, Bureau of Animal Industry of the United States Department of Agriculture, gave some suggestive data as to the widespread prevalence of tuberculosis among domestic animals. He said:

> "Among the cattle killed for meat under Government inspection during the last ten years, 391,255 were found to be so extensively affected with tuberculosis that it was necessary to condemn them as wholly and entirely unfit for use as food. During the same decade, 731,857 entire hog carcasses were condemned for the same reason. But this does not tell the whole story, as may be judged from the meat inspection records for 1924, during which, in addition to 56,760 entire cattle and 100,110 entire hogs, 73,794 parts of cattle and 1,099,253 parts of hogs were condemned for tuberculosis.
>
> "The federal meat inspection regulations do not require the condemnation of the entire carcass of every animal that shows tuberculosis lesions on

post-mortem inspection. It would be a serious matter if they did, as it would have necessitated the total condemnation of 3.1 per cent of all cattle and 15.2 per cent of all hogs killed for food under Government inspection last year. * * *

"It is well to recognize that these condemnations are current events, which repeat themselves over and over again and contribute nothing to the reduction or suppression of tuberculosis among our farm animals."

He concludes with the following summary:

"1. The known types of the tubercle bacillus are closely related but stable, distinct microparasites.

"2. The bovine tubercle bacillus is the one and only cause of tuberculosis among cattle and requires cattle to secure its perpetuation, and, therefore, bovine tuberculosis can be eradicated by suppressing its occurrence among cattle.

"3. The frequency with which human beings are attacked by bovine tubercle bacilli, especially children, is too great to permit us to characterize them as a negligible cause of disease among human beings.

"4. The amount of destruction for which bovine tubercle bacilli are responsible among domestic animals, the higher virulence they have for all species of animals with which comparative tests of the different types of the tubercle bacillus have been made, and the certainty that bovine tuberculosis among all animals will greatly increase in the course of time unless we fight it, fully justify the expenditures we are now incurring to eradicate this serious menace to public health and public welfare, this food-destroying evil."

After extended and painstaking research, Park and Krumwiede* state that of cases of children under five years suffering from tuberculosis, 21 per cent were of

* The Relative Importance of the Bovine and Human Types of Tubercle Bacilli in the Different Forms of Tuberculosis. William H. Park and Charles Krumwiede, Jr., Journal of Medical Research (Boston) 27:111. Sept. 1912.

the bovine type of infection; that of cases of tuberculosis among children between the ages of five and sixteen years, 26 per cent were of the bovine type; while the percentage of cases of this type in adults over 16 years of age was only 1.6.

From this review of the situation, it would seem that a clean and safe milk campaign that would reveal the actual condition of milk control throughout the United States would be fully justified. Accordingly, and following the policy of the Association of working through and with the official agencies, the American Child Health Association presented a cooperative plan to the Association of American Dairy, Food, and Drug Officials and to the Conference of State and Provincial Health Authorities for conducting a country-wide Clean and Safe Milk Campaign. The following resolutions were unanimously adopted:

> "WHEREAS, the Association of American Dairy, Food, and Drug Officials recognize the importance of milk and milk products in the national diet, especially as a food for infants and children; and
>
> "WHEREAS, we recognize the necessity for great care in the production and distribution of milk and milk products to the end that they may be safe and wholesome;
>
> "THEREFORE, BE IT RESOLVED: That this Association join with the Conference of State and Provincial Health Authorities and the American Child Health Association in a nation-wide movement to secure for every baby, child, and adult in America, a Clean and Safe Milk Supply."

Accordingly, in October, 1923, a cooperation program for a clean and safe milk survey was launched in North Dakota, in which the State Dairy and Food Commission, the State Department of Health, and the American Child Health Association participated. The American Child Health Association provided a field laboratory in charge of a representative of the Association, the State agencies furnishing a field inspection force and technical laboratory workers. Such communities were selected in the State as were mutually agreed upon by the respective State agencies, due consideration being given to those communities showing a high infant mortality rate from diarrhea and enteritis, and the smaller group of cities that had not as yet established adequate milk control or in which there was reason to suspect lack of or inefficient enforcement of milk control ordinances.

A similar procedure was followed in all the States in which the survey has been made since that time, including 23 States and one Province in Canada. Geographically, these States are widely distributed throughout the United States, 11 being east of the Mississippi River and 13, including the Canadian Province, west of the Mississippi River. Every major geographical section of the United States is represented by three or more States; thus the results of the survey may fairly represent the actual conditions as found in the respective groups of States of similar population throughout the United States. The following tabulation will disclose the volume and extent of the survey.

CLEAN AND SAFE MILK SURVEY

GENERAL DATA, 1923-1928

1. States visited (including one Canadian Province) 23

2. Cities Surveyed (Pop. 100 to 750,000) 483

DISTRIBUTION OF CITIES SURVEYED ACCORDING TO POPULATION

City Population Groups	No. of States	Cities Surveyed Number	Cities Surveyed Per Cent
Under— 2,500	16	211	44
2,500— 4,999	19	89	18
5,000— 9,999	19	71	15
10,000—24,999	19	68	14
25,000—49,000	18	32	7
50,000—99,000	5	6	1
100,000 and over	4	6	1
Total	23	483	

3. Total Population of Cities Surveyed	4,844,469
4. Counties in which cities are located	321
5. Samples collected	7,613
6. Dairies and Pasteurizing Plants from which samples were examined (4,069 Raw Milk Dairies and 427 Pasteurizing Plants	4,496

7. Laboratory Examinations made:

Official Plate Counts	7,241
B. Coli Counts	6,663
Sediment Tests	7,348
Butter-fat Tests	6,964
Solids Not Fat Tests	5,768
Total	33,984

With but one or two exceptions three types of examination were made of all milk supplies. First: a visible dirt test; second: a bacterial count, including in most instances B. Coli determination; third: chemical examination for the detection of adulteration, either by added water or skimming. The standard methods of the American Public Health Association were uniformly used. Only original samples of bottled milk were secured for examination.

The factor of atmospheric temperatures in total bacteria count has been equalized in some measure, at least, by conducting the surveys in the northern States during the summer months and in the southern States during the winter months.

As might be expected, obstacles in the work of the survey were encountered in a few places due to lack of understanding of the purpose of the survey, to economic considerations, to resentment for supposed interference with long-continued custom and habit growing out of the lack of milk supervision and control, and for political considerations; the latter being perhaps the most difficult to overcome for reasons that must be self-evident to those familiar with milk work. On the other hand, it must be recorded that most enthusiastic and sympathetic cooperation was afforded by the State agencies involved in the survey and as a rule the local departments of health, and in many instances—indeed, I think I would say the majority of instances—by the dairymen and dairy associations. Nor is it difficult to explain the increasing spirit of cooperation shown by the producers and distributors of milk, for those who have built up a successful business realize in an increasing measure that improved quality of their milk supplies means increased consumption and greater profits.

All samples of milk collected were official samples collected by State or local inspectors. These were collected from delivery vehicles and immediately placed in crushed ice.

A tabulation of the results of the official plate counts of samples secured in 479 cities in 22 States is shown in Table Number 1. For the purpose of special study the cities were divided into population groups, as follows: First, those under 2,500; second, 2,500 to 5,000; third, 5,000 to 10,000; fourth, 10,000 to 25,000; fifth, 25,000 to 50,000; sixth, 50,000 to 100,000; seventh, 100,000 to 800,000. The results in Table 1 are expressed in terms of percentages of all samples, including arw and pasteurized milk secured in each of the respective groups of cities.

It would seem that the bacterial count in the smaller cities shows up about as well as the bacterial count of the milk in the larger cities, and as a rule the small group of cities were without milk control. This showing is undoubtedly due to the early delivery to consumers by milk producers in the smaller cities, where the milk often reaches the consumer within a few hours after it is produced. That the cities in group seven are receiving a good return on their public health investment is clearly shown despite the fact that milk produced for this larger group of cities is many more hours old before delivery than in the less populous cities.

Table 1-A is a comparison of the bacterial count of raw

TABLE 1

OFFICIAL PLATE COUNTS
OF MILK SUPPLIES OF CITIES BY POPULATION GROUPS

RAW AND PASTEURIZED SAMPLES COMBINED

Population Groups	Percentage of Samples: Under 10,000	10,000 to 49,999	50,000 to 99,999	100,000 to 199,999	200,000 to 499,999	500,000 and over	Number of Samples	Cities in Each Group: No.	Per Cent	States: Number Affected
Under 2,500	10	33	18	11	12	16	1,104	211	44	15
2,500— 4,999	11	36	12	12	13	16	952	89	19	19
5,000— 9,999	10	33	16	15	12	14	1,228	66	14	19
10,000— 24,999	10	33	16	14	13	14	1,943	69	14	19
25,000— 49,999	9	33	17	11	16	14	1,459	32	7	18
50,000— 99,999	10	26	14	22	15	13	356	6	1	5
100,000—800,000	21	27	15	13	16	8	199	6	1	4
Average All Cities	11	32	15	14	14	14	—	—	—	—
Group Totals	—	—	—	—	—	—	7,241	479	—	22

TABLE 1-A

OFFICIAL PLATE COUNTS
OF MILK SUPPLIES OF CITIES BY POPULATION GROUPS

RAW AND PASTEURIZED SAMPLES COMPARED

Population Groups	Percentage of Samples												Number of Samples	
	Under 10,000		10,000 to 49,000		50,000 to 99,000		100,000 to 199,000		200,000 to 499,000		500,000 and over			
	Raw	Past.	R	P	R	P	R	P	R	P	R	P	R	P
Under 2,500	9	16	33	22	19	9	11	22	12	19	16	12	1,072	32
2,500— 4,999	10	18	36	39	12	13	12	4	13	14	17	12	897	55
5,000— 9,999	10	11	33	28	15	16	14	16	12	19	16	10	1,153	75
10,000— 24,999	10	9	32	38	16	16	14	12	14	10	14	15	1,718	225
25,000— 49,999	8	8	34	29	16	18	12	11	15	19	15	15	1,212	247
50,000— 99,999	10	7	22	44	14	13	24	14	14	16	16	6	271	85
100,000—800,000	24	19	16	33	18	12	15	12	19	15	8	9	73	126
Average All Cities	11	13	29	33	16	14	15	13	14	16	15	11	—	—
Group Totals	—	—	—	—	—	—	—	—	—	—	—	—	6,396	845

and pasteurized milk by population groups of cities, expressed in percentage of samples examined.

The examination showed a lower count for the pasteurized milk in practically all the various city groups, yet an inspection of pasteurization plants as well as the bacterial count of a considerable portion of the pasteurized milk will show lack of effective milk control and defective pasteurization apparatus, and oftentimes improper operation. Moreover, the fact that 15 per cent of the raw samples and 11 per cent of the pasteurized samples of milk had a bacterial count of over 500,000 is a record of which neither the raw nor the pasteurized milk producers and distributors can be proud.

Table Number 2 is a tabulation by population groups of B. Coli Determinations, raw and pasteurized samples combined. Here again the age of the milk is an important contributing factor which the larger cities, with the exception of group 6, have not met successfully.

TABLE 2

B. Coli Determinations
of Milk Supplies of Cities by Population Groups

Raw and Pasteurized Samples Combined

Population Groups	Percentage of Samples		Number of Samples	Cities		States (Number represented)
	Negative	Positive		No.	Per Cent	
Under 2,500	67	33	1,096	205	46	13
2,500— 4,999	65	35	851	82	18	14
5,000— 9,999	61	39	1,043	60	14	14
10,000— 24,999	60	40	1,813	64	14	14
25,000— 49,999	54	46	1,277	26	6	14
50,000— 99,999	71	29	384	6	1	5
100,000—800,000	55	45	199	6	1	4
Average All Cities	62	38	—	—	—	—
Group Totals	—	—	6,663	449	—	18

Table Number 2-A is a tabulation by population groups of B. Coli Determinations of milk supplies of cities with the raw and pasteurized samples compared.

In this table pasteurized milk shows the better, although the cities between 5,000 and 50,000 have a special responsibility in checking up the quality of the milk pasteurized and the efficiency of the pasteurizing plant as registered in the effectiveness of the pasteurizing process.

TABLE 2-A

B. COLI DETERMINATIONS
OF MILK SUPPLIES OF CITIES BY POPULATION GROUPS

RAW AND PASTEURIZED SAMPLES COMPARED

Population Groups	Percentage of Samples				Number of Samples		Cities		States (Number represented)
	Negative		Positive						
	Raw	Past.	Raw	Past.	Raw	Past.	No.	Per Cent	
Under 2,500	66	79	34	21	1,012	84	205	46	13
2,500— 4,999	64	81	36	19	797	54	82	18	14
5,000— 9,999	62	56	38	44	965	78	60	14	14
10,000— 24,999	60	61	40	39	1,611	202	64	14	14
25,000— 49,999	52	60	48	40	1,035	242	26	6	14
50,000— 99,999	72	69	28	31	298	86	6	1	5
100,000—800,000	40	63	60	37	72	127	6	1	4
Average All Cities	59	67	41	33	—	—	—	—	—
Group Totals	—	—	—	—	5,790	873	449	—	—

Table Number 2-D is a study of B. Coli samples having a specific number of colonies, raw and pasteurized

TABLE 2-D

POSITIVE B. COLI SAMPLES HAVING SPECIFIED NUMBER OF COLONIES
OF MILK SUPPLIES OF CITIES BY POPULATION GROUPS

RAW AND PASTEURIZED SAMPLES COMBINED

Population Groups	Percentages of Samples Showing B. Coli Counts of					Number of Samples in Each Group
	One to 500	501 to 1,000	1,001 to 5,000	5,001 to 10,000	10,001 and over	
Under 2,500	44	18	18	6	14	62
2,500— 4,999	47	12	19	11	11	90
5,000— 9,999	39	15	26	9	11	227
10,000— 24,999	30	14	26	10	20	425
25,000— 49,999	29	15	22	12	22	304
50,000— 99,999	35	17	23	8	17	34
100,000—800,000	35	18	29	4	14	45
Average All Cities	37	16	23	8	16	—
Group Totals	—	—	—	—	—	1,187

samples combined, expressed in percentages of samples showing B. Coli counts. Here the age of the milk of the small cities seems to be an important factor, the larger cities having generally better milk control than the middle group of cities, the latter group having higher counts.

Table Number 2-E is a similar study to Table 2-D, but with raw and pasteurized milk samples compared. This table does not show the position of pasteurized milk to advantage. It but emphasizes the imperative need of the closest supervision of all pasteurizing apparatus and operation of plants.

Table Number 3 gives the results of sediment tests expressed in percentage of samples examined. This table shows that only 36 per cent of the total samples can be graded clean or fairly clean, the remainder, or 64 per cent, being graded 34 per cent slightly dirty, 20 per cent dirty, and 10 per cent very dirty. Surely here is a great work for dairymen and dairy inspectors. Dirty milk is always doubtful milk, is impaired in flavor and keeping qualities and therefore economically wasteful, and from the standpoint of public health must be considered potentially dangerous.

TABLE 3

SEDIMENT TESTS OF
MILK SUPPLIES OF CITIES, BY POPULATION GROUPS
RAW AND PASTEURIZED SAMPLES COMBINED

Population Groups	Percentage of Samples					Number of Samples
	Clean	Fairly Clean	Slightly Dirty	Dirty	Very Dirty	
Under 2,500	8	20	36	21	15	1,122
2,500— 4,999	7	24	35	23	11	929
5,000— 9,999	12	24	34	18	12	1,229
10,000— 24,999	10	23	33	21	13	2,018
25,000— 49,999	8	22	36	23	11	1,436
50,000— 99,999	12	34	29	18	7	416
100,000—800,000	14	35	34	13	4	198
Average All Cities	10	26	34	20	10	——
Group Totals	—	—	—	—	—	7,348

TABLE 2-E

POSITIVE B. COLI SAMPLES HAVING SPECIFIED NUMBER OF COLONIES OF MILK SUPPLIES OF CITIES BY POPULATION GROUPS

RAW AND PASTEURIZED SAMPLES COMPARED

Population Groups	Percentages of Samples Showing B. Coli Counts of										Number of Samples in each group	
	One to 500		501 to 1,000		1,001 to 5,000		5,001 to 10,000		10,001 and over			
	Raw	Past.	R	P	R	P	R	P	R	P	Raw	Past.
Under— 2,500	43	50	19	0	18	0	7	0	13	50	60	2
2,500— 4,999	48	20	12	20	20	0	9	40	11	20	85	5
5,000— 9,999	38	54	15	31	27	7	8	8	12	0	214	13
10,000— 24,999	32	33	13	17	26	23	9	12	20	15	373	52
25,000— 49,999	27	67	15	19	22	7	13	0	23	7	289	15
50,000— 99,999	32	43	27	0	18	33	9	8	14	16	22	12
100,000—800,000	62	21	13	21	19	34	6	3	0	21	16	29
Average All Cities	40	41	16	16	22	15	9	10	13	18	—	—
Group Totals	—	—	—	—	—	—	—	—	—	—	1,059	128

Table Number 3-A is a classification of sediment tests of milk supplies by population groups, with raw and pasteurized samples compared. Here again it is a bad showing for both raw and pasteurized milk.

TABLE 3-A

SEDIMENT TEST CLASSIFICATIONS
OF MILK SUPPLIES OF CITIES BY POPULATION GROUPS

RAW AND PASTEURIZED SAMPLES COMPARED

Population Groups	Percentage of Samples										Number of Samples	
	Clean		Fairly Clean		Slightly Dirty		Dirty		Very Dirty			
	Raw	Past.	R	P	R	P	R	P	R	P	R	P
Under 2,500	8	0	19	34	37	25	22	19	14	22	1,090	32
2,500— 4,999	7	7	24	31	35	44	23	14	11	4	872	57
5,000— 9,999	13	13	23	27	34	37	18	15	12	8	1,150	79
10,000— 24,999	10	14	23	26	33	29	21	18	13	13	1,793	225
25,000— 49,999	8	8	22	23	36	34	23	24	11	11	1,177	259
50,000— 99,999	11	17	33	37	31	21	18	18	7	7	327	89
100,000—800,000	13	15	35	36	43	29	8	15	1	5	72	126
Average All Cities	10	10	25	31	36	31	19	18	10	10	—	—
Group Totals	—	—	—	—	—	—	—	—	—	—	6,483	867

Table Number 4 is a study of milk solids determinations of milk supplies by population groups. It will be noted that 14 per cent of these samples show butter-fat content below 3.5, and 12 per cent of the samples show a percentage of solids not fat below the standard of 8.5. There is no doubt but that added water was an important factor in this comparatively large per cent of samples in which the milk solids were below the standard.

We believe it would not be unfair to say that those who deliberately add water to milk to increase output and profits are possessed of a conscience that would not trouble them as to the quality or purity of the water added, or the loss of food values to the children of the community.

Table Number 5 is a display of information collected concerning tuberculin testing. From this it can be seen that 23 per cent of the herds from which raw milk

TABLE 4

MILK SOLIDS DETERMINATIONS
OF MILK SUPPLIES OF CITIES BY POPULATION GROUPS

Population Groups	Fat: Average Content	Fat: Percentage of Samples Below 3.5	Solids Not Fat: Average Content	Solids Not Fat: Percentage of Samples Below 8.5	Number of Samples: Fat	Number of Samples: S.N.F.
Under 2,500	4.2	10	8.96	5	911	820
2,500— 4,999	4.2	12	8.91	12	845	758
5,000— 9,999	4.0	13	8.87	16	1,169	1,071
10,000— 24,999	3.8	14	8.60	15	2,044	1,194
25,000— 49,999	4.1	11	8.85	13	1,467	1,256
50,000— 99,999	3.9	13	8.95	9	415	375
100,000—800,000	3.8	24	8.80	11	199	102
Average All Cities	4.0	14	8.85	12	——	——
Group Totals	—	—	—	—	7,050	5,576

was being sold were untested for tuberculosis. Here is a tremendously important piece of work for boards of health and dairy inspectors and the dairy divisions of departments of agriculture.

TABLE 5

TUBERCULIN TESTING
PRACTICE AMONG DEALERS OF RAW AND PASTEURIZED MILK COMPARED
IN CITIES BY POPULATION GROUPS

Population Groups	Percentage of Raw Milk Dealers Selling Milk from: Tested Herds	Untested Herds	Total No. of Raw Milk Dealers	Percentage of Pasteurized Milk Dealers Selling Milk from: Tested Herds	Untested Herds	Total No. of Pasteurized Milk Dealers
Under 2,500	60	40	585	81	19	13
2,500— 4,999	63	37	432	65	35	17
5,000— 9,999	73	27	661	45	55	38
10,000— 24,999	70	30	969	60	40	56
25,000— 49,999	76	24	556	78	22	82
50,000— 99,999	100	0	196	78	22	40
100,000—800,000	98	2	43	55	45	74
Average All Cities	77	23	——	66	34	—
Group Totals	—	—	3,442	—	—	320

Table Number 6 disclosed the per capita consumption of whole milk by population groups in 16 States and one Canadian Province. In this table is displayed a tremendous market for increased milk consumption, for in these States the study of the towns surveyed disclosed a milk consumption far below that considered a minimum necessary for the robust development and health of the growing child and for the optimum diet of the adult. When it has been shown in these communities that improved quality of milk will mean increased consumption, then will there be hope for a material increase in the production and distribution of this important food.

TABLE 6

DAILY PER CAPITA CONSUMPTION OF WHOLE MILK OF CITIES BY POPULATION GROUPS

16 STATES AND 1 CANADIAN PROVINCE

Population Group	Percentage of Cities Having Specified Daily Per Capita Consumption in Pints							Number of Cities in Each Group
	Under .25	.25-.49	.50-.62	.63-.74	.75-.99	1.00 and over	0.5 and over	
Under 2,500	23	36	15	6	9	11	41	81
2,500— 4,999	15	35	32	9	9	0	50	46
5,000— 9,999	5	26	31	21	10	7	69	42
10,000— 24,999	7	31	31	14	14	3	62	35
25,000— 49,999	9	24	29	29	9	0	67	21
50,000— 99,999	0	25	25	50	0	0	75	4
100,000—800,000	0	0	0	0	100	0	100	1
Average All Cities	14	32	25	12	12	5	66	230

Table Number 7 shows the extent of pasteurization of market milk in 419 cities by population groups, in 20 States and one Canadian Province. It is noted that in the larger cities the consumption of pasteurized milk is greater than in the smaller ones. As in the case of water, so we have the anomalous situation that the safest water and the safest milk is that distributed by the larger cities. By the same token typhoid fever has become almost unknown in the larger cities; indeed, this disease is now sometimes known as the rural disease, depending chiefly upon its dissemination through unguarded water supplies and unpasteurized milk supplies.

TABLE 7

EXTENT OF PASTEURIZATION OF MARKET MILK IN 419 CITIES BY POPULATION GROUPS

20 STATES AND 1 CANADIAN PROVINCE

Population Groups	Percentage of Cities Having Specified Percentages of Pasteurized Milk							Number of Cities in Each Group
	No.	1-25	26-49	50-74	75-99	100	75 and over	
Under 2,500	94	1	2	2	1	0	1	165
2,500— 4,999	76	8	8	7	1	0	1	88
5,000— 9,999	58	13	16	10	3	0	3	68
10,000— 24,999	32	21	15	26	3	2	5	61
25,000— 49,999	11	12	19	35	15	8	23	26
50,000— 99,999	0	0	17	33	17	33	50	6
100,000—800,000	0	0	0	20	60	20	80	5
Averages All Cities	68	8	9	11	3	1	4	419

Table Number 8 is a study of the extent to which milk supplies are iced during the process of delivery. Tabulation shows the supplies that are iced, the sup-

TABLE 8

EXTENT OF ICING AND TEMPERATURE OF MILK SUPPLIES AT TIME OF DELIVERY TO CONSUMERS IN CITIES BY POPULATION GROUPS

Population Group	Percentage of Samples, at Time of Collection from Delivery Vehicle			Median Temperature of Samples at Time of Collection	Number of Samples
	Iced	Not Iced	Above 55° F.		
Under 2,500	7	93	67	65	916
2,500— 4,999	8	92	50	60	764
5,000— 9,999	6	94	43	61	1,039
10,000— 24,999	10	90	63	59	1,736
25,000— 49,999	24	76	46	56	1,748
50,000— 99,999	50	50	58	52	386
100,000—800,000	72	28	37	49	150
Average All Cities	25	75	52	59	———
Group Totals	479 Cities	——	——	——	6,739

plies that are not iced, milk that shows a temperature of 55° F. and above, and the median temperature of samples at time of collection. That the age of the milk is again a factor in favor of the smaller group of cities is apparent, the larger group of cities having met the problem in many cases by icing the milk while it is being transported for delivery.

Table Number 9 is a tabulation of cities having milk control, ordinances, inspectors, laboratory service, and full-time health departments, expressed in percentage. Naturally the larger group of cities have a higher per cent of adequate milk control, but even in these groups of more populous cities there is much yet to be desired before adequate milk supervision can be established.

TABLE 9

SANITARY CONTROL OF MILK SUPPLIES IN CITIES, BY POPULATION GROUPS

Population Group	Percentage of Cities Having				
	* Milk Control	* Ordinances	* Inspectors	* Laboratories	* Full-time Health Officers
Under 2,500	8	9	1	0	7
2,500— 4,999	18	29	13	1	4
5,000— 9,999	36	57	33	6	7
10,000— 24,999	58	68	55	20	20
25,000— 49,999	90	97	81	47	40
50,000— 99,999	83	83	83	50	67
100,000—800,000	100	100	100	100	83
Average All Cities	56	63	52	32	33
Group Totals	479 Cities				

* City or City and County Combined.

Follow-up

In a majority of the States in which a clean and safe milk survey has been made the American Child Health Association has loaned to the States a representative to conduct a follow-up campaign. This representative has had a wide experience in dealing with various social and civic groups, is technically trained in dairy husbandry, and has had an unusual opportunity in dealing with the perplexing problems of milk production and distribution.

Approximately one thousand, five hundred and thirty-four conferences were held in sixteen States, 619 being group meetings, with a total attendance of over seventy-three thousand.* Many thousand pieces of literature were distributed and many institutions and laboratories were visited.

The time allotted to this paper will not permit me to make a complete tabulation of the results following the survey and follow-up work. Suffice to say that practically in every State the time and expense of the survey were completely justified by results that we have reason to believe in the majority of instances will be permanent for the improvement and betterment of the cities' milk supplies.

One of the most gratifying results is that of the increased sense of responsibility of the State and local officials for a continuing and effective program of milk supervision and control. In thirteen States several departments of the government, hitherto working independently, have been brought together in a common service and a united program for clean and safe milk. Locally, numerous ordinances have been adopted, laboratories established, or local laboratories utilized, milk inspectors appointed, dairymen's associations organized, and a general community interest for cleaner and safer milk and more of it. In six States mobile milk laboratories have been assembled and two more will probably follow. This ensures continuing programs of milk inspection. Campaigns for tuberculin testing and for increased use of pasteurized milk have been effective in

* The above figures are based on results up to and including Sept. 14, 1928.

many instances. In one State two cities established pasteurizing plants as the direct result of the survey.

I can only briefly mention the many improvements inaugurated by milk distributors and dairymen in the shape of equipment and better housing facilities, sterilizers, coolers, etc., improvements in pasteurizing plants and in their more careful operation. Equally important is the encouragement, cooperation, and good will between dairymen and local officials.

Discussion of the subject thus far has developed what seem to be five generally admitted facts:

> 1. That milk is one of the most important foods, especially for the growing child.
>
> 2. That milk may be and often is the medium for the distribution of serious infectious diseases.
>
> 3. That a considerable portion of the market milk in the 23 States thus far surveyed is of a distinctly poor sanitary quality and thus potentially dangerous.
>
> 4. That responsibility for effective milk control is often divided and confused with no clear-cut legal or technical understanding between State and local authorities as to their respective fields of labor and responsibility.
>
> 5. That the daily per capita consumption of milk is but half of what may be considered the minimum optimal quantity, especially for children.

In a report to the Conference of State and Provincial Health Authorities of the results of the survey then completed in eight States, I said:

> "These important considerations confronting us as public officials and health workers must find some practical and reasonable solution. It is submitted that the first step in that solution is to make every reasonable effort possible to render the milk safe, after which time we can, in all good conscience, work for the increased consumption of milk until it approaches, at least, the minimum requirements for our growing children.
>
> "It is the writer's judgment that this first step

will include, not only effective supervision over the sanitary production and distribution of milk, but must eventually—from the standpoint of assured safety—include the effective pasteurization of all milk sold for human consumption. It must be constantly kept in mind that pasteurization of milk is not intended, nor will it ever be, a substitute for complete sanitary control of its production.

"The American Public Health Association, at its annual meeting at Detroit, Michigan, in 1924, endorsed in a formal resolution the pasteurization of milk as 'the most practicable and rapidly carried out measure for the safeguarding of the milk supply.'

"We are not unmindful of the objections, and the difficulties economic and otherwise, that make general pasteurization in many communities, particularly the smaller communities, almost, if not quite, impossible. Unless the quantity of milk to be pasteurized is sufficient to make it economically profitable, capital will not jeopardize investment along that line.

"Is the final answer municipal or county control of a central pasteurizing plant, if, and when, there is general agreement that the health hazard and the dangerous contamination of milk, either from the dairy cow or from human sources, is so great that some form of pasteurization or sterilization is demanded?

"The results of the milk survey, thus far, have brought home to the writer, and I believe the State officials in general, in the State surveyed, the almost insurmountable problem of the production and distribution of safe milk in the small communities of this country."

And, finally: The findings of the survey would seem to indicate that there are many communities in the States surveyed in which a campaign for promoting the increased consumption of milk on the basis of assurance of safety would not, at this time, be justified.

"He who helps a child helps humanity."

REPORT OF COMMITTEE ON FOOD VALUE OF MILK AND MILK PRODUCTS

DR. PAUL B. BROOKS, *Chairman*

The subject with which this committee has to deal has been very comprehensively covered in previous reports made under the chairmanship of Professor Hiscock, and this year there is not much which is both new and important to be added.

One of the most important recent developments in this field is that in connection with the irradiation of milk, a subject dealt with at some length in last year's report. The *American Medical Journal* of September 15, 1928, contained an interesting article by Hess and Lewis on "Clinical Experience with Irradiated Ergosterol." A sterol, according to the dictionary, is a solid alcohol; one of a class of compounds widely distributed in nature, which because their solubilities are similar to fats, have been classified with the lipoids. One of the best known of these is cholesterol. Within approximately a year, according to the authors, it has been found that ergosterol, a sterol closely allied to cholesterol, is a constituent of milk and also of certain fungi, yeast, and mushrooms. It apparently derives its name from the fact that it is found in considerable quantity in ergot, a fungus which develops on grain. Ergosterol is readily activated by irradiation and apparently it is this substance which responds when milk is irradiated. Quoting Hess and Lewis: "Activated ergosterol has been shown to be a highly potent antirachitic both for animals and for man. It is perhaps two thousand times as potent as activated cholesterol, and a hundred thousand times as potent as cod liver oil, and is able to prevent or cure rickets in rats in a daily dose of 1/20,000 mg. or less, according to the purity of the preparation.

Notwithstanding the attainment of this high degree of potency, it is probable that only a small amount of ergosterol is rendered active by the irradiation, probably not more than from 1 to 2 per cent. * * * * About a year ago one of us published a report of the remarkable antirachitic activity of irradiated ergosterol. The study has been confirmed by other investigators, by Holtz and by Gyorgy in tests on rats and by Hottinger on puppies. The fact that this activated sterol exerts such a marked specific action on animals justified, from the outset, the conclusion that it would have a similar action on infants, for every antirachitic substance that has been effective on animals has been potent approximately in the same degree on infants.

"The observations in regard to the antirachitic value of irradiated ergosterol on infants have been confirmed by many; indeed, a considerable literature on this subject has developed within the year. It is unnecessary to review these studies in detail. They may be summed up by the statement that in all cases this new therapeutic agent has been found to be reliable in the prevention as well as in the cure of rickets, that its action has been remarkably rapid, all signs of rickets disappearing more quickly than has been accomplished heretofore with cod liver oil, its concentrates, or with direct irradiation. * * * * Furthermore, in cases in which the inorganic phosphorus of the blood was estimated, it was found to have acquired its normal level, and in turn when the calcium was low, it likewise had been raised to the normal. * * * The percentage of calcium responds fully as promptly to this medication as does the inorganic phosphorus.* * * But, in this respect, as in relation to phosphorus, the mobilization may be excessive."

In certain cases in which irradiated ergosterol has been used the authors state there has been an excessive increase of calcium or of inorganic phosphorus or both and they cite a report of Kreitmair and Moll, indicating that when it was given to rats in large amounts calcification of various tissues resulted. They, however, pointed to the fact that the doses given were at least ten thousand times greater than the minimal curative dose. The ill effects of excessive use of irradiated ergosterol, the authors say, in a measure resembled those observed from the use of ultra-violet rays in too great intensities in the early days of the use of this agent.

Some of the work referred to in this article may have been responsible for an editorial which appeared in the same Journal of June 30, calling attention to the dangers in the excessive use of irradiated substances and advising conservatism. In view of the presumably small amount of ergosterol in milk it would not seem that this warning would apply particularly to the use of irradiated milk, but we should not lose sight of the fact that our knowledge of the subject is still limited. It is, of course, a well-known fact that irradiated dry milk has been on the market for approximately two years and we know of no reports of ill effects from its use, whereas several observers have reported satisfactory results from its use in cases of rickets in children.

The effect of feeding on the amount of vitamin C in cow's milk was touched upon last year, the conclusion of various observers being that the vitamin C content of the ration had little or no effect on the amount of this vitamin in the milk. In this connection, Prof. John Golding of the National Institute for Research in Dairying, University of Reading, England, in a paper presented at the World's Dairy Congress this year, cited some interesting observations on the addition of cod liver oil to the cow's ration. Cows which were already receiving rations adequate for milk production were also given cod liver oil daily in amounts varying from two to four ounces upward. His findings confirmed earlier observations that the content of vitamins A and D in the milk fat could be markedly increased by addition of cod liver oil to the diet. His most interesting observation related to the effect on the butter-fat content of the milk. When the oil was added in quantities of 2 to 4 ounces daily, fat yield usually was little influenced, but when the oil was increased beyond 4 ounces there was a decline in the amount of fat of from 15 to 25 per cent, and occasionally even 40 per cent or more. At the time of writing he was carrying on further experiments in the hope of determining the cause of this decline.

Monroe, in the July-August issue of the Ohio Agricultural Experiment Station Bulletin, discusses "the possibility of producing iodized milk" and reports observations on the effect of administering potassium iodide and feeding iodine-containing substances to cows. He and his associates found that when a cow was given about two ounces of a food containing iodine or from 1.5 to 2 grains of potassium or calcium iodide daily, iodine appeared in the milk, the amount apparently varying from one part in ten million to one part in one hundred million. He says: "The iodized milk produced by cows fed iodine in the Station herd has not been richer in iodine than milk produced in regions where the feeds are rich in iodine and no supplemental iodine is fed"; but he says further: "The wisdom of producing milk with a higher iodine percentage may be questioned." In view of the well-known prevalence ot goiter among children and others in a section of the United States commonly referred to as "the goiter belt," a condition which some observers have attributed to absence of iodine from drinking water used in this area, it would appear that some advantage might accrue from the use of iodine in suitable quantities for cattle feeding and that the subject is one warranting further consideration by medical as well as agricultural research workers.

While we are considering the effect of feeding upon cow's milk, it is perhaps not out of place to call attention to the fact that at present little is known concerning the possible effects upon milk of the conditions under which cows are kept. It is a well-known fact that emotional and other disturbances in the mother often have a marked influence upon the nursing infant. It is conceivable that the practice of keeping cows in dark, damp, and uncomfortable stables or the practice—common in intensive dairying—of keeping them in close confinement in light and well-ventilated stables without adequate exercise, exposure to direct sunlight, and the opportunity to "lie down in green pastures" may be in some measure responsible for difficulties sometimes encountered in the use of cow's milk in infant feeding. The question as to the effect upon quality of milk of the intensive efforts at quantity production is one warranting further study.

In the same connection very little is known concerning the effect upon children and other human beings of the consumption of milk containing colostrum. Studies included in the recently published "Fundamentals of Dairy Science" by associates of Professor Rogers indicate that newborn calves receive immediate protective antibodies through colostrum and that it is the principal if not the only source of protection in the early weeks of life, the power of conveying antibodies not being destroyed by pasteurization. It has also been observed that colostrum has a relatively high vitamin content and that white rats fed upon it do well, although said to be susceptible to digestive disturbances. On the other hand, most milk ordinances and many agricultural laws prohibit the sale of milk during the period in which it contains colostrum. This prohibition is probably quite necessary, but inquiries as to the specific reasons for it usually bring replies which are rather vague and speculative. We should be in a position to defend the legal restrictions upon the handling and sale of milk which we endorse and from this standpoint there would seem also to be need for study of this subject.

In recent years health departments and other agencies interested in infant welfare have been active in promoting breast feeding campaigns. In our desire to promote increased consumption of cow's milk—and at this point we endorse the expression in a previous report that our efforts in this direction should apply only to milk of a good sanitary quality—we should not lose sight of the fact that mother's milk is the natural food of the infant and that under normal conditions infants thrive best upon it. That cow's milk probably will always be an important factor in infant feeding, however, is indicated in an editorial entitled "Breast Milk—A Variable Food" which appeared in the *Journal of the American Medical Association* of September 22, 1928. In this editorial it is pointed out that while "the statistics of infant mortality show convincingly that breast feeding during the early months of life is an actual advantage to the child" and that "nutrition with mother's milk affords a better chance for survival in what has been termed 'the perilous first year,'" nevertheless there is a wide variation in the quantity and quality of human breast milk and it is by no means always "a perfect food." It may fail to meet the needs of the baby and "while death may not occur, growth and development may be far from optimal." Under certain conditions its content of the vitamin protecting against rickets may be much lower than that of cow's milk. Nevertheless, it probably is the consensus of opinion among those best qualified to speak on the subject of infant feeding that all reasonable effort should be made, especially in the prenatal period, to improve the physical condition of the mother and secure the production of milk adapted to the use of her infant before resorting to the substitution of cow's milk.

"Because there is no effective substitute for milk, every satisfactory diet should include one quart of milk and leafy vegetable every day."

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

M. O. MAUGHAN, *Chairman*

This is a progress report. Last year your Committee outlined in detail the advantages of serving milk in schools, as well as in offices and factories. Specific and definite reasons were given, setting forth the advantages to the person drinking the milk as well as to the employer, the school teacher, and others. Selling arguments for the establishment of milk service in schools, offices, and factories were also set forth in considerable detail.

By way of review, we may say three systems were outlined for serving milk in schools and also three systems for serving milk in factories.

As for school milk service, Plan No. 1 involves serving milk in the hallways at recess time. Plan No. 2 relates to serving milk in special rooms, set apart for this purpose, at recess time, to which the children come in groups and sit down and drink their milk. Plan No. 3 provides for serving milk to the children at their desks; it is definitely a part of the school program.

Your Committee recommends Plan No. 3 as best. The Committee recognizes that the serving of milk in schools must have the full cooperation of the school teacher, and in some cases conditions may make it advisable to follow some plan other than No. 3.

As for factory service, Plan No. 1, outlined last year, provides for the purchase by the factory management of a certain amount of milk, and for the distribution of this milk by one of the employees. Plan No. 2 consists of establishing a milk stand in the factory to which the workers may go and get their bottle of milk at various times throughout the day. Plan No. 3 consists of the milk dealer's sending his own representative into the factory and having this man go from one employee to another, either in the midforenoon or in the midafternoon, in a business-like way selling a bottle of milk to each of the employees who believes milk is good for him.

For details regarding these methods of serving, you can write the International Association of Dairy and Milk Inspectors, 2525 Pennsylvania Avenue, Washington, D. C.

Our report this year merely sets forth such new developments as have been brought to our attention dealing with milk service in schools, offices, and factories either in midmorning or midafternoon. We are not attempting to discuss milk for lunch. This is not debatable, and most people are now sold on it.

First of all, we may say factory milk service is forging ahead at a considerably more rapid pace than school milk service. Of course, school milk service has reached quite a development now and in many sections of the country approximately twenty per cent of the children are now drinking milk regularly at school, either in midforenoon or midafternoon, generally midmorning. Factory workers are rapidly recognizing the merits of milk and they are using it in large quantities.

School Milk Service

During the past year, an interesting survey was conducted in Chicago to determine the effects of health educational work in the schools on the consumption of milk in the home. Two schools were chosen for this study. School No. 1, in January, 1927, requested assistance in weighing and measuring its 1377 pupils. This was done immediately and 53 per cent were found to be underweight. The principal, needless to say, was very much alarmed and immediately became interested in a health program, and he secured the appointment of a full-time health teacher the following September. This health worker used posters and material of many kinds to impress the pupils with the need of proper diet and better health habits. In January, 1928, exactly one year later, the children were again weighed and measured and the year's work was found to have secured most notable results in the physical condition of the children. In January, 1927, the children consumed 2766 half-pint bottles of milk in this school. A year later, in January, 1928, they consumed 3472 bottles of milk, which was an increase of 25.5 per cent. In comparing the increase in the homes it was possible to study 105 retail customers. These customers, in January, 1927, purchased 3687 quarts of milk and 323 pints of milk, whereas in January, 1928, 3754 quarts of milk and 371 pints were purchased, an increase of 2.4 per cent.

In studying these 105 families, it was found that 27 of them showed a marked increase in the amount of milk consumed, 13 showed a decrease, and 65 showed no material change. In the case of the 27 families which showed an increase, the reasons were as follows:

Baby arrived	4
Husband drinking milk	1
Children in school want more	13
Unknown	9

The reasons given for the decrease are as follows:

Part of family gone	4
Out of work	2
Wife at hospital	1
Other miscellaneous answers	6

The other school studied had a somewhat similar history. In November, 1926, 1036 pupils were weighed and measured and 40 per cent were found to be underweight. Only 80 pupils were then drinking milk in mid-forenoon. Immediately a campaign was undertaken to get more children to drink milk, and particularly the underweight ones, and within a month 350 were drinking milk. Three months later, in March, 1927, the 40 per cent had fallen to 23 per cent and each one of the 40 per cent, except eight, had shown improvement. A significant point was brought out the following May, when it was found that the only children who were underweight were the ones not getting a quart of milk a day.

In comparing the homes in and around this school, it was found that the educational work in the schools, and the promotion of milk drinking in the school had resulted, in a year's time, in increasing the consumption of milk in the homes exactly 2.6 per cent. Among the reasons given for increased consumption were:

Children want more	8
Lady drinking milk	1
Baby arrived	6

General Conclusions on This and Other Observations

1. Educational work in schools does influence the purchases of milk in the home, but constant work is necessary to maintain the increased rate of consumption.

2. Educational work among school children with the cooperation of both parents and teachers secures better results than educational work without the help of the parent-teacher group.

3. Work done among children in school on the food value of milk will reflect itself in the purchases of milk in the home.

4. Educational work in the schools establishes the

value of milk in the home and actually lessens cut-downs because of unemployment.

This observation seems to be typical of practically all observations along this line and merely emphasizes more strongly than ever the opinion held for some time that teaching children to drink milk in schools results in increasing milk consumption in the homes.

A preliminary report* of an experiment made under the auspices of the Scottish Board of Health mentions the fact that groups of children of the ages of five to six, eight to nine, and 13 to 14 years in seven Scottish towns, four groups from each town, each group consisting of 40 to 50 children, making a total of approximately 1200, were selected and carefully studied under different diets.

The first group was given the ordinary diet. The second group received the same diet with biscuits added, the third group with separated milk added, and the fourth group with whole milk added. The feeding was carefully supervised in the schools. In addition to this, the home dietary (626 cases) was studied, since some children received milk at home in addition to the milk received in the school.

The experiment continued over seven months and showed an average monthly gain of 0.17 inches and 0.42 pounds for the groups which did not receive extra milk, against 0.21 inches and 0.52 pounds for those receiving milk. The average increase in height was 1.470 inches and in weight 3.617 pounds for the milk-taking group, against 1.212 inches and 2.974 pounds for those not receiving milk. In other words, it would seem that the addition of milk was responsible, wholly or in part, for an increased gain in height of 20 per cent and an increased gain in weight of 21 per cent over the basic

* Reported at World's Dairy Congress, 1928; also in the London Lancet, Jan. 28, 1928; American Journal of Public Health, May, 1928; British Medical Journal, January, 1928.

gain. These figures include the three age groups mentioned.

The general condition of the children was noted and on the whole it was found that among those getting extra milk at school, the hair was glossier, the complection clearer, and they held themselves more erect.

Another item of considerable interest regarding the serving of milk in schools has been reported by Doctor Shrader, formerly of the Baltimore Health Department, now Director of the Research Laboratory of the National Dairy Products Corporation. Doctor Shrader stated that in Baltimore they seriously debated the advisability of allowing chocolate milk to be served in the schools. They studied the problem. One of the school officials who has charge of the school cafeterias kept a record of the relative use of whole milk and chocolate milk. Where both were offered for sale, the total consumption over a definite period amounted to 50.2 units of butter-fat, whereas during a similar period of time and under the same conditions so far as possible, when chocolate milk was not offered for sale, but only whole milk, the total butter-fat consumption was reduced to 28.8 units.

It is clear from these figures that although chocolate milk is sold with only 2 per cent butter-fat, as compared with Baltimore milk, which contains approximately 4 per cent, yet because of the much greater quantity of chocolate milk consumed it resulted in a greater consumption by the children of butter-fat as represented by the ratio of 50.2 to 28.8. "In other words," says Doctor Shrader, "chocolate milk with less butter-fat was consumed to such a greater extent than milk that there was a material net advantage in actual butter-fat consumption. In view of the above facts," continues Doctor Shrader, "I recommend that chocolate milk containing 2.5 per cent of butter-fat, and so stated on the label, be allowed to be sold in Baltimore schools."

These figures were taken from representative high schools in Baltimore. It might be that if a similar study were made of grade school children, the ratio of butter-fat consumption might be different, yet it seems that this and other studies indicate that chocolate milk has a place. Your Committee as a whole, however, is not ready as yet to say that chocolate milk can be satisfactorily substituted for whole milk, if the child would desire, because there are many factors to consider in addition to butter-fat intake, one of which is the relative effect of the chocolate milk and whole milk on the appetite for the noonday meal.

This experiment is, however, of unusual interest and value in that ever since chocolate milk was put on the market there has been an open question in the minds of many milk dealers and workers as to its merits, some being enthusiastic over chocolate milk and others holding the opposite view.

Milk Service in Offices

Most office workers now receive the careful attention of the milkman, and considerable business has developed in office buildings. A fair percentage of office workers now take a bottle of milk at 9 or 10 A.M. because of having eaten very little, if any, breakfast; or the milk is taken in the afternoon at 3 or 4 P.M. to remove that tired feeling and give renewed energy during the remainder of the day. Some of the large insurance companies, such as the Metropolitan Life and the Prudential, make it a regular practice to serve milk to their employees. We understand the milk is at all times readily available for each employee desiring it. Milk service in offices is increasing slowly but with certain success. Doctor Tobey, another member of the Committee, is of the opinion that dried milk tablets offer an excellent form of nourishment.

Factory Milk Service

In some sections of the country, particularly Indiana, there has developed a fourth plan of serving milk in factories. This plan is as follows: A person who has no connection with the factory or with the milk dealer, working entirely on his own initiative, arranges with the management for permission to establish a milk distribution system in the factory. One young man who made a study of factory milk service in the country started in Huntington, Indiana, to serve the Erie Railway employees and one or two other factories in his home town. The plan has become so successful that he has now spread his organization activities to include several other cities, among which are Indianapolis, Fort Wayne, and Marion. This plan may have merit, yet the milk dealer should be able to deliver the milk at a lower cost and with equally good service.

With reference to half pints versus pints of milk in factories, it seems advisable to sell pints, both from the standpoint of the health of the worker and also from the viewpoint of successful business on the part of the milk dealer.

Conclusions

1. A vast amount of work is yet to be done. Many school authorities are not even now sold on milk service; financing and proper handling facilities are a problem; and too many milk dealers fail to cooperate as they should.

2. Factory milk service has many problems, one of which is the return of empty bottles.

3. The milk industry needs more research, experimental and statistical work, to throw more light on many problems, including milk service in schools, offices, and factories.

More ways of using milk should be found, more surveys like Doctor Shrader's should be conducted in factory, office, and school, and a more scientific approach to our problems should be made possible. The field for milk sales in schools, offices, and factories is great, and greatly in need of further development.

"Every mission constitutes a pledge of duty."

THE U. S. PUBLIC HEALTH SERVICE MILK CONTROL PLAN

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U. S. Public Health Service, Montgomery, Ala.

INTRODUCTION

Last year the United States Public Health Service Standard Milk Control Code, embodying the milk control plan of the United States Public Health Service, was submitted by the Service to practically all national public health and dairy organizations, with the request that committees be appointed to study it and confer with the Service regarding any desirable modifications. A frank discussion of the program should promote complete understanding between the dairy industry, other public and private agencies interested in the sanitation of milk supplies, and the Public Health Service.

There can be no doubt whatever that American milk control thought will gradually focus upon an approximately uniform milk control practice. The disadvantages of the present chaotic conditions and the desirability of unified milk control practice are so self-evident that they need no emphasis. Hence it is believed that unification is inevitable whether it materializes now or later, whether it is inspired and promoted by an organized governmental plan such as that of the Public Health Service, or whether it materializes through the slow drift of unorganized public opinion.

INCEPTION IN ALABAMA

The Public Health Service plan had its inception in Alabama in 1923, when the Alabama State Board of

Health called upon the Public Health Service to formulate for it and assist it in beginning the execution of a state-wide plan of milk control. The plan developed was so successful that up to the present writing approximately forty, or nearly all, of the cities in the State have adopted it and have achieved a marked improvement in milk quality and a heavy increase in milk consumption. Reprint No. 1144 from the Public Health Reports shows the results of an intensive survey in fourteen of the Alabama communities, and gives clean-cut evidence of the fact that milk quality has improved from less than 50 per cent compliance to approximately 90 per cent compliance with a set of ideal requirements, that the percentage of milk pasteurized has increased from 6.9 to 21.6, and that market milk consumption has increased almost 90 per cent. Both the dairy industry and the health officers of Standard Milk Ordinance cities have recorded themselves as being well pleased with the plan.

Adoption in Twelve Other States

These unmistakably favorable results, both from the standpoint of the public health and from the standpoint of the welfare of the dairy industry, attracted the attention of nearby States, which in rapid succession adopted the plan and called upon the Public Health Service for advice and assistance. Thirteen States have now adopted the plan and over two hundred cities are controlling their milk supplies under the Standard Milk Ordinance. These cities afford examples of the climatic, governmental, and racial variations found in a very large area; namely, one extending from the Gulf Coast on the south to the Ohio River on the north, and from the Atlantic Seaboard on the east to Arizona on the west.

Description of Public Health Service Milk Control Plan

The Public Health Service Milk Control Plan contains the following fundamental elements:

1. It recommends for passage by cities a Standard Milk Ordinance

   (a) which lists the precautions under which Grade A Raw and Grade A Pasteurized Milk shall be produced and pasteurized, and which permits such supplies to be labeled Grade A Raw and Grade A Pasteurized, respectively.

   (b) which requires that milk supplies which are repeatedly found not to be protected by every one of these precautions shall be degraded by the health officer and required to carry lower grade labels.

   (c) which requires that the grades of all dairies and plants must be redetermined and announced at least once every six months, and that all grades awarded must be based upon field inspections and laboratory analyses made subsequent to the immediately preceding announcement of grades.

   (d) which leaves to each community the decision as to which raw grades shall be permitted to be sold raw to the final consumer, but frankly urges as much pasteurization in each community as public opinion will support.

2. It recommends that the State Board of Health detail periodically a qualified milk specialist to visit each city and survey the milk control work and results

   (a) so as to promote uniform inspection, laboratory and grading work throughout the State, and

   (b) so as to measure the excellence of the results obtained in each community.

Development of Standard Milk Control Code

After several years' research work with the Standard Milk Ordinance it became evident to the Public Health Service that in order to insure uniform interpretation and enforcement it would be necessary to prepare what has become known as the Standard Milk Control Code. This document discusses the Standard Ordinance item by item, gives in detail what is recommended as satisfactory compliance with each item, and outlines the public health reason for each item. The code may therefore be defined as the Standard Milk Ordinance interpreted and justified. It is intended:

1. to stabilize the interpretation of the Standard Ordinance,
2. to serve as a handbook for milk inspectors,
3. to serve as a clearing house for the milk control opinions of public health and dairy organizations, and as one source of textbook material for the teaching of practical milk control administration.

Ordinance and Code Referred to National Public Health and Dairy Organizations

By 1927 it had become evident to the Public Health Service that the rapid rate of approval of the Standard Ordinance by individual State health departments, and the fact that it had been approved by the State Health Officers' Association as a body, were giving the ordinance a nation-wide significance, and that therefore it would be proper to invite the various national dairy and public health organizations to discuss the whole plan of milk control with the Public Health Service and to suggest any modifications which in their opinion were desirable.

Inasmuch as the whole plan was fully covered in the Standard Milk Control Code, which embodied both the ordinance and its interpretation, it was decided to use the code as a vehicle for joint discussion, and accordingly a copy of the code was sent by the Surgeon General to each of the following organizations with the request that committees be appointed to study it and confer with the Public Health Service regarding any desirable modifications:

The American Public Health Association
The Conference of State and Territorial Health Authorities
The American Dairy Federation
The American Medical Association
The American Association of Medical Milk Commissions
The Association of Dairy, Food, and Drug Officials
The Certified Milk Producers' Association
The International Association of Dairy and Milk Inspectors
The International Milk Dealers' Association
The National Cooperative Milk Producers' Federation
The National Dairy Council
The Dairy and Ice Cream Machinery and Supplies Association
The American Dairy Science Association
The American Veterinary Medical Association.

Conclusion

In conclusion it is emphasized that the Public Health Service has observed excellent results from the application of its recommended plan of milk control in the areas in which it has been applied; that it believes the same excellent results can be secured with the same plan in practically all other areas; that nevertheless it has in effect said to the industry: "We are constantly asked for advice in matters of milk control. We want that advice to be as sound as possible. We wish, therefore, to give you an opportunity to express your opinion about each item of a tentative plan which we have developed as a result of a number of years preliminary field experience. Will you not please discuss each item with us, and tell us how you think it could be improved?"

The Public Health Service proposes to publish in the next issue of the Standard Milk Control Code not only the suggestions from all national organizations, which it can approve, but also, in an appendix, all other nonapproved suggestions, together with the reasons for nonapproval; so that every State and every city will have before it not only the judgment of the Public Health Service, but also any dissenting views on specific items, and can exercise choice according to conviction.

It is difficult to conceive a fairer plan for a real clearing house of national milk control opinion, and it is earnestly hoped that the dairy industry will lend itself to that plan. As the years go on such a continued program of constructive cooperation between the national dairy organizations and the official national health organizations will inevitably result in the disintegration of unsound items and the confirmation of the sound ones, and finally in a substantial benefit to both the public health and the dairy industry.

"Men worry over the great number of diseases; doctors worry over the small number of remedies."

RESULTS OF MILK CONTROL WORK DURING THE PAST FIVE YEARS IN ALABAMA

C. A. ABELE, *Director of Inspection,*
Alabama State Board of Health, Montgomery, Ala.

The exact nature of the sanitary conditions surrounding the milk supplies of some twenty-five communities situated in all parts of a State is rather difficult to portray. In order that the picture be accurate, the conditions at every dairy and pasteurizing plant at a given milk-handling time should be ascertained. This, however, is utterly impossible. Only a limited number of dairies can be thoroughly inspected by one person in a single day.

Simultaneous inspections of a large group of dairies being impracticable, the next best method of obtaining a picture of general conditions is to make the inspections in as short a space of time as possible, and consider the resulting composite picture as an average picture, which might be duplicated at any time during this period, and might be taken to be representative of any one milk-handling time. This was the method followed in determining present dairy and milk-plant conditions in Alabama. The inspections were made in the routine manner during August and September by the State Milk Inspectors. The preënforcement conditions referred to in this paper were ascertained at various times, usually when the first dairy inspections in each community were made—either shortly before or soon after the milk ordinance was passed.

The method of determining the milk sanitation rating of any milk supply is described in United States Public Health Service Reprint No. 1098. This method was followed in making the August-September survey, and the interpretation placed on each section of the specifications for Grade A Raw or Pasteurized Milk in the November, 1927, issue of the United States Public Health Service Milk Control Code was used in the inspections in which the data presented in this paper were obtained.

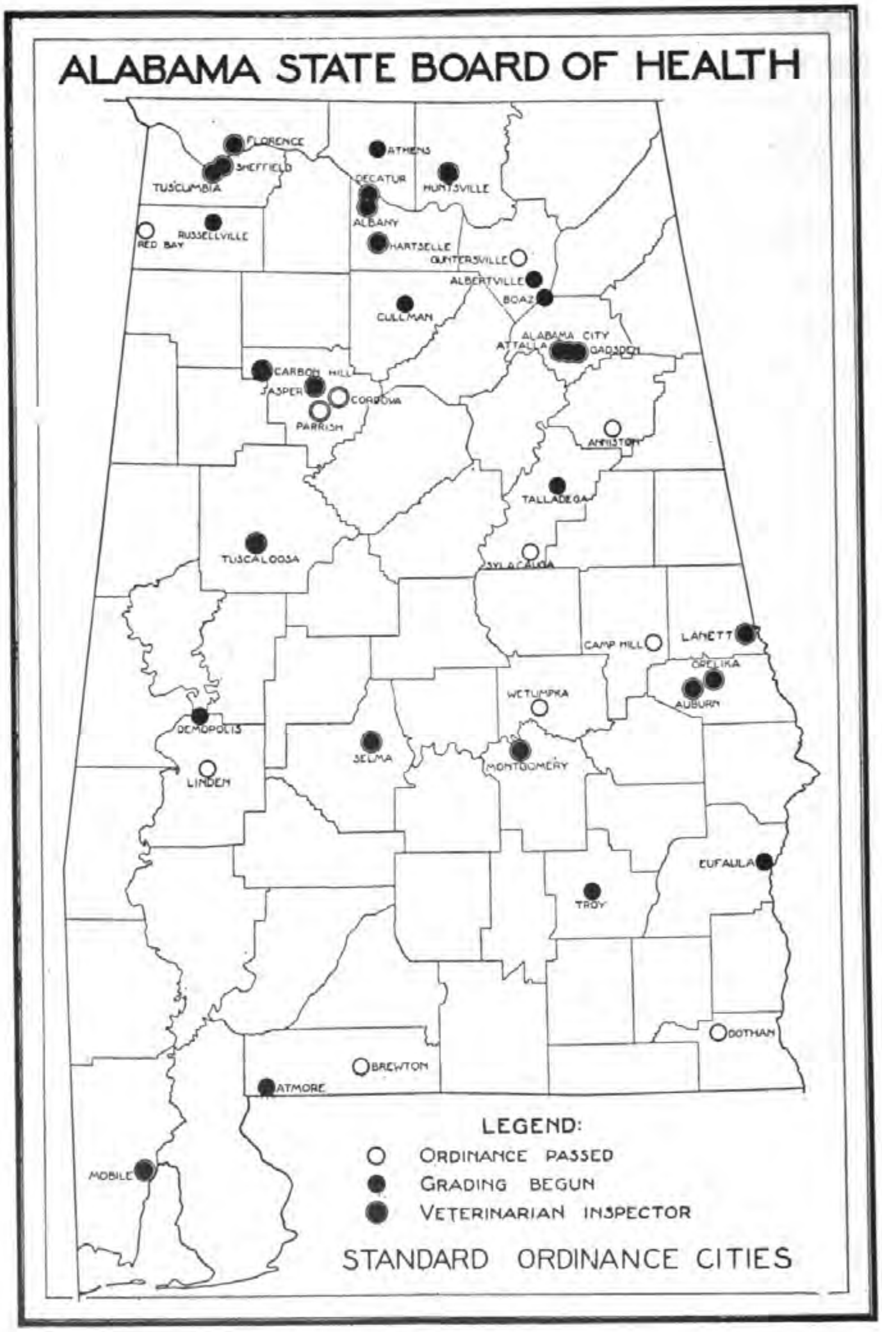
Extent of the Alabama Milk Control Program

The United States Public Health Service Standard Milk Ordinance has been passed in 40 Alabama cities. In three cases two or three towns are so located as to form one community; therefore these 40 cities and towns form 36 separate and distinct communities. The grades of all milk supplies have been publicly announced at least once in 25 of these 36 communities. It is the results obtained in these 25 communities which are discussed in this paper.

The map shown in Plate I indicates the distribution of the Standard Ordinance cities. The most interesting feature of the map is the number of cities in which the milk inspector is a full-time veterinarian, engaged either in meat and milk inspection, or in milk inspection solely. In general, these include only the larger communities, although they also include six towns with a population of less than six thousand.

The Birmingham Milk Ordinance has been passed by three of the municipalities in Jefferson County. Although this is not the Standard Ordinance, it practically parallels it in many of its provisions. However, because standard forms and practices are not used in the enforcement of the ordinances in these three cities, the results have not been included in this paper.

The 25 Standard Ordinance Cities considered in this paper are listed in Table I in the order in which the ordinance was passed. The calculated or estimated population, the date of passage of the Standard Milk Ordinance, the date of the first public announcement of the


ALABAMA STATE BOARD OF HEALTH
FLORENCE
ATHENS
SHEFFIELD
TUSCUMBIA
DECATUR
HUNTSVILLE
ALBANY
RUSSELLVILLE
RED BAY
HARTSELLE
GUNTERSVILLE
ALBERTVILLE
BOAZ
CULLMAN
ALABAMA CITY
ATTALLA
GADSDEN
CARBON HILL
JASPER
CORDOVA
PARRISH
ANNISTON
TALLADEGA
TUSCALOOSA
SYLACAUGA
CAMP HILL
LANETT
OPELIKA
AUBURN
WETUMPKA
DEMOPOLIS
SELMA
MONTGOMERY
LINDEN
EUFAULA
TROY
DOTHAN
BREWTON
ATMORE
MOBILE
LEGEND:
ORDINANCE PASSED
GRADING BEGUN
VETERINARIAN INSPECTOR
STANDARD ORDINANCE CITIES

grades of all milk supplies, and the number of grade announcements made through September 15 of this year are also given in this table. It is interesting to note that the Standard Milk Ordinance is being successfully applied under Alabama conditions in communities ranging in pop-

TABLE I

DATA OF STANDARD ORDINANCE CITIES

City	1928 Pop.	Date of Passage	Grading Begun	No. Grade Announcements **
Tuscaloosa	15,139	6-12-23	10-31-24	17
Gadsden	18,395	6-18-23	3-31-26	15
Alabama City	6,411	5-2-27	12-11-27	3
Attalla	4,120	3-21-27	12-31-27	3
Mobile	68,900	8-21-23	12-31-23	18
Florence	13,900	9-4-23	11-29-24	17
Huntsville *	20,000	10-26-23	12-15-24	16
Montgomery *	60,000	12-18-23	3-29-24	19
Selma	17,300	3-4-24	9-30-24	16
Eufaula	5,534	11-4-24	7-31-25	12
Decatur / Albany	14,200	1-5-25 / 6-5-25	11-15-25	11
Athens	4,732	3-10-25	7-20-28	1
Sheffield / Tuscumbia	12,650	4-5-25 / 5-12-25	5-20-26	8
Jasper	3,891	7-6-25	5-31-26	9
Carbon Hill	3,579	7-14-25	10-15-26	6
Troy	6,340	8-18-25	4-15-26	9
Opelika	5,157	12-15-26	10-8-27	4
Atmore	2,400	1-4-27	9-30-27	4
Lanett	5,988	2-7-27	8-29-27	5
Boaz	1,685	2-17-27	6-15-28	2
Albertville	1,771	3-7-27	6-25-28	2
Hartselle	2,567	4-12-27	11-15-27	4
Russellville	2,464	4-19-27	7-10-28	1
Cullman	2,763	5-16-27	7-3-28	1
Talladega	7,150	6-28-27	4-7-28	2
Demopolis	3,095	8-18-27	3-31-28	2
Auburn	4,787	9-16-27	3-10-28	2
Total	314,918			209

* Estimated.

** These are the official public announcements of the grades of all retail and pasteurized supplies.

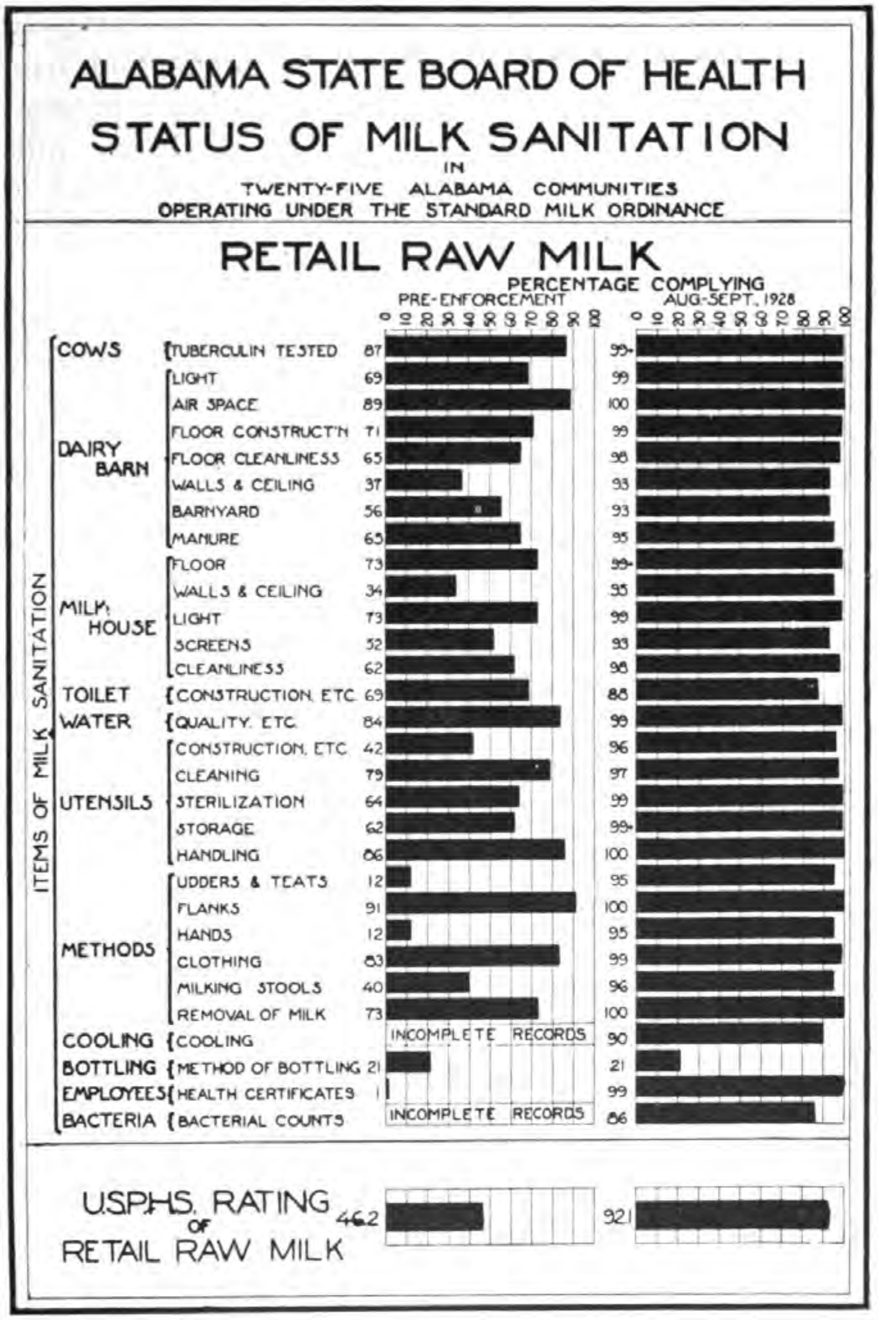
ulation from less than 2,000 to approximately 70,000. The estimated urban population in Alabama communities of 500 or more is approximately 890,000. The population of these 25 communities is about 315,000, or 35 per cent of the total urban population. The population of the 36 Alabama communities in which the Standard Milk Ordinance has thus far been passed is nearly 42 per cent of this estimated total urban population, and, including Birmingham, Bessemer, and Fairfield, the cities in which the Birmingham Milk Ordinance is in effect, 80 per cent of the urban (over 500) population of Alabama is receiving milk from sources under organized supervision, conforming to or closely paralleling the Standard Milk Ordinance in essentials.

In Table I is also set forth the number of public grade announcements which have been made. It is the general practice to make these announcements regularly at three-month intervals. That this program has been closely adhered to is proved by the fact that the average interval between the 209 grade announcements so far made since January 1, 1924, has been three months and thirteen days. The clock-like regularity of public announcement of the grades of all milk supplies has proved to be a very important feature of our ordinance enforcement practice.

The milk quality control program of the Alabama State Board of Health consists essentially of dairy and milk plant inspections made in cooperation with the local inspectors, milk sample examinations, and ordinance enforcement. The State is divided into five milk inspection districts, with a qualified dairy inspector assigned to each district. These inspectors are either veterinarians or graduates in dairy husbandry. All milk samples are examined in the State Board of Health Laboratories, which are so located that milk samples can be sent in insulated shipping cases and arrive there at temperatures under 50 degrees Fahrenheit.

Results

The improvements in milk quality achieved in these 25 Alabama communities since the passage of the Standard Milk Ordinance are summarized in Plates II, III, and IV, and in Tables II, III, and V.



ALABAMA STATE BOARD OF HEALTH
STATUS OF MILK SANITATION
IN
TWENTY-FIVE ALABAMA COMMUNITIES
OPERATING UNDER THE STANDARD MILK ORDINANCE
RETAIL RAW MILK
PERCENTAGE COMPLYING
PRE-ENFORCEMENT
AUG-SEPT., 1928
ITEMS OF MILK SANITATION
COWS
TUBERCULIN TESTED 87 99+
DAIRY BARN
LIGHT 69 99
AIR SPACE 89 100
FLOOR CONSTRUCT'N 71 99
FLOOR CLEANLINESS 65 98
WALLS & CEILING 37 93
BARNYARD 56 93
MANURE 65 95
MILK HOUSE
FLOOR 73 99+
WALLS & CEILING 34 95
LIGHT 73 99
SCREENS 52 93
CLEANLINESS 62 98
TOILET
CONSTRUCTION, ETC. 69 88
WATER
QUALITY, ETC. 84 99
UTENSILS
CONSTRUCTION, ETC. 42 96
CLEANING 79 97
STERILIZATION 64 99
STORAGE 62 99+
HANDLING 86 100
METHODS
UDDERS & TEATS 12 95
FLANKS 91 100
HANDS 12 95
CLOTHING 83 99
MILKING STOOLS 40 96
REMOVAL OF MILK 73 100
COOLING
COOLING INCOMPLETE RECORDS 90
BOTTLING
METHOD OF BOTTLING 21 21
EMPLOYEES
HEALTH CERTIFICATES 1 99
BACTERIA
BACTERIAL COUNTS INCOMPLETE RECORDS 86
U.S.P.H.S. RATING OF RETAIL RAW MILK 46.2 92.1

Improvement in Retail and Raw Milk Supplies:

Plate II is a composite picture of the preënforcement and present conditions surrounding the production, handling, and sale of retail raw milk. Each bar represents the percentage of the total volume of retail raw milk which complied with that particular item of the Grade A Raw Milk specifications in the United States Public Health Service Standard Milk Control Code.

As stated heretofore, the last issue of the Milk Control Code was adhered to in making all dairy and milk-plant inspections. Inspections were rigid. Over 30 per cent of them were made at milking time, a considerable number during the morning milking, when conditions are most apt to be lax. It is needless to state that all inspections were surprise visits.

A glance at Plate II reveals the general improvement in the retail raw milk supplies of these twenty-five communities, which in August and September consisted of 15,723 gallons, or, as many prefer to consider it, 62,892 quarts. The weighted average retail raw milk sanitation rating of these supplies before enforcement of the ordinance was 46.3; in August-September, 1928, the rating was 92.1, an improvement of 99 per cent.

The degree of improvement is indicated in spite of the fact that our inspection judgment has become more rigid. Had we then followed the interpretations now included in the Code, the preënforcement picture and the general preënforcement rating would have been even less favorable than it now appears to have been.

Note the uniformity with which over 90 per cent of the total quantity of retail raw milk complies with the various specifications for Grade A Raw Milk. The reasons for the low percentage of compliance with "toilet facilities" and "method of bottling" are given later in this paper.

The degree to which these 25 supplies of retail raw milk complied with the temperature and bacteria count requirements for Grade A Raw Milk is not made entirely clear by the percentage figures given. For the purpose of this rating all bacteria counts made between September 1, 1927, and August 31, 1928, inclusive, were used, except in the cases of cities in which a full year's counts were not available. In these latter instances, all counts during the three months before the first announcement of grades and since were included. Of the 4,903 samples examined, the counts of 3,988, or 81.3 per cent, were 50,000 or less per c.c. Only 1.5 per cent of the counts exceeded 1,000,000 per c.c. It is also noteworthy that 80.6 per cent of the 4,236 reported sample temperature readings were 50 degrees Fahrenheit or lower.

As an example of the rigid nature of the late inspections, note the items "toilet facilities" and "method of bottling" in the August-September, 1928, column of Plate II. A concerted drive to make the feces disposal at every dairy completely sanitary has been under way this past summer. Some of the toilets had fallen into a state of disrepair and at some dairies, formerly operated entirely by white people, negro dairy employees had been hired, but separate toilet facilities for these had not been provided.

Wherever privy sanitation had not been entirely completed at the time of the August-September inspections, even though the construction materials were on the ground, the lack of a sanitary toilet was charged against that milk supply. (I have been informed, since my arrival in Chicago, that every one of the toilets, the lack of which affected the right-hand bar of Item 10 on Chart II, has now been constructed or repaired.)

In only three of the communities included in this survey has the latest form of the Standard Milk Ordinance been passed. In the previous form of the Ordinance the use of mechanical milk bottle cappers was not prescribed; consequently very few are in use in Alabama. The dairymen, instead, rinse the bottle caps in a hypochlorite solution before use. Nevertheless, the Code being the basis of our inspections for this report, unless a mechanical capper was found in use, no credit

TABLE II

U. S. Public Health Service Ratings of Retail Raw Milk

City	Sanitation Ratings Preënforcement	Sanitation Ratings Aug.-Sept., 1928	Percentage Improvement
Tuscaloosa	44.6	93.9	110
Gadsden, Alabama City, Attalla	42.4	91.5	116
Mobile	49.8	90.5	82
Florence	40.9	95.5	109
Huntsville	38.5	92.2	139
Montgomery	52.6	91.4	74
Selma	60.2	93.7	56
Eufaula	29.5	83.9	184
Decatur-Albany	20.5	93.7	357
Athens	40.5	94.4	133
Sheffield-Tuscumbia	36.2	93.2	157
Jasper	20.2	88.0	336
Carbon Hill	21.9	76.4	249
Troy	68.4	92.6	35
Opelika	42.5	92.9	119
Atmore	57.6	91.5	59
Lanett	55.5	92.7	67
Boaz	18.6	92.9	399
Albertville	20.9	93.4	347
Hartselle	50.6	95.0	88
Russellville	31.5	89.1	183
Cullman	21.7	95.5	340
Talladega	32.4	89.9	177
Demopolis	45.9	96.2	110
Auburn	47.1	95.2	102
Average	46.3	92.1	99

was given for disinfected caps, and the bar of Item 24 appears to indicate that a majority of the dairymen are violating the ordinance, although this is not really the case.

Table II shows the improvement in the retail raw milk sanitation ratings of each of the twenty-five communities. It is to be noted that with only a few exceptions an approximately uniform level of sanitary conditions has been attained (ratings of 90 per cent or above). As was to be expected, the communities with the poorest initial conditions have made the greatest percentage improvement.

Table III is an analysis of the retail raw milk ratings given in Table II. Note that 76 per cent (19) of the 25 communities had preënforcement retail raw milk ratings of 50 or less, whereas in 80 per cent (20) of these communities the present retail raw milk rating is above 90, and none is less than 70.

TABLE III

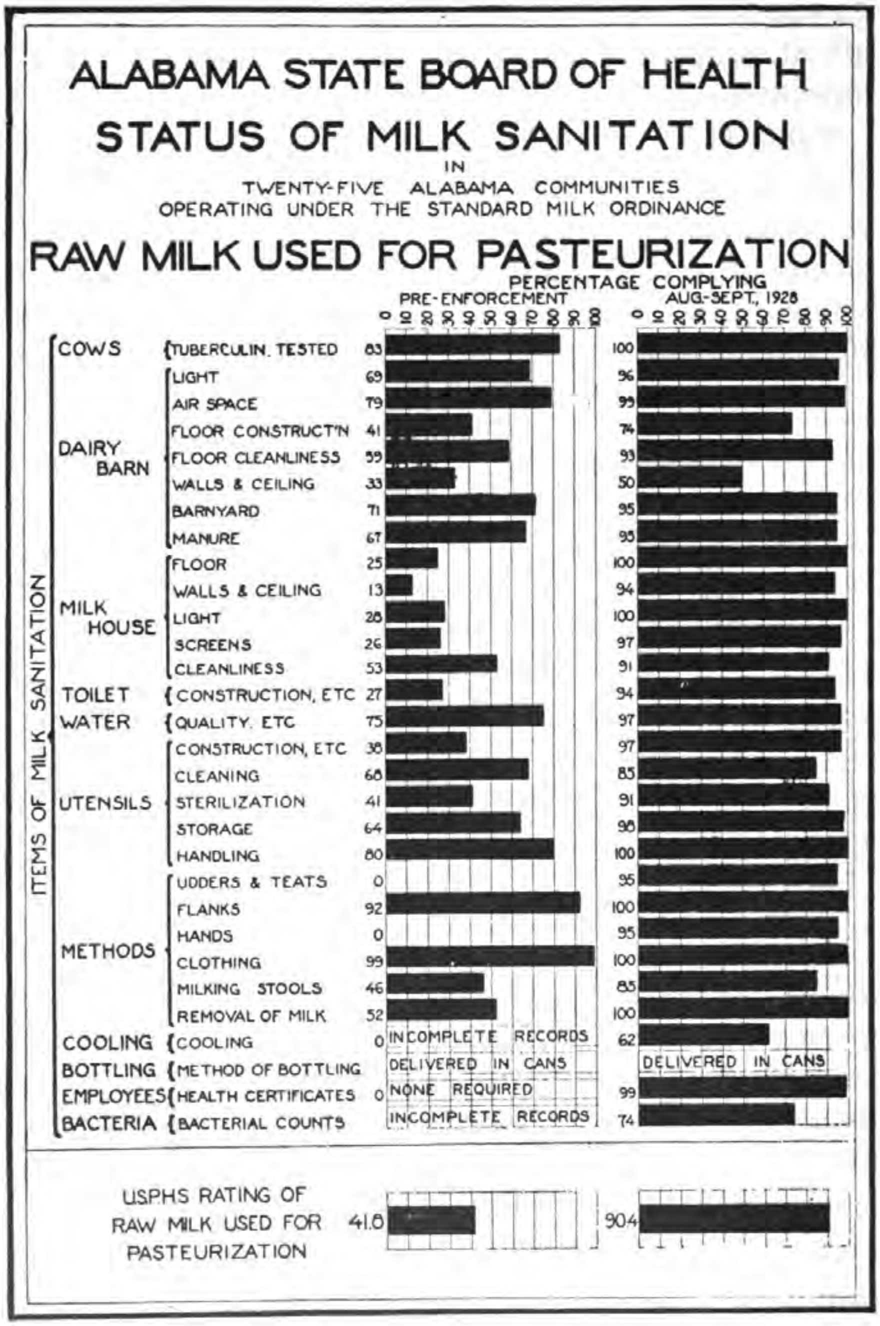
ANALYSIS OF MILK SANITATION RATING IMPROVEMENT

Milk Sanitation Ratings	Percentage of Cities in Each Range Preënforcement	Aug.-Sept., 1928
0.0—20.0	4	—
20.1—30.0	24	—
30.1—40.0	16	—
40.1—50.0	32	—
50.1—60.0	16	—
60.1—70.0	8	—
70.1—80.0	—	4
80.1—90.0	—	16
90.1—100.0	—	80

Improvement in Raw Milk Delivered to Pasteurizing Plants:

Pasteurized milk is now available in nine of the communities included in this report. Plate III indicates the improvement effected in the quality of the milk delivered to the pasteurizing plants. The preënforcement data applies to only four communities. In the other five there was no milk pasteurized at the time the ordinance was passed.

A comparison of Plates II and III will reveal the fact that, except for barn floor construction, barn walls and ceilings, cooling, and bacteria counts, the dairy conditions surrounding the production of milk for pasteurization are almost as good as those under which the retail raw milk is produced.


ALABAMA STATE BOARD OF HEALTH
STATUS OF MILK SANITATION
IN
TWENTY-FIVE ALABAMA COMMUNITIES
OPERATING UNDER THE STANDARD MILK ORDINANCE
RAW MILK USED FOR PASTEURIZATION
PERCENTAGE COMPLYING
PRE-ENFORCEMENT
AUG-SEPT., 1928
ITEMS OF MILK SANITATION
COWS
TUBERCULIN TESTED 83 100
DAIRY BARN
LIGHT 69 96
AIR SPACE 79 99
FLOOR CONSTRUCT'N 41 74
FLOOR CLEANLINESS 59 93
WALLS & CEILING 33 50
BARNYARD 71 95
MANURE 67 95
MILK HOUSE
FLOOR 25 100
WALLS & CEILING 13 94
LIGHT 28 100
SCREENS 26 97
CLEANLINESS 53 91
TOILET
CONSTRUCTION, ETC 27 94
WATER
QUALITY, ETC 75 97
UTENSILS
CONSTRUCTION, ETC 38 97
CLEANING 68 85
STERILIZATION 41 91
STORAGE 64 98
HANDLING 80 100
METHODS
UDDERS & TEATS 0 95
FLANKS 92 100
HANDS 0 95
CLOTHING 99 100
MILKING STOOLS 46 85
REMOVAL OF MILK 52 100
COOLING
COOLING 0 INCOMPLETE RECORDS 62
BOTTLING
METHOD OF BOTTLING DELIVERED IN CANS DELIVERED IN CANS
EMPLOYEES
HEALTH CERTIFICATES 0 NONE REQUIRED 99
BACTERIA
BACTERIAL COUNTS INCOMPLETE RECORDS 74
USPHS RATING OF RAW MILK USED FOR PASTEURIZATION 41.8 90.4

Of the 1,984 samples of raw milk to plants which were examined, the counts of 1,757, or 88.9 per cent, were 200,000 or less per c.c., and 80 per cent of the 1,457 temperature readings were 60 degrees Fahrenheit or lower.

TABLE IV

U. S. PUBLIC HEALTH SERVICE RATINGS OF RAW MILK TO PASTEURIZING PLANTS

City	Sanitation Ratings		Percentage
	Preënforcement	Aug.-Sept., 1928	Improvement
Tuscaloosa	34.0	87.3	157
Gadsden, Alabama City, Attalla	——*	79.3	——
Mobile	0	0	0
Florence	——*	96.3	——
Huntsville	——*	93.6	——
Montgomery	50.3	88.9	77
Selma	0	0	0
Eufaula	0	0	0
Decatur-Albany	——*	91.1	——
Athens	0	0	0
Sheffield-Tuscumbia	——*	87.6	——
Jasper	22.3	88.6	297
Carbon Hill	0	0	0
Troy	0	0	0
Opelika	0	0	0
Atmore	0	0	0
Lanett	0	0	0
Boaz	0	0	0
Albertville	0	0	0
Hartselle	0	0	0
Russellville	0	0	0
Cullman	23.0	91.2	297
Talladega	0	0	0
Demopolis	0	0	0
Auburn	0	0	0
Average	41.8	90.4	116

*In five cities the sale of pasteurized milk was inaugurated after the ordinance had become effective, and the milk supply was obtained from dairies which had been retailing their supplies, or which complied with Grade B requirements before their milk was used.

Table IV shows the improvement in or the present quality of the raw milk used by the plants for pasteurization in the several communities; and indicates that a general improvement in quality from 41.8 to 90.4 in the raw-milk-to-plant rating, or 116 per cent, has been effected.

Improvement in Pasteurizing Plant Conditions:

Plate IV is the composite picture of conditions in the few pasteurizing plants in these same nine communities. There has been in the last two years a very considerable advance in the design and operation requirements for pasteurization machinery demanded by health officials. Accepted practices of two years ago are now considered inadequate. It was therefore necessary to reconstruct our inspection records of four and five years ago in the light of present requirements.

The improvement in the pasteurizing process is the most striking feature of Plate IV, unless it be the improvement in the weighted average pasteurizing plant process rating, from 24.8 during the preënforcement period to 95.3 at present. All of the Alabama pasteurizers are now equipped with both indicating and recording thermometers, and, according to the charts on file, are properly operated; all are equipped with flush valves and leak protectors, or are disconnected during the holding operation, and are steamed before the piping is set up and the vat emptied. Several cooling boards are not yet covered. We have found no foam formation, which is rather surprising to us in view of the reports from other sections.

Of the 541 samples examined, the counts of 86.4 per cent were 50,000 or less per c.c., and 91 per cent of the 457 recorded sample temperatures taken on the delivery routes were 50 degrees Fahrenheit or lower.

Table V pictures the improvement in pasteurizing plant conditions in each of the nine communities. Note that all but one of the ratings are above 90.

Increase in Milk Consumption:

Only part of our objective would have been attained had our results been limited to quality improvement. It

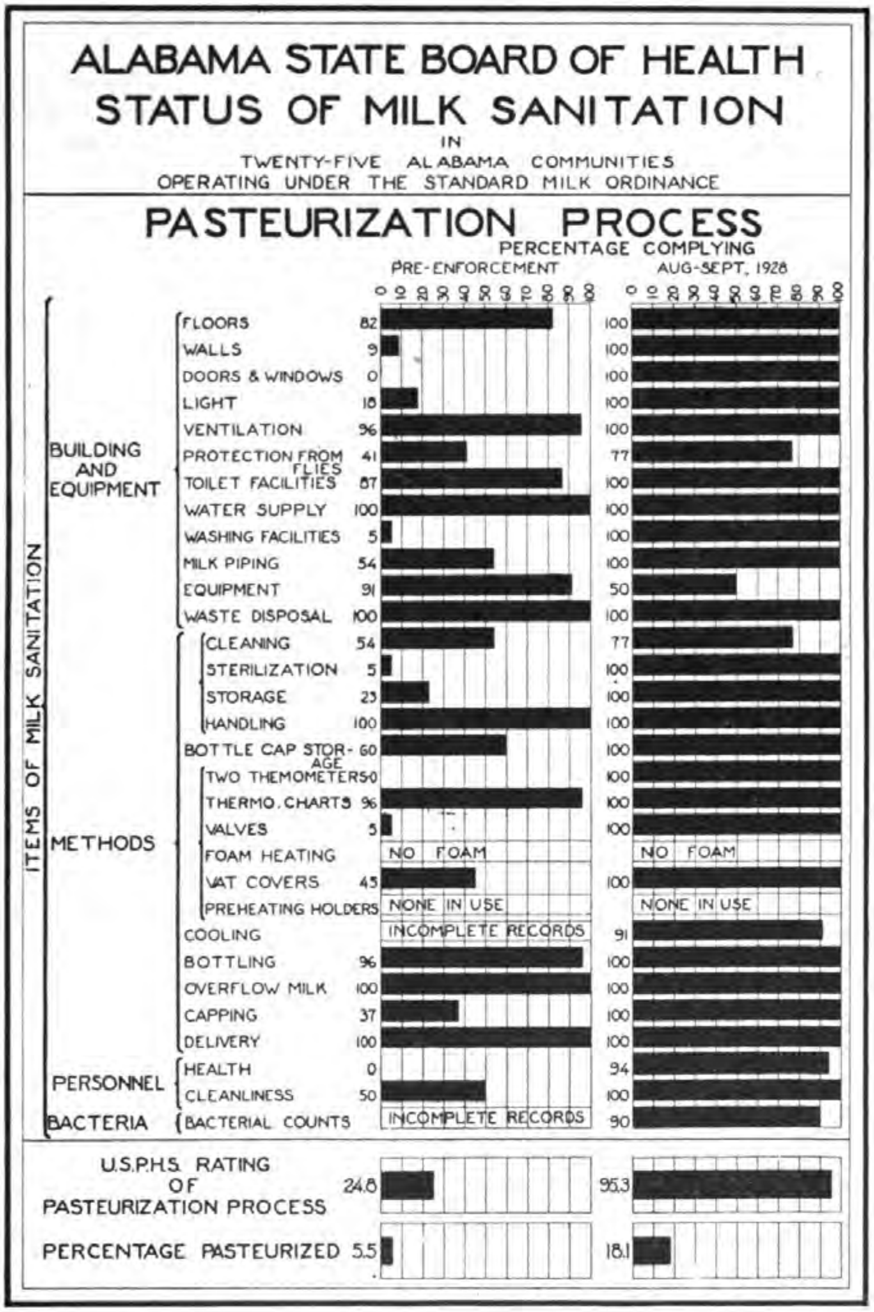

ALABAMA STATE BOARD OF HEALTH
STATUS OF MILK SANITATION
IN
TWENTY-FIVE ALABAMA COMMUNITIES
OPERATING UNDER THE STANDARD MILK ORDINANCE
PASTEURIZATION PROCESS
PERCENTAGE COMPLYING
PRE-ENFORCEMENT
AUG-SEPT, 1928
0 10 20 30 40 50 60 70 80 90 100
ITEMS OF MILK SANITATION
BUILDING AND EQUIPMENT
FLOORS 82 100
WALLS 9 100
DOORS & WINDOWS 0 100
LIGHT 18 100
VENTILATION 96 100
PROTECTION FROM FLIES 41 77
TOILET FACILITIES 87 100
WATER SUPPLY 100 100
WASHING FACILITIES 5 100
MILK PIPING 54 100
EQUIPMENT 91 50
WASTE DISPOSAL 100 100
METHODS
CLEANING 54 77
STERILIZATION 5 100
STORAGE 23 100
HANDLING 100 100
BOTTLE CAP STORAGE 60 100
TWO THEMOMETERS 50 100
THERMO. CHARTS 96 100
VALVES 5 100
FOAM HEATING NO FOAM NO FOAM
VAT COVERS 43 100
PREHEATING HOLDERS NONE IN USE NONE IN USE
COOLING INCOMPLETE RECORDS 91
BOTTLING 96 100
OVERFLOW MILK 100 100
CAPPING 37 100
DELIVERY 100 100
PERSONNEL
HEALTH 0 94
CLEANLINESS 50 100
BACTERIA
BACTERIAL COUNTS INCOMPLETE RECORDS 90
U.S.P.H.S. RATING OF PASTEURIZATION PROCESS 24.8 95.3
PERCENTAGE PASTEURIZED 5.5 18.1

TABLE V

U. S. PUBLIC HEALTH SERVICE RATINGS OF THE PASTEURIZING PLANTS AND PROCESSES

City	Sanitation Ratings Preënforcement	Sanitation Ratings Aug.-Sept., 1928	Percentage Improvement
Tuscaloosa	28.0	90.9	225
Gadsden, Alabama City, Attalla	—*	89.1	—
Mobile	0	0	0
Florence	—*	95.6	—
Huntsville	—*	98.8	—
Montgomery	23.8	94.3	296
Selma	0	0	0
Eufaula	0	0	0
Decatur-Albany	—*	98.2	—
Athens	0	0	0
Sheffield-Tuscumbia	—*	97.6	—
Jasper	19.0	96.7	409
Carbon Hill	0	0	0
Troy	0	0	0
Opelika	0	0	0
Atmore	0	0	0
Lanett	0	0	0
Boaz	0	0	0
Albertville	0	0	0
Hartselle	0	0	0
Russellville	0	0	0
Cullman	32.0	95.0	197
Talladega	0	0	0
Demopolis	0	0	0
Auburn	0	0	0
Average	24.8	95.3	284

* In five cities the sale of pasteurized milk was inaugurated after the ordinance had become effective, and plant conditions met existing requirements before any milk was sold.

is also of public health importance to increase the consumption of milk. That this has been achieved is indicated by Table VI. However, the accuracy of the data of this table should not be overestimated. They are not comparable with the figures given in United States Public Health Service Reprint No. 1144, "Standard Milk Ordinance Results in 14 Alabama Towns," for the following reasons:

(1) That report covers only 12 communities, whereas this paper covers 25, several of which have not had time to experience the increased consumption

brought about by improvement in quality (in some cases the period between preënforcement and the present survey is scarcely six months).

TABLE VI

INCREASE IN MARKET MILK SALES

City	Quantities Preënforcement	Aug.-Sept., 1928	Percentage Increase
Tuscaloosa	630	1,216	93
Gadsden, Alabama City, Attalla	608	881	45
Mobile	2,708	4,451	64
Florence	277	391	41
Huntsville	358	853	138
Montgomery	2,067	3,566	73
Selma	645	814	26
Eufaula	77	149	94
Decatur-Albany	209	523	150
Athens	116	96	−17
Sheffield-Tuscumbia	296	396	34
Jasper	115	243	110
Carbon Hill	39	59	51
Troy	175	311	78
Opelika	222	203	− 9
Atmore	210	159	−24
Lanett	394	432	12
Boaz	28	44	57
Albertville	50	51	2
Hartselle	68	86	26
Russellville	75	80	7
Cullman	135	165	22
Talladega	170	199	17
Demopolis	250	168	−33
Auburn	156	187	20
Total	10,078	15,723	56

(2) The postenforcement figures of Reprint No. 1144 represent the spring milk flood conditions of 1926, whereas those of this paper represent the consumption in a period of milk shortage—a shortage unusually early, in spite of a wet spring and rainy summer; and

(3) An error in the preënforcement figures of Reprint No. 1144 has recently been discovered, in that the preënforcement figures for Montgomery and Mobile were part estimates, and it has since been possible to determine more accurate figures.

Table VI indicates that all except four of the 25 communities have experienced an increase in milk consumption. The four apparent decreases are the result of (1) comparing fall with spring conditions and (2) the fact that school consumption is not included in the post-enforcement figures.

TABLE VII

PERCENTAGE OF MILK PASTEURIZED

City	Percentage Pasteurized Preënforcement	Aug.-Sept., 1928	Percentage Increase
Tuscaloosa	35.7	54.3	52
Gadsden, Alabama City, Attalla	-----	18.1	—
Mobile	0	0	0
Florence	—	72.9	—
Huntsville	—	49.2	—
Montgomery	13.1	19.6	50
Selma	0	0	0
Eufaula	0	0	0
Decatur-Albany	—	57.3	—
Athens	0	0	0
Sheffield-Tuscumbia	—	48.0	—
Jasper	21.7	45.3	109
Carbon Hill	0	0	0
Troy	0	0	0
Opelika	0	0	0
Atmore	0	0	0
Lanett	0	0	0
Boaz	0	0	0
Albertville	0	0	0
Hartselle	0	0	0
Russellville	0	0	0
Cullman	18.5	24.2	31
Talladega	0	0	0
Demopolis	0	0	0
Auburn	0	0	0
Average	5.5	18.1	227

Increase in Pasteurization:

The public health significance of pasteurized milk makes this paper incomplete without a statement concerning the percentages of the supplies in these communities which are pasteurized. Table VII gives these figures. The totals, of course, apply to the entire 25 communities considered in this survey. We are still far from our goal in this phase of our work, but it is to be recalled that most of our communities are small; consumers know their dairymen personally and socially, and patronize them for these reasons; raw milk quality from the layman's standpoint is good; there have been no milk-borne outbreaks of disease in any of these towns in five years; and business men hesitate to invest heavily for pasteurizing plant equipment where the expected volume of output will be low, as is usually the case in small towns. We must be content with gradual progress in the percentage of milk pasteurized.

Summary

This paper may be summarized briefly thus:

Forty-three towns, or 80 per cent of the population of Alabama in towns of 500 or more, enjoy a high-grade protection of their milk supplies; and 40 towns, or 41 per cent of this population, are protected by the Standard Milk Ordinance, the enforcement of which is participated in by the State Board of Health.

The retail raw milk sanitation rating of the total supplies in the 25 communities considered in this paper improved from 46.3 to 92.1, or practically 100 per cent. The sanitation rating of the raw milk delivered to the pasteurizing plants improved from 41.8 to 90.4, or 116 per cent. The sanitation rating of the pasteurizing plant condition and process improved from 24.8 to 95.3, or 284 per cent.

Milk consumption, in the towns in which it could be measured, has increased at least 56 per cent.

The number of towns having pasteurized milk has increased from four to nine, the percentage of milk pasteurized in the 25 communities having increased from 5.5 to 18.1.

"Nothing so needs reforming as other people's habits."

YE LOWLY THERMOMETER

PROF. R. M. WASHBURN, *Chemical Technologist,*
Liquid Dehydration Corporation, Chicago, Ill.

The object of this paper is to stress one fact, to focus attention on one phase of the milk problem.

The first mercury thermometer was devised by the Italian Galileo in 1612. This was sufficiently correct to be of value to chemists. In 1714, Sir Isaac Newton of England and Gabriel Daniel Fahrenheit of Germany almost simultaneously brought forth improvements on Galileo's thermometer. The instrument designed by Fahrenheit was generally considered preferable to that of Newton and has remained in use to this day with very slight modifications. During the past 214 years, therefore, mercury thermometers of present type have been in use. The centigrade thermometer, a product of conference, was brought into existence in 1800, or 128 years ago.

The point of this brief paper is to ask bluntly why it is that after these hundreds of years of experience with thermometers so few milk producers use them or even appreciate the use of them. In a recent survey concerning the quality of milk furnished Minneapolis and St. Paul, the writer inspected about five hundred dairy farms, scoring each by the Government score card or otherwise going intimately into the practices on these farms so far as they pertained to milk production. Most farmers had what they call weather thermometers, but the same individuals did not own dairy thermometers, not even to the extent of three per cent of the milk producers inspected. This statement should be modified to say that of the 106 farmers supplying milk to St. Paul to be consumed raw—that is, not pasteurized—six had thermometers and three occasionally used them, whereas of the 400 farmers who sold milk into Minneapolis, which milk was later to be pasteurized, less than two per cent had dairy thermometers.

A number clearly revealed that they did not know that a "weather" thermometer could be used to take the temperature of water or milk. Two housewives brought forward bath thermometers of Fahrenheit scale, but did not know that the same glass tube arrangement could be used in testing the temperature of water from the well, or milk, or the bread set to rise in the kitchen.

Trained, as we all are, in the use of thermometers in controlling the growth of bacteria, it was disappointing to me that farmers held such exceedingly vague and often incorrect conceptions of the relationship plainly existing between temperatures and plant growth. To fix in their minds the relationship of temperature to growth, I developed a little speech which never missed getting attention and which I believe had something to do with the improved showing made that summer by these milk producers.

I started by recalling to the farmer what he already knew and then building up, somewhat as follows:

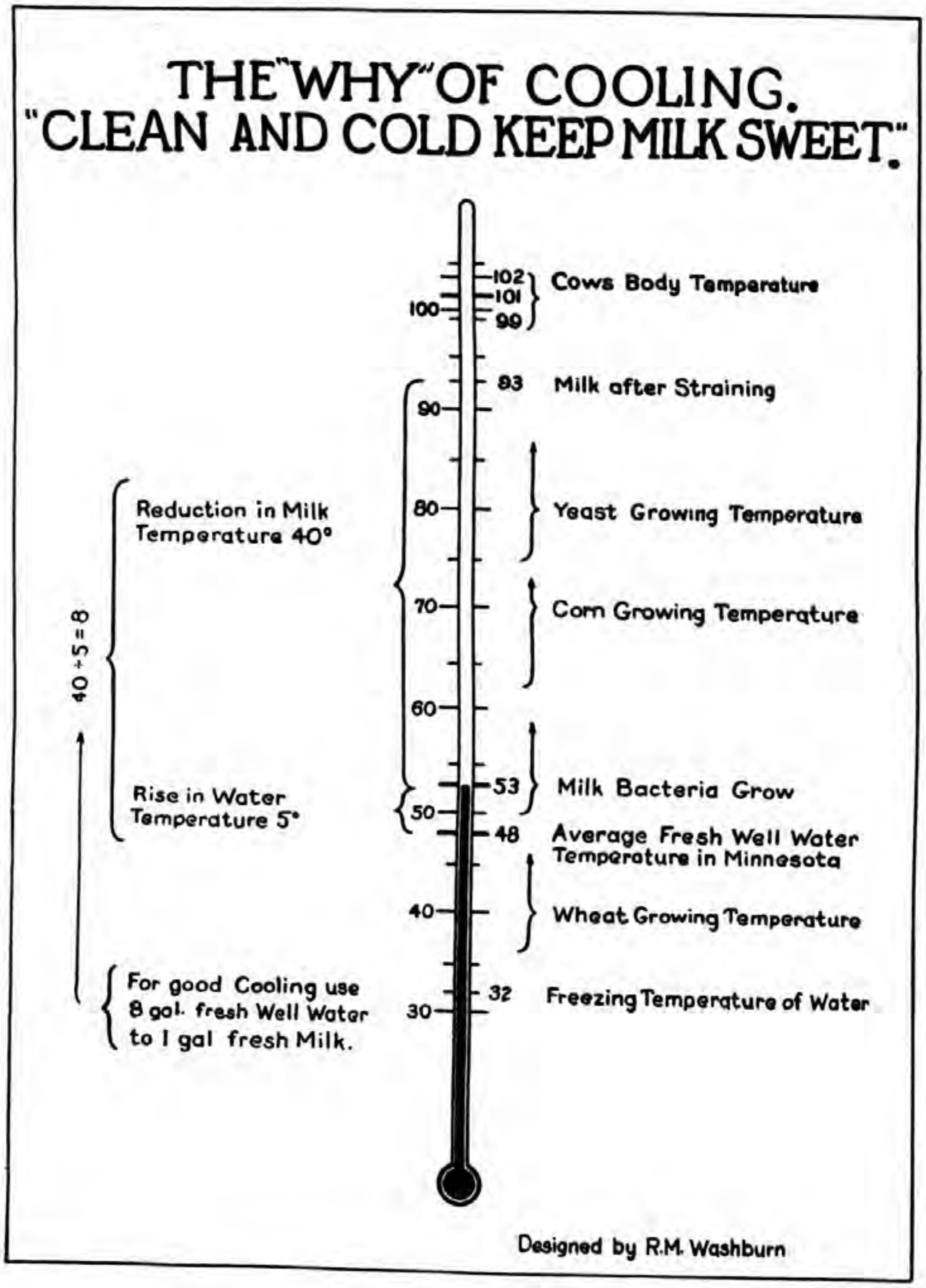
Water freezes at 32°. In winter the grass does not grow. Why? Because too cold. The grass roots are alive all winter but lie dormant. In spring the pasture grass shows green, first on the south slope where it gets warm first, and later on the north slope. Wheat is sown in the very early spring because it will germinate and even grow at 40° or lower. What would corn do if planted when wheat is sown? It would rot, of course, because too cold. At what temperature will corn sprout? At about 65°. At what temperature will it grow thriftily? At about 75°, better at 80°. The yeast that makes the bread rise is a mass of plants also. If the dough gets too cold it will sour before rising. If too warm, the yeast grows too fast and the sponge becomes coarse and strong-flavored. What, then, is the most desirable temperature for bread yeast? About 80°. If much higher, growth is too rapid, and if much lower, the growth is too slow, because it is the nature of the yeast plant to thrive only under such temperature conditions. We cannot change the nature of these various plants but we can adapt the conditions to the needs of the plant, whether the plant is wheat, corn, or yeast.

Several women were delighted to learn the relationship between temperature and yeast growth, which would enable them to keep their bread dough at favorable temperature.

Bacteria are plants also. There are many varieties of them, just as there are a great many kinds of grass, weeds, and trees. Some bacteria grow best at high temperatures, others at lower temperatures, but there are very few indeed which can grow at all rapidly at a temperature of 50° or lower. Above 50°, the higher the temperature, the faster the growth within the limits of summer heat.

What is the temperature of a cow on the inside? What is the temperature of her milk? These vary from 100° to 102°, with an average of about 101°. Some bacteria of several kinds always get into the milk. If the milk is left warm, the germs grow and the milk sours. If cooled promptly to a cold enough temperature, the bacteria cannot grow rapidly enough to be harmful, just as grass cannot grow below freezing and just as the corn cannot grow much below 60°. Thus the necessity for cooling to a fairly low degree is made a natural part of their thinking.

Water is universally used in the North for the cooling of milk, and very properly so. It is our cheapest cooling agent. In Minnesota, the temperature of the well water in the summer time varies from 46° to 50°, with an aver-


THE "WHY" OF COOLING.
"CLEAN AND COLD KEEP MILK SWEET."
102
101
100
99
Cows Body Temperature
93
Milk after Straining
90
80
Yeast Growing Temperature
70
Corn Growing Temperature
60
53
Milk Bacteria Grow
50
48
Average Fresh Well Water Temperature in Minnesota
40
Wheat Growing Temperature
32
Freezing Temperature of Water
30
Reduction in Milk Temperature 40°
Rise in Water Temperature 5°
40 ÷ 5 = 8
For good Cooling use 8 gal. fresh Well Water to 1 gal fresh Milk.
Designed by R.M. Washburn

age of about 48°. In the winter the temperature is from two to three degrees lower. If, therefore, we set the highest point at which milk may be properly stored at 53° and the cows' milk at the time of straining at 93°, the milk must be cooled down through a range of 40°, while the water is being warmed up from 48° to 53°, or 5°. Thus we have 40° divided by 5° equals 8, which is about the number of gallons of water which will be required to cool one gallon of milk down to the temperature of slow bacteria growth.

Eight times as much water as milk seems like a lot, but on the average would be required for first-class work. When the reasons for the cooling are explained in terms of temperature at which growth takes place, and especially when this germ growth is well connected up with the growth of grass and field crops, the farmer appreciates what is taking place much more clearly, in my judgment, than he possibly can if the dairy side only is presented to him.

This whole scheme of relationship of temperature to growths I have attempted to depict in the graph. In the great Southland, just now coming into dairying, water is much warmer and the problems more acute, but the principles involved are the same. I used the same chart with the farmers, explaining as I drew the picture.

Some very amusing arguments were presented and superstitions brought forth, all, it seemed, because the farmers had never had the question of germ growth and milk quality taught to them in terms of their other practices. A few of the superstitions or the fallacies listened to with as much kindly patience as possible were as follows:

Thunder sours milk. Air, even hot air, blowing past a dry milk can will cool the milk within. A large cow tank filled with water at 70° will cool milk down to 55° because there is so much water in comparison to the amount of milk. Spring water is always cold, even though it be drawn down a hill or rammed up a hill several rods. Milk cooled with ice will sour quicker than the same milk cooled to the same degree with water. Running water will always register cooler than the same water standing still. And so on through numerous fallacies that could be easily proved to be such.

I found several dairymen whose milk had been rejected, and on investigation found that the water in which they had attempted to cool the milk had been drawn from a cistern on the hillside. Fresh well water at those places registered 47° to 48°, but was pumped first to the hillside cistern, whence it was piped into the house, barn, or dairy. The temperatures of water actually used for cooling purposes, in numerous cases, were so high that the water could not possibly cool the milk below the growth temperature. The milk had to be rejected. Thus the farmer lost money and lost interest. The dealer lost labor and confidence and the consumer lost the milk, and because of it paid a higher price for that which he did get. But even these points all taken together are not the saddest feature to me, but rather this: that there is so little being done by any responsible agency to correct the practice and to prevent the malpractice of the present generation being builded into the habits of the next generation.

I found farmers with thick-walled concrete tanks exposed to the sun, standing mostly empty during the warm day, which would absorb so much heat that when fresh water was pumped in that night, the thick walls of the tank itself warmed the water even before the milk was set into it. Rejected milk and complaints followed, of course. Shading the tank was sufficient in many instances to prevent further loss. Because fresh pumped water had been used, the farmer had assumed that the milk got the benefit of it, all because he was not accustomed to the use of the thermometer.

In nearly every farm home there are two or more calendars. The top portion of the calendar is used to advertise something. Occasionally farm machinery or a local bank is advertised, but more often a patent medicine. As I saw these things hanging on the walls, useless or of small value, I visualized on the top part of these hundreds, yes, thousands of calendars, some device similar to this chart, which would stand there month after month telling its story of the relationship between temperature and plant growth, its story of cause and effect, to the young people.

I found a few dairies in which everything was dirty, in which contamination was exceedingly high, and yet in which there had been no complaint of sour milk because there had been a wonderfully efficient system of cooling; and I found numerous places in which everything was clean—cows, pails, cans, and hands—and yet in which there had been frequent loss by sour milk. We are all accustomed to the score card and to the use of certain admonitions of cleanliness, but frankly, within the limits of common decency as to cleanliness, the question of cooling the milk quickly and thoroughly is far more important than the question of cleanliness when high acid or high count is to be used as a gage of quality.

At another time I enlisted the cooperation of 20 good housewives among my neighbors, and kept tab on the temperature of home ice chests or so-called refrigerators. As a result, the average temperature was found to be about 60°, often 65° to 70°. The name "refrigerator" is a misnomer; they are slow incubators. Yet if the housewife would set the bottle of milk into a deep dish, and into the dish drop a chunk of ice, then fill the dish with water and set dish and milk in the ice box, the milk would keep sweet four or five times as long as it will if merely set in the cool air of the ice chest.

Both producer and consumer certainly need a lot of educating in the use of the common thermometer.

"The latest gospel in the world is 'Know thy work and do it.'"

REPORTS OF DELEGATES TO WORLD'S DAIRY CONGRESS—I.

PAUL B. BROOKS, M. D.,
Deputy Commissioner of Health of the
State of New York, Albany, N. Y.

The Congress opened officially in London on June 26. I was one of a party of fourteen, including the ladies, that took what was referred to as the "pre-congress" trip, sailing from Quebec on May 26, traveling through Jersey, Guernsey, Northern France, Belgium, and Holland, and arriving in London in time for the opening of the Congress. This was a "conducted" trip with a strenuous travel program and entertainment at every turn, and when we arrived in London for the real beginning of activities, most of us were pretty well tired out.

The Congress was attended by people from nearly every part of the world interested in all phases of dairying. The agricultural and commercial sides were featured rather more prominently than the sanitary. The Congress consisted first of a series of meetings—approximately one week in London, two days at Reading, where the meetings were held at the University, and one day in Edinburgh—and a series of side trips to dairy farms, milk plants, and other places of interest. There were trips arranged for practically every day, including Saturdays and Sundays, and on some days there were from ten to fifteen from which to make a selection. Following the Congress a party of about 200 went up through Scotland and the Scottish lakes, and back through the English lake region. The latter was said to be very beautiful, but unfortunately it rained on the day when we made the trip and at the point which was supposed to be most picturesque the fog was so thick that we were unable to see much beyond the sides of the busses. Later a party of about fifty of us spent nine days in Ireland. Others who went over just in time for the opening of the Congress took trips later to other parts of Europe.

Feeling my responsibility as a delegate, I made conscientious efforts to attend the meetings. The official languages at the Congress were French, German, and English. Unfortunately, I could understand neither French nor German. In the aggregate I probably put in a day and a half at the meetings. However, the papers were all printed, and I am going through them gradually. I found it necessary to devote a good deal of my time, while the meetings were going on, to making arrangements for the trips which I hoped to take later in the day. I always got somewhere, but not always where I had planned to go. In this connection, the trips during and after the Congress were handled by Thomas Cook & Sons in conjunction with the Congress management. We had some experiences which were disconcerting at the time, as when our party of 200 arrived in Edinburgh and we were distributed among the several hotels, arriving at the hotels with our baggage at about the time when an official reception was supposed to be starting, and several of the party, including fifteen Americans, found that no room reservations had been made for them. I do not feel so inclined to be critical, looking at the matter in retrospect, as I did at the time, and everything went along as well as it could under the circumstances, but it was evident that the Cooks had a rather larger job on their hands than they were prepared to handle.

We were entertained royally everywhere. There was a continuous round of receptions, banquets, luncheons, and afternoon teas, and all of us were thoroughly impressed with the spirit of hospitality that we encountered. Personally, being somewhat of a retiring disposition and not greatly given to social activities, I found it rather wearing. Notwithstanding the fact that we were fed several times a day I discovered when I had reached home that I had lost five pounds.

I think I should say something about the status of delegates. In the preliminary notices of the Congress, the delegates were classified into three groups: (1) Official delegates, these being "government" representatives; (2) Association delegates or those delegated by "local authorities" and associations; and (3) Member delegates, a group which included all not in either of the other groups. There were approximately forty representing the United States Government, and it appeared that only two or three were expected. I gained this latter impression from the fact that at a banquet for official delegates, places were provided for only two or three, when I understand that the group had to elect a smaller group to represent them. In other words, there was something of an excess of delegates. When we who were representing States and this Association arrived and presented our credentials, the question arose as to whether or not we were official delegates, and it was decided that we were not. We received the same badge which was given to every one who had paid his membership fee. In other words, no delegates other than those representing national governments had any official standing.

I noted a few observations, mostly relating to milk, which I thought might be of interest. First, let me say that the attendance at meetings was not at all like that at the meeting of this Association, where every one comes early and attends every session. A good deal of the time, while the meetings were going on, I should say at least a third of the group was "milling around" outside, engaged in conversation or trying to make arrangements for the trips they hoped to take.

Referring to milk, it was evident from some of the papers and exhibits that a systematic effort is being made in some of the European countries, and particularly in England, to stimulate increased consumption of milk. In some of the countries they are working under great difficulties. Dr. Van Norman referred last night to the marked improvement in milk sanitation that he noted in Great Britain, comparing conditions on this last visit with those prevailing when he was over a few years before. I also had an opportunity to visit several very good milk plants. I missed the one in London to which he referred, but in Belfast I visited a very fine plant not unlike one of those we visited this afternoon. This, like several others, was largely equipped with American machinery. They were employing a bacteriologist, trained at the University of Reading, and in the plant were doing excellent work. We also visited several fine dairy farms and, as Doctor Van Norman said, some "certified" milk is now being sold in England, particularly in London. The standard, I believe, differs somewhat from ours. We were able to pick up some very good points. At one dairy they were paying employees a weekly bonus for low bacteria counts, apparently with very good results. In general, however, it seemed to be admitted that farm conditions are bad. There are a great many small farms handling only a little milk where there is little effort at sanitation, and no cooling. An effort is being made to improve conditions in many sections, but usually they depend on pasteurization at a high temperature for safety. As a rule, no bacteria counts appeared to be made before pasteurization.

In France very little fluid milk is used for beverage purposes, most of the milk being made into butter and, in the section which we visited, into Camembert cheese. In Paris we visited a large plant maintained by the company said to handle about a third of the city's milk supply. All of it is sold as loose milk through stores, and is pasteurized. We visited one of these stores and found it very clean and attractive in appearance, but the milk was more or less exposed in a large container, on which were hanging measures running from the equivalent of a quart down to one ounce. In this plant they were putting up what was termed "sweet" cream in pasteboard containers. According to our standard, the cream was actually sour before it left the plant. They were also putting up in bottles, similar to our "pop" bottles, a sweetened milk for babies. This was sterilized at a high temperature and it was said that it would keep for a month or more. There was a great lack of labor-saving machinery, and we saw butter bricks being weighed, formed, and wrapped by thirty or more people, where one machine would have done the job. We saw one such machine elsewhere, and were told that probably it was the only one in France. This Paris plant had a very fine dairy farm just outside of the city, the milk from this farm being used in making first-quality butter.

In Scarbeck, one of the "boroughs" of the City of Brussels, we witnessed a milk inspection. Periodically the milk dealers in a stated area were notified through the police to come to a station for inspection before starting out on their routes in the morning. Most of the dependence was placed on visual inspection and sediment tests. There are no official bacterial standards, and in fact no law authorizing inspection or milk control. This system of inspection was said to have been started by the Germans during the war, and something apparently is being accomplished. I noticed one dealer particularly, a woman, who had one small can of milk on a cart drawn by a dog, and was told that some of the dealers probably would not net more than 20 cents on their day's sales.

"Those who cannot themselves observe can at least acquire the observation of others."

REPORTS OF DELEGATES TO WORLD'S DAIRY CONGRESS—II

THOMAS HOLT, *State Dairy and Food Commissioner,*
Hartford, Conn.

As soon as I received my appointment to attend the World's Dairy Congress at London, I was favorably impressed with the idea of going by the St. Lawrence route, and made arrangements accordingly. By this route we traveled two days and nights down the St. Lawrence River and Bay, stopping at Quebec for passengers and mail. About three days before sailing date, we received a letter from Dr. Hucker, of Geneva, the leader of the delegates sailing on the *Duchess of Bedford,* advising us that the mayor of Montreal had invited all delegates to the World's Dairy Congress sailing on the *Duchess of Bedford,* June 15, to be his guests on June 14, the ladies to go on a sightseeing trip and the men to visit milk plants in Montreal. We visited several pasteurizing plants and I believe we were all impressed with the idea that they are being very carefully operated since the terrible epidemic of typhoid fever.

The plants we visited were naturally among the best and were evidently doing very good work, but with a meager amount of control. They were using American machinery for the most part but adapted for Canada on account of the Imperial Measure and bottles larger than ours. The volume of milk consumed is very much less than before the epidemic and it will doubtless take years for its effect to wear away. We certainly were indebted to the mayor of Montreal for the fine reception he gave us.

We sailed from Montreal at 10 A.M., June 15, and on the 19th Doctor Hucker called the delegates together on shipboard for a conference on matters pertaining to the Congress to be held in London. We arrived at Liverpool fully one day ahead of time. As our ship was new and on her maiden voyage, they evidently had underestimated her speed.

Having been a resident of a manufacturing district 50 miles from Liverpool during my youth and still having relatives living there, I naturally wanted to spend my time there until the convening of the Congress in London on June 26. I wanted to investigate conditions and compare them with those of nearly fifty years ago. Practically the only difference observed was in their delivery carts; they use a low-down, one-horse spring cart which they call a float, low enough so the driver can hop on behind and between two large milk cans that are strapped to the cart. This vehicle in most cases is rubber-tired, grained and varnished, and kept clean. The large cans have two brass bands around them and brass faucets, and these and the brass hames on the harness are highly polished. They use the same style of measure and eight-quart peddling can they used when I was a boy. There is no provision for agitating the milk. They draw the milk from a faucet, exposed to street dirt, but they don't seem to mind it.

There is very little control by public officials of production and distribution of milk, except that they look out very diligently for watered milk, and a fine of about ten pounds, or fifty dollars, is generally imposed for any one guilty of selling watered milk.

The farming is practically the same as it was 50 years ago, with the exception that they do use mowing machines to cut the grass instead of scythes. Practically every farmer sells his own milk direct, some twice a day, others in the morning or at night. There is plenty of competition and probably none of them do enough business to get ahead financially. Milk is sold for 6d., or 12 cts., per Imperial quart. There is a firm from a town about twenty miles away which is trying to introduce the sale of milk in bottles, but is making rather slow progress. This is about the story of the milk business as conducted in places up to 50,000 population.

On Tuesday, June 26, we journeyed to London, a distance of practically two hundred miles, to attend the World's Dairy Congress, and on arrival found registration in full swing, with nearly two thousand delegates trying to register where only fifteen hundred were expected. The Congress was really opened in joint session on Wednesday morning by the Right Hon. Walter Guinness, M. P., Minister of Agriculture and Fisheries, after which sectional meetings were held in different rooms in Central Westminster Hall until about 12:30, when we adjourned for lunch.

Each morning was given up to papers and discussion. Lunch could be procured in the basement, and the afternoons were given up to visiting farms outside of London or milk plants in London. These tours were well planned and were well patronized. Every tour was described in the program, so you could make your choice. About three plants or farms were scheduled for each tour in the afternoons, and the last plant or farm visited served tea, which of course, in England means a meal. Tickets were purchased in advance for the tours and there were always plenty of chars-à-bancs or busses to meet all requirements.

The Kerry cows at Sir John Fitzgerald's certified farm at Stanmore were larger than expected, a little larger than the Jerseys and not quite so large as the Guernseys, and they seemed to be producing a good quantity of milk, an average of 7,200 pounds per annum for the herd, averaging 4.2 per cent fat, with very little grain fed in summer. The English pastures are marvelous and the cows certainly do not have to spend much time grazing. The grass is so thick one can scarcely see the ground.

Most of the milk produced in England is from milking Shorthorns, and the reason is not far to seek, for they can nearly always purchase a new milch cow with the cash secured from a dry one sold for beef. Very few commercial dairies raise their own cows. They are raised in northern counties, a distance from milk markets, and are generally kept two lactation periods before being placed on the market. The Friesians mentioned are registered with the British Friesian Association, and while they have the color and, to some extent, the formation of the Holstein-Friesians in this country, yet they are only medium in size and have been bred for butter-fat. Their milk averages 3.7 to 3.8 per cent fat. They are not very popular, as they do not produce beef as well as do the Shorthorns.

There were 25 distributing plants on the list for visitation, and while some of them were crude in their methods, yet I feel it my duty to mention two which I had the privilege of inspecting minutely. In one case I was with seven other Americans, and in the other instance I visited with only one other to look the plant over. The largest plant was owned by the United Dairies, where milk was pasteurized and bottled for wholesale trade only. They were putting out 200,000 Imperial quarts daily, which would equal 250,000 of our quarts. This is a splendid plant in every way, and we have no better in this country. They have been very generous in laying out their buildings, as they have plenty of room for everything. They have a machine shop in connection with the plant where they not only do all their repair work but actually build new machinery. The same group of men under a different company name have a very large factory where they manufacture bottles, caps, and cases and ship goods all over the country.

The other milk plant was also owned by the United Dairies. Here they prepared milk for retail distribution from wagons, bicycle wagons, and push carts. Some of the latter put out as much as 400 Imperial quarts daily. This was a very well managed plant. A special feature connected with this plant was the fifty cottages for employees, with sports grounds and gardens, giving a very beautiful effect and undoubtedly increasing the use of milk from that plant. It is my belief that the great success of the United Dairies lies in the fact that they use either American machinery or machines made after American patterns in their own shops; also that every man holding any important position spent at least a year in American milk plants learning the business. This company owns ten plants in London, but I understand the two mentioned are the outstanding plants. All this has been accomplished since they received their inspiration at the World's Dairy Congress held in America five years ago.

The United Dairies are certainly to be commended for the forward steps they have taken, with practically no city or national control. The men at the head really have a desire to do everything to safeguard the public health. Most of the milk comes by train, but glass-lined tanks are coming into use very rapidly between these two plants and the country stations. They are shipping milk from a distance of 150 miles. These concerns handle some certified milk. They also have "Grade A" and "Grade A from tuberculin-tested cows." Ordinary milk sells for 6d. (12 cts.) per Imperial quart, and "Grade A" for 50 per cent more, with certified double price. (Three Imperial quarts equal four of ours.)

On our visits to certified farms, we found dairymaids doing most of the milk room work and in many instances doing the milking. It is said they are better sanitarians than the men, and owing to the fact that there are three million more women than men in the United Kingdom, the supply is not likely to run out. In some of the certified dairies a weekly bonus is paid employees for low bacteria count, ranging from four shillings down, which works very nicely, as all are anxious to secure it and it makes them all look out for the other employees to see that they observe proper sanitary precautions to keep the milk low in bacteria.

I personally spent two days in Liverpool visiting dairy plants, and found they are not to be compared to those of London. One of the largest plants there does a lot of advertising about food value of milk, etc., but they do not mention the fact that their milk is pasteurized. When questioned on this point they said they didn't dare; the people would not buy it, as they have not been educated in regard to the qualities of pasteurized milk. The method of pasteurization in Liverpool has but little to recommend it.

The County of Cheshire produces most of the milk. It is pasteurized there in one of their plants, and after pasteurization is placed in cans and taken to Liverpool for bottling. The amount brought direct to the Liverpool plant is put through a flash pasteurizer, and this is by far the best plant in Liverpool, which is a very large city. A large portion of their milk is still sold raw and handled in very crude fashion. In every large city some sterilized milk is sold, usually in rubber-stoppered bottles similar to the ones used here largely for soft drinks. These are filled about three-fourths full and then put in water and brought to the boiling point.

There appears to be much less contagious disease among cows on the farm than in the States, possibly for two reasons: They have always had stone, concrete, or brick construction in their stables, which is much easier to keep sanitary than wood. Also, in the large dairy herds they usually keep the cows one lactation period only, and the troubles that might be perpetuated are ended on the butcher's block. The large bulk of the milk business is still carried on in a very primitive fashion. Their stables are unhandy for the most part. The cows are tied by the neck, with the mangers against the wall, necessitating the carrying of feed from behind, which means much waste of feed and labor. In spite of this, however, it can be said that their animals, whether cows in dairy barns or horses on the street, nearly always look well cared for, and one seldom sees any creatures showing their bony outline.

If one wants to see real show animals, a visit to the Annual Royal Agriculture Show will satisfy his longings. The show this year was at Nottingham and the sight presented fairly beggars description. One might spend a whole week there and still fail to see all worth while in livestock and machinery. A large room was set apart for delegates to the World's Dairy Congress, and it was almost like a reunion of the delegates who had been scattered for a few days. The King and Queen of England visited the show on the second day, which of course drew quite a crowd.

On the whole, England is very much behind the States in milk handling, and their milk consumption per capita is less than half that of the United States. England set a wonderful pace for other nations in entertaining delegates to the World's Dairy Congress. London lends itself admirably for gatherings of this kind, both on account of the central location and its ability to absorb a large number of visitors without crowding and a large number of interesting places that can be reached within a few miles. If the holding of a World's Dairy Congress has the effect of stimulating a desire on the part of public officials to properly supervise the production and distribution of milk, which in turn will have a tendency to increase the consumption of milk, especially by children, it will mean much for the physical well-being of the human race, and the holding of a World's Dairy Congress will not have been in vain.

"When I was at home, I was in a better place; but travelers must be content."

MILK GRADES

DR. WARREN F. FOX,* *Health Officer*, Pasadena, Cal.,
and DR. J. L. POMEROY, *County Health Officer*,
Los Angeles, Cal.

We will all agree that milk is an indispensable food, the one food above all others that is most important to mankind. We will all agree that every known safeguard should be thrown around the production and distribution of milk, whether certified, raw, or pasteurized. We will all agree that milk for human consumption should be from nonreacting tuberculin-tested cows. We will all agree that as milk is a perishable product, it should reach the consumer properly cooled and with a low bacterial count. Many of us will agree that all milk handlers should be examined.

There are, however, many divergent viewpoints regarding the grading of milk. There are enthusiasts for certified milk, for raw milk, and for pasteurized milk. In any discussion of milk grading we must not forget that conditions vary in different parts of the country. Some communities, in view of the long distance which milk has to be hauled, can only have pasteurized milk and possibly a small supply of certified milk. Other communities can have raw milk of a high grade quality. Rural sections, likewise, may have only a raw milk supply available.

As health officers we should insist, and do insist, that the community we serve shall have a clean, safe, wholesome milk supply. We are not primarily interested in milk from the commercial angle, and "sales resistance" means nothing to us; neither do we sell milk. But we

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will work with the dairy industry to increase the per capita consumption of milk and to raise the standards of milk to a higher plane.

Let us consider for a moment what the authorities of the United States Government have to say regarding grades of milk:

The United States Department of Agriculture takes as the standard for milk (1) "the whole, clean, lacteal secretion obtained by the complete milking of one or more healthy cows, properly fed and kept, excluding that obtained within 15 days before and 5 days after calving, or such longer period as may be necessary to render the milk practically colostrum free."

Mendenhall, of the United States Department of Labor (2), in "Milk the Indispensable Food for Children," states:

"It is left to the State (3) or the city to set up further standards to protect consumers of milk against fraud and disease and to insure that proper methods are used in the production, handling, and transportation of milk. The regulation of milk and milk supplies, with other public-health protection, is part of the police power of the State, as the United States Supreme Court has decided on several occasions. (4)."

The United States Public Health Service has prepared a Standard Milk Ordinance which has been enacted as a local ordinance by over two hundred American communities. This ordinance has been adopted as a standard since 1922 by the State Boards of Health of Alabama, Texas, Virginia, Kentucky, Tennessee, South Carolina, Missouri, North Carolina, Arkansas, Louisiana, West Virginia, Arizona, Mississippi, and Oklahoma. The results of the operation of this ordinance have been discussed by different speakers at this convention. The Standard Milk Ordinance provides for the following grades of milk: Certified milk, Grade A raw milk, Grade

B raw milk, Grade C raw milk, Grade D raw milk, Grade A pasteurized milk, Grade B pasteurized milk, Grade C pasteurized milk.

It might be of interest to contrast the grading of milk in New York State and in California. Chapter III of the Sanitary Code of New York State was amended to take effect July 1, 1928. Of particular interest are the requirements for the various grades of milk, of which there are five; namely, Pasteurized Grade A, Certified, Pasteurized Grade B, Unpasteurized Tuberculin Tested, Unpasteurized not Tuberculin Tested. Specifically, the requirements are as follows:

Pasteurized Grade A: The bacterial count before pasteurization shall not exceed 100,000 colonies if the milk is pasteurized at the place of production; if the milk is shipped by rail before pasteurization the count shall not exceed 200,000. After pasteurization the count shall not exceed 30,000 colonies. The pasteurizing plant must be inspected and approved by a representative of the State Commissioner of Health. Employees handling milk during or after pasteurization are required to submit to the health officer for examination such specimens of bodily discharges as he may prescribe. The milk must be delivered in bottles (with certain exceptions) within 36 hours after pasteurization.

Certified: This grade of milk must conform to the requirements of the American Association of Certified Milk Commissions. In addition the county milk commission must be registered with names and addresses of members with the State Department of Health. County commissions are also required to report to the health officer monthly results of bacterial counts, examinations of milk handlers, tuberculin tests and physical examinations of cattle; and failure on the part of any county commission to function in accordance with the above requirements is made ground for refusal of the health officer to issue a permit based on its certification.

Pasteurized Grade B: The colony count before pasteurization shall not exceed 300,000; when pasteurized after shipment by rail the count shall not exceed 750,000. After pasteurization the count shall not be more than 50,000. Such milk must be delivered within 48 hours after pasteurization in bottles only (with certain exceptions).

Unpasteurized Tuberculin Tested: Bacterial count shall not exceed 20,000 colonies. All employees shall, "previous to employment and as often thereafter as the health officer shall require," submit for examination such specimens of body discharges to the health officer as he may prescribe. Such milk shall be delivered within 36 hours after milking in bottles only (with certain exceptions).

Unpasteurized not Tuberculin Tested: The requirements are identical with those for unpasteurized tuberculin tested.

The authors will not attempt to discuss all the grades of milk in California, but will review the situation in the State. At present six grades of milk are allowed, if under an approved milk inspection department; namely, Certified milk, Guaranteed raw milk, Guaranteed pasteurized milk, Grade A raw milk, Grade A pasteurized milk, Grade B pasteurized milk. All ungraded milk is sold as market milk, either raw or pasteurized, in cities and counties not having an approved milk inspection department.

Certified milk is market milk which conforms to the rules, regulations, methods, and standards for the production and distribution of certified milk adopted by the American Association of Medical Milk Commissions and must bear the certification of a milk commission appointed by a county medical association, organized under and approved by the medical society of the State of California, and must otherwise conform to the requirement of the so-called certified milk act, approved April 25, 1913. (Stats. 1913, p. 83.) (5)

Guaranteed milk, if raw, shall be from nonreacting, tuberculin-tested cows, produced on a dairy which scores not less than 90 per cent, bottled on the premises where produced, delivered in containers having the pouring lip completely protected from contamination, and cooled immediately after milking to 50° F. or less and so maintained until delivered to the consumer, when it shall contain not more than 15,000 bacteria per c.c. and not less than 3.5 per cent milk fat. Physical examination of employees is also provided for. If pasteurized, Guaranteed milk shall conform with all the provisions of raw Guaranteed milk, except with respect to bottling at the ranch where produced and except it shall contain not more than 3,000 bacteria per c.c. at the time of delivery to the consumer.

Grade A raw milk shall be from nonreacting tuberculin-tested cows, produced on dairies that score not less than 80 per cent, and containing not more than 50,000 bacteria per c.c. at the time of delivery to the consumer. Physical examination of employees may be made.

Grade A pasteurized milk shall be produced on dairies that score not less than 70 per cent, and shall contain not more than 150,000 bacteria per c.c. before pasteurization and not more than 15,000 bacteria per c.c. at the time of delivery to the consumer. The health of the cows shall be determined by physical examination at least once in six months by an official representative of an approved milk inspection department.

Grade B milk is market milk which shall conform to the following minimum requirements: The health of the cows shall be determined by physical examination at least once in six months. The milk shall be produced in dairies that score not less than 60 per cent, shall always be pasteurized, and shall contain not more than 1,000,000 bacteria per c.c. before pasteurization and not more than 50,000 bacteria per c.c. at the time of delivery to the consumer, and shall be sold only in cans to the wholesale trade to be used for cooking and baking purposes.

Let us ask ourselves: What does the grading of milk imply? Does it mean that one grade of milk is richer in quality than another? Does it signify that one grade of milk is cleaner and safer than another? Why does one grade of milk command a better market price than another? In other words, upon what do we base our grading of milk?

First of all, the grading of milk is based upon the health of the cows, whether they are tuberculin-tested or not and free from disease, how often they are physically examined, and what care is taken of them. Then the inspection of the dairy farms and the methods of production and distribution of the milk are taken into consideration. This includes inspection of creameries and all other milk plants. Finally, laboratory examination of the milk is an important factor in determining the grade of any given milk supply.

Do we, as health officers, consider the milk problem as seriously as we do the water problem and the problem of the disposal of sewage? What about our governing bodies and our citizens in general? Are they as interested in milk and milk control measures as they should be?

We raise these questions because we believe that much more rapid progress in the dairy industry can be made if a greater interest is shown by our governing bodies and our fellow citizens in public health generally. In no way whatsoever should this be construed as an attack on any legislative or governing body. Our Federal and State departments of agriculture, our United States

Public Health Service, and many of our city health departments have accomplished a great deal. Nevertheless, when one considers that a great State with 58 counties has only 23 county health departments, and of these only 11 are full-time, one wonders how fast progress will be in milk control work, when interest in public health appears so little. Surely when approved milk inspection departments do not exist, one even wonders how it is possible for us consistently to advise a decrease in the number of grades of milk when we know it will manifestly be impossible to enforce such a law.

To revert to our own State, California, we believe there should be only three grades of milk. We base our views upon an exhaustive study of the milk problem and as a result of hearings and meetings held under the auspices of the Southern California Public Health Association, at which both authors have been present.

Before arriving at these conclusions, one of the authors, who was appointed chairman of the Milk Committee of the Southern California Public Health Association, communicated with many authorities nationally and internationally known, including pediatricians, bacteriologists, sanitarians, physiologists, health officers, and others. A questionnaire was sent to these authorities, and the questions and replies are tabulated below:

1. Is pasteurized milk a good milk for babies?

Answers: Yes, 72; no, 1; no answer, 6.

2. Do you consider certified milk to be more suitable for infants and growing children than pasteurized Grade A milk?

Answers: Yes, 13; no, 41; no answer, 25.

3. Does raw milk have greater nutritive value in infant feeding than pasteurized milk?

Answers: Yes, 12; no, 42; no answer, 25.

4. Do you think certified milk should be pasteurized,

and if so, what should be the extent of the heat treatment?

Answers: Yes, 55; no, 10; no answer, 14.

5. Have you any suggestions as to how an investigation of the relative merits of the different milks I have mentioned could be carried out so as to give us the information we want?

Note the overwhelming number of authorities who believe that pasteurized milk is a good milk for babies. However, in justice to these authorities, it should be stated that most of them are in favor of pasteurized milk only if the milk is originally a clean milk, of good quality, and is then pasteurized properly under official supervision.

Bear in mind that in this number are included sixteen of the leading pediatricians of the country. One eastern supporter of certified milk states: "I consider pasteurized milk a good milk for babies, provided the quality of the milk is up to the accepted standards." A professor of pediatrics writes: "In reply to your letter, I would like to say that I believe that all milk used for human consumption should be pasteurized and that all milk given to infants should be boiled. I make this statement irrespective of the bacteriological counts. Pasteurized milk and raw milk should be supplemented in the diet by the use of fruit juices." Another states: "Pasteurized milk is a good milk for infants. I have been using it in my institution for the past fifteen years." A western pediatrician states: "If the milk is of good sanitary quality and is pasteurized under proper safeguards, I believe it is a real good milk for babies."

The answer of probably the country's foremost bacteriologists is: "I believe pasteurized milk is good for babies when orange juice or some supplement is added. With this addition and sometimes a little cod liver oil, I believe pasteurized milk to be as good as certified milk." Still another says: "I believe that pasteurized milk is satisfactory since it is so easy to supplement it with other substances containing vitamins if it is believed that pasteurization reduces vitamin content. If I should say that pasteurized milk was not satisfactory one might imply that raw milk should be used. We know, however, that at certain times of the year even raw milk may be deficient in necessary accessory substances. I speak somewhat from experience, since we have raised three youngsters on pasteurized milk, of course supplementing it with orange juice and tomato juice."

The replies of some of the heads of departments of hygiene and public health in our leading universities are of interest. One states: "In those cities in which pasteurized milk is most generally used in infant feeding, infant mortality has declined steadily and satisfactorily, and the general physique of infants using pasteurized milk has improved. There seems no doubt that pasteurized milk is a good milk for babies." Another says: "To my mind it is the safest milk for any one to use, provided the pasteurization is carried out with proper care." Another authority known throughout the world states: "Pasteurized milk is good for babies. Refer to the New York experiments carried out under the City Board of Health, in which some 18,000 babies were fed daily in summer and 16,000 in winter over a period of three years, with a lessening of the mortality as well as morbidity." Still another states in part: "In view of these facts, we consider raw milk, in general, a dangerous food, especially for infants."

What is the opinion of some of the international authorities? Calmette, of Pasteur Institute, writes: "Le lait pasteurisé est un lait excellent pour les bébés." A Canadian authority writes: "Clean milk properly pasteurized is a good milk for babies."

Our State and city officials have this to say: "Clean, properly pasteurized milk is the best milk (other than mother's milk) which is obtainable at a reasonable price and in all sections of this State." "Yes, if good milk to start with and efficiently pasteurized." "Properly pasteurized milk is a good milk for babies." "Experience and scientific medical experiments have failed to reveal any definite contra-indication in the use of properly pasteurized bottled milk for babies, the word 'properly' being understood to include care on the dairy farm, while in transit, and approved pasteurization equipment."

Finally, the replies from many authorities whom we have not classified are of interest. A leading life insurance expert answers simply, "Yes." Two famous health news writers say: "Pasteurized milk is a good milk for babies." A representative of a great dairy council states: "Yes, pasteurized milk is a good milk for babies. In my opinion, any milk other than that of the baby's mother should be pasteurized as a safeguard to the infant's health." And a professor in a college of agriculture of a western university says: "I would consider that properly pasteurized milk in no way affects its good qualities for feeding."

Some of the replies to Question 2—"Do you consider certified milk to be more suitable for infants and growing children than pasteurized Grade A milk?"—are interesting. Five of the sixteen pediatricians previously referred to answered "yes," eleven "no." One of those in favor of certified milk answered: "Yes, but only because it is cleaner." Another one in favor says: "Yes, because of the condition under which it is cooled, diet of cattle and proper stabling." Another pediatrician states: "I do not consider certified milk more suitable for either infants or grown children than pasteurized milk. I never use it." Another answers: "I do not prefer certified milk to good pasteurized milk." A western pediatrician writes: "Grade A milk pasteurized under suitable safeguards seems to me as safe and satisfactory for general feeding of infants and growing children as is certified milk. Personally, in the case of certified milk, I have always advised heating it before feeding it to infants."

A bacteriologist answers: "In my own case, if I had to choose between certified and pasteurized Grade A milk, I would always choose pasteurized Grade A milk, making, however, a very careful distinction between 'pasteurized milk' and milk which has been 'passed through a machine called a pasteurizer.' I would wish to know that the pasteurized milk had been thoroughly pasteurized and handled in accordance with all the laws of decency and hygiene. I make this statement because I have great fear of tuberculosis. The difference in price is also to be considered. Certified milk in this section of the country costs around 30 cents per quart, while milk pasteurized according to the regulations of the Illinois Department of Public Health sells for around 14 cents. It seems to me that the weight of evidence should drive one to properly pasteurized milk."

A university authority answers: "No, unless the certified milk is also boiled." Another university authority states: "I know of no evidence which would indicate any superiority of certified milk over pasteurized Grade A milk."

One Canadian authority says "No." Another Canadian authority says "Yes." He further states: "Leading pediatricians seem to be in general agreement, in view of the present status of pasteurization, as to the desirability of boiling all milk used for infant feeding for two minutes. Certified milk is a cleaner, better product in every particular than Grade A pasteurized milk and if both are to be boiled, as an additional safeguard, the former is a preferable product. It seems to be generally admitted that boiling for this short time does not impair the nutritive quality of the milk, nor render it more difficult to digestion."

The State officials in general do not think that certified milk is any more suitable for infants and growing children than properly pasteurized Grade A milk.

One eastern city health officer states: "Certified milk is made with more care than most milk, so that generally speaking, it is a little more satisfactory, but raw certified milk may carry disease germs, and I think that most children specialists recommend the pasteurization of certified milk." A Middle West authority answers: "Yes, providing the certified milk undergoes the process of approved pasteurization, in its fullest sense. C-L-E-A-N milk is better than C-L-E-A-N-E-D milk." An eastern health officer says: "The better the milk, the cleaner it is produced, the better it is for babies and, therefore, certified milk is more suitable for infants and growing children. Of course, certified milk is out of the reach of most people." Another eastern health officer states: "There is no intrinsic merit in certified milk that should give it preference over pasteurized milk, if you have thereby the food value of the respective milk in mind. The cost for certified milk is usually so great that it is in all events beyond the reach of the masses and as a quantity product certified milk is out of the question as a municipal milk supply."

Let us consider some of the answers to Question No. 3 —"Does raw milk have greater nutritive value in infant feeding than pasteurized milk?" Most of the sixteen pediatricians are agreed that raw milk has somewhat greater nutritive value than pasteurized milk because of its vitamin content, but that deficiency can be easily supplied with orange or tomato juice. An eastern pediatrician answers: "According to my investigation, raw certified milk from the ——— laboratories here in

———had a greater nutritive value in infant feeding than pasteurized milk. It is only fair to state, however, that this advantage may have depended upon the greater care taken in the feeding of the cows in the ——— herd and its superiority may depend upon that fact and not upon its quality of rawness. To determine this point, I should have to repeat my experiment, using on a similar group of children a certified milk which in one series should be given raw and in another series pasteurized." A Middle West authority says: "Not to my knowledge. Vitamin C should be supplied in either case." A western authority states: "I do not believe that raw milk has any greater nutritive value than clean milk pasteurized under suitable conditions. The deficiency of vitamin C can easily be supplied with orange juice or tomato juice. As a matter of fact, I have found that many children take pasteurized milk better and show fewer upsets than when fed raw milk of any grade."

The health authorities throughout the country seem to agree in general with the following answer: "The only difference so far discovered between raw and pasteurized milk is the possibility of the destruction of certain vitamins during the process of pasteurization. This evidence is not conclusive, and the almost universal practice of supplementing infant food with cod liver oil and fruit and vegetable juices makes the question one of no practical importance."

A State authority says: "No. Most pediatricians today believe that heating milk makes for smaller curds in stomach and more than offsets the slight loss of nutritive properties easily obtained by tomato, orange juice, etc." A food expert has this to say: "The only objection to pasteurized milk that I know of is the possibility of development of a scurvy-like condition; but this possible danger is so easily met by the administration of very small quantities of fruit juices that it does not seem to me to constitute any longer a valid objection to pasteurization."

Let us next consider Question No. 4—"Do you think certified milk should be pasteurized, and if so, what should be the extent of the heat treatment?" Of the pediatricians, nine believe that certified milk should be pasteurized, four believe it should be boiled, one believes it should not, and two answer "not necessarily." A leading eastern pediatrician says: "If certified milk is really produced according to accepted standards such as prevail in the ——— plant, I do not think it is necessary to pasteurize it. But if the certification is faulty, pasteurization, of course, would add a measure of protection."

Bacteriologists are agreed that certified milk should be pasteurized or boiled. One states: "As an epidemiologist, I believe in the pasteurization of all grades of milk, including certified, the reason being that it is impossible to completely guard against the transmission of infections through the medium of raw milk, no matter how carefully its production is supervised."

A university authority answers: "If certified milk is to be pasteurized, the extent of the heat treatment should be the same as that for any other milk, otherwise the term pasteurized should not be used. I should personally like to see some certified milk which is also pasteurized. At the present time, I do not believe it is desirable to urge that all certified milk be pasteurized." Another answer is: "I think certified milk should be pasteurized at 142° for thirty minutes, or boiled before being fed to infants. I know of no other method of protecting a public milk supply against the possibility of transmitting acute infectious disease."

A State authority states: "If properly produced, the factor of danger of infection is so small that pasteurization should not be necessary." Another State authority answers: "Pasteurization should not be necessary if the milk has been produced and handled directly in accordance with the rigid rules and regulations of the American Association of Medical Milk Commissions. I would say that the sole purpose of production of certified milk is to have a high grade of raw milk available." Another State authority says: "If certified milk were pasteurized, it would have the additional advantage of always being free from possible bacterial contamination." Most of the city health officers questioned are agreed that certified milk should be pasteurized.

Finally, let us consider a few of the answers to the last question—"Have you any suggestions as to how an investigation of the relative merits of the different milks I have mentioned could be carried out so as to give us the information we want?"

An eastern pediatrician says: "It would make an interesting research to feed two groups of children on raw certified and pasteurized certified milk from the same source. I am convinced that one reason for the superiority of certified milk over pasteurized Grade A milk depends upon the fact that in the case of certified milk you have a definite herd very carefully supervised and scientifically rationed and, as a rule, under better hygienic conditions as regards sunlight and fresh air. This must have its inevitable effect upon the quality of the milk secreted. I should regret exceedingly to have anything happen which would reduce the consumption of certified milk, for the standards involved in producing such milk necessarily tend to keep up the standard of pasteurization of Grade A milk. If I were not very confident that certified milk was kept up to the 100 per cent standard, I would, of course, favor pasteurization."

Another says: "By metabolic observations on infants." Another: "It will be very difficult to make an investigation of the relative merits of the different milks. Animal experiments of this kind are of very limited value. The best evidence is that of qualified children's specialists who have had many years of experience." Another states: "This is not necessary. It has all been worked out." This authority believes that all milk should be boiled at least five minutes. Another makes the statement: "The subject has been investigated sufficiently to prove the dangers from raw milk and the slight disadvantage from pasteurization. All that is necessary to come to a decision in the matter is to refer to authoritative statements in the literature by health officers, pediatricians, expert workers in tuberculosis and nutrition, and bacteriologists."

A western pediatrician offers a suggestion "to study the records from the child welfare centers of a number of cities where different types of milk are used."

A reply from one university authority is as follows: "If such an investigation of the relative merits of the different milks were to be carried out, such an investigation should cover a long period of time and be so regulated that the results apply to children rather than strictly to small animals such as guinea pigs or rats. I believe, however, that we have, on a large scale, sufficient evidence to indicate the relative merits of pasteurized milk as compared with milk of other grades."

Another answer, and one the authors desire to call particular attention to is: "I do not believe these questions can be settled by any practicable investigation. In the face of an offer of the necessary financial support, several members of the faculty of this School interested in nutrition and in pediatrics concluded that such an investigation offers no hope of success."

A United States Government expert states: "I doubt if it would be expedient to attempt any one investigation which would determine the relative merits of milk produced by different methods. So many factors come into the question of the nutritive value of milk and its safety from transmission-of-disease standpoint that I doubt whether all of these conditions could be controlled in any one experiment. I think that progress can be made more rapidly by taking up the individual factors which come into this question separately. In other words, the question of vitamin content of milk and its destruction by heat and other conditions should be thoroughly worked out before a decision as to the relative merits of pasteurized milk and certified milk can be made."

A State authority answers: "At the suggestion of producers of certified milk, a number of us have had under consideration the possibility of an investigation to determine the comparative nutritive value of raw vs. pasteurized milk. Dr.———, one of the group, informs me that he can think of no laboratory experiments which would be of any value at all in this connection and I do not believe that children coming to milk stations such as we have in ——— would be satisfactory subjects for experiments because these children, living in their own homes, cannot be satisfactorily controlled. I believe the most helpful method of dealing with this question would be in a large asylum or infant home where large numbers of children, say 50 to 100, could be fed for a year on certified milk and a corresponding number fed on pasteurized milk. We have no institutions in ——— which would lend themselves to this study."

A State authority answers: "The only effective way of conducting an investigation as to the questions submitted in your letter is to arrange for the study of children in several institutions, using proper control methods, for the feeding of raw, pasteurized, and certified milk to equal groups of children in such institutions, eliminating contact between them so that any disease arising would not be due to factors other than milk. Such investigation would have to be checked up by laboratory studies to determine chemical and bacteriological difference of various types of milk, the effectiveness of pasteurization, and animal experiments as to the difference in nutritive value. For my own part, I think enough work has been done in various parts of the country which has been properly and carefully compiled and makes unnecessary such an investigation."

In general, it would appear that concensus of opinion among the authorities to whom the questionnaire was sent out is that very little would be gained by further investigation as to the relative merits of the different milks specified.

From the evidence accumulated, it would appear that pasteurized milk is the ideal milk for the majority of our citizens and that in the minds of many of these authorities raw milk, whether certified or not, is not a safe milk unless pasteurized or boiled. In other words, the evidence is overwhelmingly in favor of pasteurization.

However, it should not be forgotten that in California we have an excellent raw milk supply. Some of our cities have led the way in milk control measures. For example, Pasadena was one of the first cities in the country to require that all milk sold within the city be from tuberculin-tested cows. An ordinance to this effect was passed April 6, 1906, over 22 years ago, and other cities and counties in California now have similar ordinances. Probably over 50 per cent of our Guaranteed and Grade A raw milk dairies could be certified, if bacteriological counts alone were considered. No epidemics have been traced to our local certified dairies, and we wish to give due credit to the fine work of the Los Angeles County Medical Milk Commission.

There is no doubt in the minds of all of us that the men interested in certified milk have contributed greatly to the upbuilding of the dairy industry. Unquestionably, they have raised the standards of the industry to a high plane. But with the rapid growth of Southern California, our problems are beginning to multiply. We realize that the health officer should have full knowledge of all conditions pertaining to the milk supply over which he has supervision. Therefore, while we commend the work of the certified commissions, we likewise feel that the step which New York State has taken in requiring county commissions to report to the health officers monthly results of bacterial counts, examinations of milk handlers, tuberculin tests and physical examinations of cattle is a good one. It will be noted that the amended Sanitary Code of New York State now has this requirement. In other words, we feel that the health officer should have his finger on the pulse of the dairy industry.

In the study referred to, many questions affecting the dairy industry have been considered. On different occasions hearings were held with representatives of certified, Guaranteed and Grade A raw, and pasteurized milk distributors. The meetings were well attended and a great deal of interest was shown.

Conclusions

In general, it might be stated that many of those present at these hearings agreed with the tentative findings of the Milk Committee, with which the authors agree:

1. Requirements for all milk. Irrespective of whether the milk is certified, Grade A raw, or pasteurized, the Committee is of the opinion that all milk should be produced under the following conditions: All milk must be clean, safe, wholesome milk. All milk must be produced from nonreacting tuberculin-tested, clean, healthy cows. All milk must be produced under clean and sanitary

conditions. All milk must be distributed in a clean, sanitary manner. The production of all milk must be under an approved milk inspection service. All milk must reach the consumer properly cooled, as it is a perishable product. All milk handlers should be physically examined.

2. Definition of pasteurization. In the opinion of the Committee the term "pasteurization" should be considered as the process of heating milk to a temperature of approximately 145° F., never lower than 142° F., holding every portion of the milk at that temperature for at least 30 minutes and then promptly cooling it to 50° F.

Milk shall contain not more than 50,000 bacteria per c.c. previous to pasteurization and not more than 10,000 bacteria per c.c. at the time of delivery to the consumer, and also

Provided that the design of all pasteurizing machinery and equipment shall be of a type approved by the State Department of Public Health and the State Department of Agriculture and that the entire process of pasteurization shall be under official supervision of an approved milk inspection department; and

Provided, that the word "milk" be defined as the unadulterated, fresh, clean, lacteal secretion, all parts of which shall have been obtained from the udder by the complete milking of one or more healthy cows properly fed and kept (excluding that obtained within five days after or fifteen days prior to parturition), free from foreign substances detrimental to its quality or the quality of products prepared therefrom, and containing not less than 3.3 per cent of milk fat and not less than 8.5 per cent solids not fat.

3. All milk sold in the State of California to be from tuberculin-tested cows after five years from the passage of a law to that effect.

4. That the number of grades of milk should be reduced to three; namely,

(1) Certified milk.

(2) Raw milk of equal grade as to bacteriological standards, physical examination of employees, and butter-fat content, but produced under the supervision of health departments having approved milk inspection departments.

(3) Pasteurized milk (as defined).

5. That with due consideration to the importance of milk-borne diseases to the public health, nevertheless, it is felt that there should be no curtailment in the use of milk.

In addition to these findings, the authors believe it would not be unreasonable to require medical milk commissions which supervise certified dairies in districts where the health officers have approved milk inspection departments to have these health officers as active, participating members of the Commission.

References

(1) U. S. Dept. Agri.: Standards of Purity for Food Products, p. 4, Dept. circular 136, Washington, 1919.

(2) Mendenhall, Dorothy Reed, M.D.: U. S. Dept. Labor, Children's Bureau, Bureau Publication No. 163, pp. 16, 1926.

(3) Legal Standards for Dairy Products in Effect July 1, 1924. (Mimeographed.)

(4) U. S. Public Health Service, U. S. Treasury Dept.: The Legal Aspects of Milk Control, by James A. Tobey. Reprint No. 939, Washington, 1924, 8 pp.

(5) Dairy Laws of California, Revised to Oct. 1, 1927; pp. 55, State Dept. Agri. Spec. Bulletin No. 78.

Discussion

Dr. Fox, answering several questions in closing the discussion, spoke in part as follows:

Certified milk has been a leader in the field. We do not attack certified milk.

In Pasadena we can secure most of our milk supply within a radius of 60 miles. It can be delivered to the city for pasteurization with bacterial counts lower than 50,000 per c.c.

Our examination of nasal, throat, and chest cultures of milk handlers has gone on for three months only. We do not take the Wassermann test and at this time cannot give figures as to result of tests. The handlers are to be re-examined every six months.

In Pasadena pasteurized milk is delivered with counts below 10,000 bacteria per c.c.

"Science begets knowledge, opinions ignorance."

REPORT OF COMMITTEE ON MILK ORDINANCES

WM. B. PALMER, *Chairman*

The Committee on Ordinances has held two meetings requiring two days each. Mr. L. C. Frank was present on one occasion, when due and careful consideration was given to the Standard Milk Ordinance of the United States Public Health Service.

In order to cooperate with that agency in making the ordinance as practicable as possible, the Committee has suggested certain changes and modifications.

The Committee commends the efforts of the United States Public Health Service in attempting to coordinate various ideas with respect to this subject, and the Committee has also sought through correspondence the advice of milk authorities in different parts of the country.

Although reports from certain officials with whom the Committee has been in communication indicate that this Standard Ordinance is apparently operating in a satisfactory manner in certain territories, the Committee questions the feasibility of preparing a standard ordinance in specific and detailed form, using definite phraseology, which will be universally applicable and can be put into practical operation in all sections of the country, without numerous modifications on account of local conditions. This defect applies particularly to such matters as grading of milk, provisions for tuberculin testing of cattle producing milk to be pasteurized, temperature requirements for milk cooling, and bacterial standards.

The Committee believes, however, that it is possible and desirable to formulate fundamental principles for the guidance of officials in preparing milk ordinances.

It is suggested that uniform requirements should be put into effect in groups of States and sections where such uniformity would be mutually desirable and conducive to efficiency and effective control.

It is also suggested that whenever a milk ordinance is proposed, representatives of the dairy industry be consulted by municipal officials and given an opportunity to cooperate and aid in the preparation of the ordinance.

The Committee reaffirms its report of 1927 that the following general principles should be accepted and incorporated in all ordinances for the supervision and control of milk:

1. Pasteurization of supplies.
2. Pasteurization standards.
3. Tuberculin testing of dairy cattle.
4. Physical examination of cattle by veterinarian.
5. Medical examination and laboratory tests of milk handlers.
6. Regulations for certified milk.
7. Grading of supplies based on sanitary quality of the product, providing for higher grade pasteurized, lower grade pasteurized, certified, and, if legally permissible, noncertified raw milk.
8. The bottling and labeling of milk.
9. Milk plant equipment and practices.

Recommended amendments have been submitted to the Public Health Service and advice has been given that the same will be published with the amended code when it is issued.

Discussion

Mr. Jennings: Is the report as presented an indication of doubt as to the Standard Ordinance?

CHAIR: It is a report of the Committee and does not bind the Association. The committee members took time and went to some expense for travel, etc., to give most careful consideration to the subject, and I want to express appreciation of their efforts.

MR. FRANK: My understanding of the report is that the Committee is doubtful as to the universal application of the United States Public Health Service Standard Milk Ordinance. The United States Public Health Service will be quite satisfied with the report and suggestions and will let time tell the story.

MR. PALMER, chairman, in closing the discussion said in part:

We cooperate to the fullest possible extent. We have made suggestions to the United States Public Health Service and hope they will be of value to all concerned.

"Advice is like snow: the softer it falls, the longer it dwells upon, and the deeper it sinks into, the mind."

REPORT OF COMMITTEE ON SANITARY CONTROL OF ICE CREAM

RALPH E. IRWIN, *Chairman*

In the preceding reports of your Committee there has been set forth the requirements of each State and Province concerning the sanitary control of ice cream. The replies to our questionnaires indicate there is but little State or municipal supervision at present. They also indicate that considerable legislation requiring such supervision may be expected in the near future.

This year our report deals in a general way with present tendencies in supervision and indicates what is believed to be a plan of procedure for the immediate future.

The equipment used in the manufacture of ice cream is practically the same as in a milk treatment plant. The homogenizer and freezer differ somewhat, but respond to the same cleansing processes. The finished product is kept at a lower temperature prior to delivery than market milk. This possibly inhibits bacterial growth but has little effect upon the kind of organisms of most interest to the sanitarian.

It has been well established that milk and milk products have been the cause of communicable diseases and may be expected to be a contributing factor in the future.

Three references are given:

1. Ice Cream as a Cause of Epidemics: F. W. Fabian, Michigan Agricultural Experiment Station, Bulletin No. 192.
2. Communicable Disease and Pasteurized Milk: Edward S. Godfrey, Jr., Director, Division of Communicable Diseases, New York State Department

of Health. *The Nation's Health,* Volume 5, No. 1, January 15, 1923.

3. Milk-borne Typhoid Fever and the Rôle of the Human Carrier: Charles Armstrong, United States Public Health Service. The Pennsylvania Association of Dairy and Milk Inspectors, Third Annual Report, 1927.

A "Bibliography on Ice Cream," up to and including the year 1926, has been prepared by the United States Department of Agriculture Library. Ninety-eight references are given under "Poisoning and Epidemics."

The sanitary control of ice cream is necessary to

1. Protect the health of the consumer.
2. Meet our desire for cleanliness.
3. Create public confidence.
4. Increase the consumption of an excellent food.
5. Protect the capital invested.

The progressive ice cream manufacturer has recognized the importance of sanitary control over the products used in his factory, factory conditions, and methods of distribution. The pasteurization of the ice cream mix is almost universal in large plants. By this process the ingredients may be made safe with the exception of flavors and fruits, which are usually added near the close of the freezing period. Because a uniform product is desired in the mix, the time and temperature of pasteurization need not receive so much attention as in the case of market milk. The International Association of Ice Cream Manufacturers has taken action concerning pasteurization. The "Report of the Proceedings of the Twenty-sixth Annual Convention" held in 1926 has this resolution, which was adopted:

> "Be it resolved, That this Association go on record as favoring the pasteurization of ice cream mixes."

This is a step in the right direction. However, pasteurization is not defined, the equipment is not described, and protection after pasteurization is not mentioned. National sanitary regulations have not been proclaimed. It is believed, however, that such regulations of a general character should be provided.

The regulations of each State have been studied and we find there has been considerable activity. Fourteen States and the District of Columbia have adopted sanitary regulations. Two States require the ice cream mix to be pasteurized. Eleven States and the District of Columbia require the milk and cream used in the mix to be pasteurized. Some of the States require a record of the time and temperature used in pasteurization.

City ordinances regulating sanitation are few in number and thus far it seems that a sound basis for municipal regulations has not been established. In fact, it would appear that the necessary information for State and municipal supervision is not at hand.

To obtain quality and safety it is necessary to supervise the dairy products from the time they are produced on the dairy farm. Each year this is becoming easier. Producers' organizations are looking after farm conditions that have much to do with quality. Receiving platform inspection is improving and plant equipment and methods are beginning to be standardized.

We are in need of some kind of measuring stick with which to determine the sanitary quality of milk as delivered by the producer. With such a measure we could determine whether milk received was suitable for consumption as raw milk or whether it should be pasteurized, made into ice cream, cheese, butter, powder, animal feed, or billiard balls. Each year brings an improvement in our measuring devices, but as yet they are too slow or inaccurate to allow us to center our entire attention on the can of milk delivered and pay no attention to dairy farm conditions. Usually the results of our measurements are of a bygone product and are useful only as an estimate as to what the producer may deliver another day. This has brought about a grading or selection of milk for various purposes. Compliance with certain sanitary and safety rules places the milk in the grade designated by the inspector. Thus some milks are designated as suitable for drinking purposes; other milks are declared useful for condensing, making ice cream, etc.

Messrs. A. E. Fay and N. E. Olsen, of Kansas Agricultural Experiment Station, in a report entitled "The Bacterial Content of Ice Cream" conclude that "it is practical to consistently produce ice cream containing less than 100,000 per gram by pasteurizing at 150° F. for 30 minutes and by using utensils that have been thoroughly cleansed and steamed."

Mr. R. C. Fisher, of the French Brothers-Bauer Company, Cincinnati, in a paper read before the twenty-sixth annual convention of the International Association of Ice Cream Manufacturers in 1926, states as follows:

"Properly interpreted, the bacterial content of ice cream furnishes a real index as to the sanitary quality of the ingredients used, the efficiency of the pasteurizing process, and the degree of contamination afterwards. The bacterial content of ice cream is even more valuable as an index of the sanitary conditions under which it was produced or manufactured than in the case of milk. In the case of milk, there is some chance for bacterial growth after it reaches the final package, because it frequently is exposed to temperature of 55° F. or over. No such conditions prevail in the manufacture of ice cream. It is kept in frozen condition from the time it reaches the can until it is consumed. For this reason I believe the bacterial content of ice cream to be an even more valuable measuring stick of the pasteurizing process and the sanitary conditions prevailing in the plant than is the case with milk. No attempt, however, should be made to distinguish between ice cream showing a bacterial content of 10,000 or 25,000 per c.c. Such differences are slight and insignificant, but when one batch shows 20,000 and another batch 200,000, there is reason to look into your operations and determine the reason why. For general purposes and application, I believe the following interpretation of bacteria counts is useful and practical:

25,000 or below—Excellent.
25,000 to 50,000—Good.
50,000 to 100,000—Fair.
100,000 to 300,000—Poor.
Over 300,000—Very poor."

Professor Fred Rasmussen, Executive Secretary of the International Association of Ice Cream Manufacturers, in a paper which appears in the Fourth Annual Report (1928) of the Pennsylvania Association of Dairy and Milk Inspectors, states as follows:

"Lest I be misunderstood, let me repeat that I thoroughly believe in the application of bacteriology to dairy products inspection. When carefully and consistently made, bacteriological tests are exceedingly helpful both to the public official and to the manufacturer of ice cream. By wisely using them, improper and dangerous conditions may be discovered and changed. Counts should not take the place of intelligent inspection or the giving of advice by health officials for correction of faults. Bacterial counts should be guides to investigation and not basis for prosecution."

As previously mentioned, the ice cream plant is similar to the milk treatment plant. Efficient equipment kept in repair, carefully operated and properly cleansed and protected after cleansing, makes the heart of the sanitarian rejoice. But these plants, like the dairy farm, need supervision. Too many plants are without proper equipment and, of more importance, those in charge have no conception of what cleanliness means and are without a desire to learn. A few manufacturers have employed sanitarians whose duty it is to improve the sanitary quality of their product and the general appearance of the plants. In a manual entitled "Methods Involved in Making High Quality Ice Cream," prepared by the research and production department of one large company, we are pleased to note the following in the foreword written by the general manager to his plant managers:

"It is possible that some of our managers do not yet realize the good will created by having it broadcast that our ice cream is made under most sanitary conditions and by having boards of health report that our ice cream has a low bacteria count and is good ice cream.

"We realize that not all our plants are strictly modern from the standpoint of construction, but that does not mean that a high quality ice cream cannot be made in these plants. All we expect you to do is to follow instructions and do the best that can be done with the plant and equipment available.

"Just keep these two things in mind, and there will be no cause for complaint.

"1. Keep your plant in such condition that you would not be ashamed to show it off to your friends at any and all times.

"2. Put yourself in the place of the consumer and see that the ice cream is so made and packaged that you and your family would be perfectly satisfied when making a purchase.

"The Research Department has prepared this manual to help our employees to do their job right and particularly to act as a guide for the plant manager and foreman, whose job it is to see that they do it right. The directions set forth in the manual have all been edited by our executives and have their full approval. We are going to depend on you for RESULTS."

In this same manual, which treats the subject of sanitation at considerable length, we note under the heading of "Personal Hygiene" the following:

"You are handling a dairy product eaten by thousands of men, women, and children daily. This food must be pure and wholesome. We take every precaution in blending dairy products, sugar, and flavor to make a high quality product. It is up to you to do the rest, so that our work will be completed.

"In handling ice cream, keep your hands off of the ice cream. Using one's fingers to determine the flavor of raw materials or the finished ice cream is most unsanitary and sooner or later the sampler will contaminate the ice cream with some transmissible disease with which he may be suffering, and this causes the company no end of trouble."

Under "Grounds and Platforms" this statement is given:

"As one is judged by the company he keeps, so does the public form their opinion of an ice cream plant and its products by what they observe in the plant and surroundings. These exterior conditions are usually a good measuring stick of what the plant looks like inside."

In the "Summary for Daily Guidance of Foreman" there are 31 items, five of which are as follows:

"Keep your eye on the personal hygiene habits of your men. Lay them off if they fail to respond to correction.

"Keep toilet and dressing rooms clean.

"See that equipment is cleaned according to directions and check up on its cleanliness. Keep sterilizing solution on hand at all times.

"See that clean cans are properly stored.

"Don't put a new man on a job without proper instructions."

In making ice cream plant inspections some kind of record is necessary. Several score cards have been prepared. Three of these are considered of special value:

1. A score card for city ice cream plants: F. W. Fabian, Michigan Agricultural Experiment Station, East Lansing, Michigan.

2. Ice Cream Score Card: Milton E. Parker, Philadelphia Dairy Products Company, Philadelphia.

3. Factors to Consider in the Inspection of the Ice Cream Plant and in Testing Its Products: H. F. Judkins, Eastern Dairies, Inc., Springfield, Mass.

The ice cream manufacturer through his own organization has indicated to a certain extent what he believes to be proper supervision. Through correspondence it was learned that the members of your committee believe that the International Association of Ice Cream Manufacturers should have a committee on sanitation ready and willing to cooperate with the committee appointed by this association of regulatory officials. Furthermore, it is believed that the manufacturer of ice cream plant equipment should shoulder some of the responsibility for the efficiency of his equipment from a sanitary standpoint. A member of your committee stated this clearly when he said: "I see no reason why the officials of the country should be burdened with the necessity of preparing plans for standard apparatus for the benefit of the manufacturer. * * * * I have particularly objected to the unwarranted burden which the manufacturers of dairy equipment have placed upon the purchasers of such apparatus and the officials supervising the processes, to whom the manufacturers have left the job of studying the merits and efficiencies of their system and the machinery contained in it."

From the data presented it is evident that:

1. The sanitary conditions surrounding the production of ingredients and the processes of manufacture and sale should and can be improved.

2. There is little State or municipal supervision, but legislation requiring such supervision may be expected in the near future.

3. The manufacturer should be in active cooperation with health officials in the preparation and enforcement of such sanitary control measures as have to do with the ingredients used in the manufacture of ice cream and with the processes of manufacture and methods of sale.

4. That the enforcement of sanitary regulations concerning ice cream should be a part of all milk control work.

5. That a uniform score card should be prepared for ice cream mix and ice cream plants.

With the approval of the president of our association, your committee sent a letter to the secretary of the International Association of Ice Cream Manufacturers, as follows:

"July 9, 1928.

"Mr. Fred Rasmussen,
"Executive Secretary,
"International Association of Ice Cream Manufacturers,
"Telegraph Building,
"Harrisburg, Pa.

"My dear Mr. Rasmussen:

"The Committee on the Sanitary Control of Ice Cream of the International Association of Dairy and Milk Inspectors has been in existence since 1925. In the preparation of its reports the Committee has found that as yet few States or municipalities have adopted legislation dealing directly with the sanitary condition of the ingredients and the processes used in the manufacture of ice cream but that there is a growing tendency toward such legislation.

"The Committee believes that the International Association of Ice Cream Manufacturers is interested in the development of sanitary requirements, and that it might stimulate progress by presenting to regulatory officials such regulations as are deemed necessary for the distribution of a safe, clean, attractive ice cream. If our committee can be of service to a similar committee from your Association in this connection, please call upon us.

"This communication has received the endorsement of the Committee membership and the President of our Association.

"Very truly yours,
"RALPH E. IRWIN, *Chairman,*
"Committee on Sanitary Control of Ice Cream.

The communication will be presented to the International Association of Ice Cream Manufacturers at its meeting held in Cleveland this month.

DISCUSSION

MR. ANDERSON: Decided improvement in the quality of ice cream distributed in one of our Indiana cities resulted from publicity given the unsanitary quality of ice cream as distributed a few years ago. This change came about largely as a result of the Health Officer giving information to the physicians of the city.

MR. IRWIN, in answering questions and closing the discussion, stated he believed ordinances and laws for the control of ice cream should be standardized and made workable and effective. The manufacturers of ice cream favor pasteurization of the ice cream mix.

"The man who feels that he must make a choice of evils usually finds a large assortment."

IMPROVEMENT OF PASTEURIZATION PLANTS AND THEIR MILK SUPPLIES IN KENTUCKY

SARA VANCE DUGAN, *Director*, Bureau of Foods, Drugs and Hotels, State Board of Health, Louisville, Ky.

In 1918 the enforcement of the Food and Drugs Act passed from the Experiment Station, University of Kentucky, to the State Board of Health. These two organizations had joint enforcement of the Food Sanitation Act from the time of its passage in 1916, but until 1918 the State Board of Health had had no appropriation for food inspection work. The State Board of Health had always led the movements for better milk supply, and before 1918 had inaugurated the tuberculin testing of cattle, which was later transferred to the State Live Stock Sanitary Board.

Among my first inspections as director, made in 1919, were visits to the pasteurizing plants in Louisville. Knowing as little as I did of equipment at that time, I was appalled at the methods employed in many of these plants. Since that time, the Bureau of Foods and Drugs, through various inspectors with limited training and experience, has attempted improvement of both raw and pasteurized milk.

Our State health officials, until recent years, were, rightfully perhaps, of the opinion that pasteurization was not a factor of safety and that the milk left the plant worse than when it entered. This was, perhaps, not always true, but following the history of pasteurization in some other States, the raw milk supplied to the pasteurizing plants was infinitely worse as to age, flavor, and initial bacterial count than the retail raw milk sold on the same market. The pasteurization plant operator dumped all the milk together and heated it, usually with no closer control than is possible with an alarm clock and an indicating thermometer placed anywhere on the vat, or perhaps a hand thermometer lowered into the milk. I really dread to look back upon the by-passes, long effluent pipes, right-angle bends, and other atrocities of not more than a year or so ago.

In 1919 the State Board of Health had adopted and published regulations governing the grading of milk. These regulations dealt mainly with the grading of the dairy farm and were based on the old New York State regulations.

That part of the regulations dealing with the grading of pasteurized milk had only to do with the bacterial counts of the milk before and after pasteurization. The requirements of pasteurizing plants were those dimly outlined by the food sanitation law, which covers the sanitary requirements of all food establishments. Our regulations laid much stress on the total score and the bacterial count. With one central State laboratory and only one other city laboratory, our objective was far above our attainment.

The visit to Kentucky of the American Child Health Association's Field Laboratory in 1924 only gave us added proof of the conditions which we were well aware existed.

The United States Public Health Service "State-wide Milk Sanitation Program," appearing in November, 1924, seemed to offer a solution. The State Board of Health of Kentucky asked the United States Public Health Service for the services of an engineer to assist the State of Kentucky in putting on a program similar to that in Alabama.

In July, 1925, the State Board of Health adopted the Standard Milk Ordinance as it is printed in *Public Health Reports* for November 7, 1924, as the regulations for inspection and grading of milk, dairies, and milk plants.

In April, 1926, the State Board of Health issued specifications for all pasteurization apparatus that would be installed in Kentucky after that date. These specifications covered properly designed flush valves and the requirement of recording thermometers on all milk pasteurizing equipment.

In October, 1926, the Board readopted as regulations the modified form of the Standard Milk Ordinance as published in Reprint 1099 of the United States Public Health Service.

For the latter part of 1925 and all of 1926, the State Board of Health devoted its milk work to the furtherance and adoption of the Standard Milk Ordinance in various towns in Kentucky.

Our greatest opposition to milk sanitation developed as a result of the false belief that the State Board of Health was urging this ordinance for the benefit of pasteurizing plants. Criticism of the conduct of the pasteurizing plants was in many cases justified, and our immediate problem seemed to be a correction of pasteurizing plant practice before we could truthfully say that pasteurized milk in Kentucky was safe milk. Early in 1927, a systematic inspection of every pasteurizing plant in Kentucky was begun. These inspections were made by Mr. E. E. Jacobson, Assistant Sanitary Engineer, of the Bureau of Sanitary Engineering of the Board, and to him is due the credit for the improvement shown in the charts accompanying this paper.

The first inspection in 1927 of each of the 69 plants was not the first inspection under the new regulations, and all of the plants were or should have been familiar with the requirements. Pasteurizing plants are located at widely separated points in the State, and the difficulty of supervising these plants from our central office in Louisville is easily understood.

Chart No. 1 clearly shows the conditions found. The percentages shown are based on the daily gallonage of whole milk sold by the plants, and as many of the plants have a capacity of less than 500 gallons daily, the chart does not indicate the fearful conditions found in the majority of the plants. Under the item "pasteurization," only six of the 69 plants were properly pasteurizing 32 per cent of the milk, and three of these plants were located in towns which had had the Standard Milk Ordinance for over a year and had adequate local supervision.

In three of the cities of Kentucky, over 90 per cent of the milk supply is pasteurized, and these cities account for 57 pasteurization plants having a daily production of from 70 to 8,000 gallons. The other 22 plants are located in 15 towns scattered over the entire State.

Our records indicate that about 30 per cent of the whole milk consumed in Kentucky in 1927 was labeled pasteurized milk, and this 30 per cent amounted to 37,415 gallons daily. During 1927, in only nine of the 18 towns having pasteurizing plants was even the slightest attempt being made locally to inspect the plants or their raw supply, and in only five of these nine towns could the local inspection be even dignified by such a name, as the only visits to the plants made by local representatives in the other four towns were made in company with the State inspector.

During 1927, 207 inspections were made of the 69 pasteurizing plants, and of the 67 plants in operation, at the end of the year 16 had attained a rating of "A," indicating that the plants had complied with all the requirements of the Standard Milk regulations. These plants pasteurized 61 per cent of the pasteurized milk sold in the State. The ratings of all the pasteurizing plants in the State were published in the 1927 report of the Bureau of Foods, Drugs and Hotels, and this publication had much to do with the improvement.

CHART NO. 1

STATUS OF MILK SANITATION IN KENTUCKY

INSPECTION OF PASTEURIZING PLANTS UNDER STANDARD MILK REGULATIONS

Building and Equipment		1927	1928
Floors		94	96
Walls and ceiling		72	91
Doors and windows		95	68
Lighting		91	99
Ventilation		99	100
Protection from flies		67	60
Toilet facilities		73	68
Water supply		99	100
Washing facilities		41	69
Milk piping		94	65
Equipment		81	87
Waste disposal		99	98
Methods			
Containers	Cleaning	92	43
	Sterilization	88	66
	Storage	96	99
	Handling	99	99
Storage—Bottle caps		90	99
Pasteurization		32	74
Cooling		100	100
Bottling		99	100
Overflow milk		100	100
Capping		87	98
Delivery in 36 hours		100	100
Personnel, health		6	87
Cleanliness		99	99
Pasteurization plant rating		64	79
Number plants		69	64

The second half of Chart No. 1 shows the conditions found in the plants on the latest inspection for 1928. In some items the chart would indicate conditions are worse now than they were in 1927. The items "doors and windows" and "protection from flies" would appear in this light. It should be noted, however, that the 1927 inspections were made during the winter when the fly menace is nil, and the violations found for that item were due to improper separation of various plant operations. During 1927 and the first half of 1928, 44 of the 69 plants representing the first inspections have reconstructed their plants and separated the washing operations completely from the pasteurizing, cooling and bottling of the milk. The inspections forming the basis of the chart of 1928 were made during the middle of the fly season, and the defects noted under these two items are due mainly to presence of flies in the plant and broken or improperly placed screens. This condition clearly shows us, however, the direction toward which our efforts must be directed in the coming year.

The items "milk piping," "container cleaning," and "sterilization" would also lead us to believe that our work had made a backward step. We are, however, inclined to believe that our inspections of these particular items were not so strict in 1927 as in 1928, because it is undoubtedly true that the milk piping of 1927 was of the same physical condition as to design and set-up as that of 1928.

While in 1927 only six plants were given credit for the item "pasteurization," the 1928 record shows 27 plants having properly designed and properly operated equipment. These 27 plants are pasteurizing 28,770 gallons of milk as against the 13,280 gallons pasteurized by the six plants in 1927. Ten of the pasteurizing plants represented on the 1927 portion of the chart have since gone out of business. Of the 64 plants represented on the 1928 portion, six are new plants which were not in existence at the time of the 1927 inspection. The amount of pasteurized milk represented in 1927 is 37,415 daily gallons, while the 1928 inspection represents 38,702 daily gallons.

In order to stimulate an interest in the importance of the recording thermometer, the Bureau has requested weekly delivery to its office of all recording thermometer charts of the preceding week. So far, the Louisville plants, 25 of them, are the only ones required to submit these regularly, though a number of plants out in the State are sending in their charts voluntarily for comment. We require that the temperature of the indicating thermometer be entered on the chart at some time during the pasteurization period. A receipt is mailed to the plant each week when the charts arrive at the office. The filing of these charts has been required of Louisville plants, with full consent of the Louisville Health Department, only since July, 1928. We expect in time to extend this filing of charts to pasteurizing plants out in the State located in towns having no health departments. We keep the charts for three months only.

The pasteurization plant rating at the bottom of Chart No. 1 is obtained by use of the scoring system described in publications of the United States Public Health Service on the Standard Milk Ordinance, and certainly indicates marked improvement. We do not feel that this improvement is due entirely to our own efforts, but credit should be given the health departments and milk inspectors of Louisville, Newport, Henderson, Madisonville, Owensboro, Paducah, and Covington, for their support of the work. The cities of Henderson, Owensboro, and Paducah are operating under the Standard Milk Ordinance, while the other four cities use the State regulations for making inspections of pasteurizing plants.

This report is only a report of progress, and we hope at some future time to show even greater advancement towards the goal of 100 as a pasteurizing plant rating for the State.

While we have been working on the improvement of pasteurizing plants, we have not neglected the raw milk supply sold either direct to the consumer or to the plants, except as we have been handicapped for lack of funds and personnel. In seven towns there is and has been in the past two years inspection of the dairy farms. This in many cases is well done, and the State, having innumerable tasks, does not attempt to duplicate this work.

In one of our largest towns we have dairy inspection provided at the rate of one inspector per 125,000 population. Considering the area of the milk shed of this town and its daily milk consumption of nearly 28,000 gallons, one can realize that the milk inspection service is hopelessly handicapped at the start. The pasteurization plants located in this town get their milk wherever they can buy it, and in some cases in lots of from two to five gallons. It is not difficult to imagine the condition of dairies supplying such a community.

One of the largest pasteurizing plants in this town, selling seven to eight thousand gallons of whole milk daily, came to the State Board of Health in the winter of 1928 and asked if our inspectors could inspect the dairy farms supplying them and put on a campaign to improve their raw supply. Our personnel was too limited to undertake this work. However, a provision of law gives the State Board of Health the power to accept funds from any source to be used for the furthering of health work, and funds were provided by this company for the employment of an inspector to inspect the dairy farms supplying their plant. This inspector is employed and paid by the State Board of Health and is supervised in exactly the same way as other inspectors.

CHART NO. 2

STATUS OF MILK SANITATION IN KENTUCKY

RAW MILK USED FOR PASTEURIZATION BY PLANT G

		December, 1925	March, 1928
Cows	Tuberculin testing	91	90
Dairy Barn	Lighting	11	46
	Air space	90	92
	Floor construction	28	85
	Floor cleanliness	26	76
	Walls and ceilings	5	43
	Barnyard	46	59
	Manure	32	77
Milk Room	Floor	9	26
	Walls and ceilings	1	14
	Lighting	17	19
	Screening	10	15
	Cleanliness	9	14

CHART NO. 2—*Continued*

		December, 1925	March, 1928
Toilet	Construction	9	7
Water	Quality	0	0
Utensils	Construction	19	21
	Cleaning	89	86
	Sterilization	38	90
	Storage	26	78
	Handling	43	100
Milking	Udder and teats	4	2
	Flanks	59	93
	Hands	8	4
	Clothing	63	100
	Milking stools	16	6
	Removal of milk	14	21
Employees	Health	0	0
No. dairies		73	81

In March of 1928, an inspection of 81 dairies selling their milk to this plant was made. These were picked because no dairy produced less than 20 gallons daily. The conditions found are represented by the second half of Chart No. 2. The inspections represented on the first half of this chart were made of 73 dairies supplying the plant in 1925 and represent small as well as large dairies, some producing two or five gallons a day. The 1925 inspections were made during a survey of the city's entire supply, and doubtless represent the average condition of the dairies supplying the plant in 1928, if we had considered their smaller sources of milk.

All of these 81 dairies inspected were notified that if they made improvements in their methods of handling and equipment so as to receive a grade of "B" from the State Board of Health on inspection, and if they maintained this grade on subsequent inspections, the plant would pay them a premium beginning on the date of their first grade "B" inspection. Each dairy desiring to try for this grade was urged to communicate with the plant or the State Board of Health.

In the six months since March, 35 dairies, supplying nearly 2,000 gallons daily, have attained grade "B" on inspection. Each dairy once getting a grade of "B" is inspected at least once a month thereafter, and if any defect is found the dairy loses its grade until the dairyman indicates that he has corrected the defect and another inspection proves this to be true. Since the first "B" grade was given only one dairy has been degraded, and that dairy has made the necessary corrections and again attained a grade of "B." All reports are made to the State Board of Health, and the Bureau of Foods, Drugs and Hotels notifies the plant by letter of the change in grade of the dairy. On the day that a dairy attains a "B" grade the first time, the plant begins to pay the premium. Up to the present time, this plant has not attempted to sell a graded milk but is working toward a better supply in general.

CHART NO. 3

STATUS OF MILK SANITATION IN KENTUCKY

RAW MILK USED FOR PASTEURIZATION BY PLANT G

		March, 1928	September, 1928
Cows	Tuberculin testing	86	100
Dairy Barn	Lighting	32	38
	Air space	84	93
	Floor construction	33	43
	Floor cleanliness	77	100
	Walls and ceiling	45	83
	Barnyard	69	100
	Manure	78	100
Milk Room	Floor	51	100
	Walls and ceiling	36	100
	Lighting	46	100
	Screening	22	100
	Cleanliness	26	100
Toilet	Construction	4	100
Water	Quality	10	100
Utensils	Construction	27	100
	Cleaning	87	100
	Sterilization	96	100
	Storage	46	100
	Handling	95	100

CHART NO. 3—*Continued*

		March, 1928	September, 1928
Milking	Udder and teats	9	100
	Flanks	98	100
	Hands	15	100
	Clothing	100	100
	Milking stools	1	100
	Removal of milk	42	100
Employees	Health	6	100
No. dairies		35	35

The inspections recorded on Chart No. 3 show the conditions found in these 35 dairies in March, 1928, and in September, 1928. The second half of the chart looks almost too good to be true, but we are convinced that conditions have improved to that extent.

The improvement shown and the actual work of inspection should be credited to Mr. John Null, Dairy Inspector of the Bureau of Foods, Drugs and Hotels. The work has been slow, but repeated inspections of these farms have shown that it has been sure. The premium has been an incentive, but the fact that we were not forcing them to make corrections has made our suggestions and recommendations welcome.

The improvement of the dairies is not only gratifying from the standpoint of improvement of the milk supply, but indicates better living and working conditions on the dairy farm, and there is not one of the 35 dairymen represented in Chart No. 3 who would go back to the old methods and equipment, even if the premium were not considered.

We are thoroughly convinced in Kentucky that the Standard Regulations for the grading of milk, either with the bacterial counts considered or without, as interpreted by the Standard Milk Ordinance Code, are enforceable and form a basis for a really workable plan of milk control and improvement from the following standpoints:

1. Of the State health or milk control official as

regulations for sanitation of either milk plants or dairy farms, or simply as a basis for inspection.

2. Of the city health department as a sane and workable milk ordinance either for the small town or the large city when in each community sufficient inspection force is provided.

3. Of the pasteurizing plant as a basis for buying milk on grade.

4. Of the individual dairyman as a fair and equitable plan for the sale of his product and a guide for the building up and sane improvement of his dairy.

We further feel that the periodical publication of grades by State or city is of importance in the furthering of this plan and has in Kentucky proved a vital part of our program.

"We must never make experiments to confirm our ideas, but simply to control them."

REPORT OF COMMITTEE ON EDUCATIONAL ASPECTS OF DAIRY AND MILK INSPECTION

PROF. C. L. ROADHOUSE, *Chairman*

The last report of the Committee on Educational Aspects of Dairy and Milk Inspection emphasized the importance of proper technical knowledge of dairying by those who are engaged in milk and dairy control work. It was emphasized that without such knowledge dairy inspection becomes largely of a police control type—unsympathetic in its policies and, in many instances, inefficient in its accomplishments.

It is believed that constant progress will be made in the improvement of the quality of milk and public confidence in inspection will be strengthened where a minimum educational requirement is established for new men entering the field of dairy and milk inspection.

In the report for 1927, the Committee recommended that men selected as dairy control officials be graduated from an agricultural college or from an accredited veterinary college, and that they should have received instruction in the fundamental sciences related to dairying. It was further recommended that the inspector should have some knowledge, either by experience or otherwise, of the principles of the manufacture of butter, cheese, ice cream, and other dairy products, the production and handling of market milk, and the operation of dairy machinery.

The question of importance for this report is: How can the men now engaged in dairy and milk inspection improve their knowledge in these subjects and make their work more effective?

There are now many opportunities for men of all ages to improve their knowledge during their adult years. This is particularly true for people interested in agriculture and agricultural subjects. The United States Department of Agriculture and the various State universities offer opportunities for study along many lines.

Short Courses

Most of the State agricultural colleges offer short courses in dairying and dairy manufactures, which are intended for experienced men engaged in dairy and milk inspection, dairy farming, and dairy manufacturing. These courses are of a practical nature and are attended by men of all ages. Such courses vary in length from ten days to three months, and are usually offered during the winter when inspectors can be more easily spared from their work. A few colleges offer a one-year course for men who can be spared from their positions for a longer time. Dairy inspectors now engaged in dairy control work, who have not received such instruction, should not be satisfied to continue without enrolling for instruction at one of the agricultural colleges offering a short course in dairying.

Cooperation with the Extension Activities of the Colleges

Many of the extension divisions of the State colleges of agriculture are organized to give assistance along the lines of dairy sanitation to dairy farmers and to dairy plant operators. Such activities can be stimulated by the inspector in some instances, since any such activity must have outside support for best results. It is recognized that some of the finest accomplishments along many lines result from cooperative effort on the part of different agencies. It is believed that dairy education and milk supervision would each benefit from a closer relation.

Literature

Abraham Lincoln, in an address to farmers at the Wisconsin State Fair, September 30, 1859, stated: "A capacity and taste for reading gives access to whatever has already been discovered by others. It is the key, or one of the keys, to the already solved problems. It gives a relish and facility for successfully pursuing the unsolved ones."

There is an abundance of literature available to men engaged in dairy and milk inspection, which, if read, would improve their knowledge of the subjects related to their work, stimulate their discussion of such matters, and strengthen their ability as officials engaged in public work.

(a) Journals:

Journals are published dealing with public health, as are numerous trade papers dealing with various phases of the dairy industry. Such publications as the *American Journal of Public Health*, the *Journal of Dairy Science*, the *Journal of Bacteriology*, the *Journal of Industrial and Engineering Chemistry*, if on file in the headquarters of the inspection department would be helpful to all men in the inspection force.

(b) Bulletins:

Bulletins dealing with dairy sanitation, production, manufactures, and management are published by the United States Department of Agriculture, Washington, D. C., and by many of the dairy departments of State colleges and universities. The inspector should be familiar with the problems of the people with whom he is dealing, as well as with the principles of sanitation. These bulletins are valuable sources of information and may, in most instances, be secured free upon application.

The Benefits Derived from Adult Education

It has been recognized for a long time by men of intelligence that we are never too old to learn. The more knowledge one has, the more he realizes that this is true. Modern public health supervision and modern technical dairying are making such rapid progress through the large amount of research work which is being done in this country and in other countries that no one can keep up with all of the developments which are taking place. One who is specializing in dairy control work should be familiar with the latest developments in public health as it is influenced by the milk supply, and in addition should have some knowledge of improvements which are being made in dairy manufacturing processes and in milk production.

Men engaged in dairy control who have made the most of their opportunities in the study of the subjects with which they are dealing have frequently received attractive offers from dairy institutions, which have led to their advancement to better positions. This is the goal to which every salaried man may justly aspire.

The man engaged in city or State milk control service who is not interested in improving his knowledge and keeping up with the rapid progress being made in these lines, cannot expect to be successful or to maintain the support which this service deserves.

"Strive to know why, for this teaches how and when."

REPORT OF COMMITTEE ON BOVINE DISEASES

THEIR RELATION TO THE MILK SUPPLY AND TO THE PUBLIC HEALTH

DR. C. D. PEARCE, *Chairman*

As milk is universally used as a food and beverage, the control of those diseases which may be transmitted through milk is important. There are many animal diseases, but from our present-day knowledge only a few of these spread through the milk supply.

Two bovine diseases, tuberculosis and contagious abortion, from an economic standpoint hold the center of the stage. Ten years ago the losses from tuberculosis and abortion were estimated to be about equal, according to Dr. Mohler, Chief of the United States Bureau of Animal Industry, while today the losses from tuberculosis have been reduced one-half and those of abortion have doubled.

Both diseases show a similarity in many respects. They are chronic diseases caused by specific organisms, developing slowly without marked clinical signs. They spread from animal to animal slowly but surely. Tuberculosis is transmissible to man, and evidence is accumulating that contagious abortion may likewise be transmitted to man, causing a febrile condition similar to Malta fever. Whether or not it is definitely proved that abortion is a milk-borne disease, the transmission of both diseases through milk may be controlled by pasteurization.

Statistics tend to show that nonpulmonary tuberculosis in man is decreasing in cities where compulsory pasteurization has been in effect for several years. Pasteurization, however, is only one factor in controlling human tuberculosis. In order to check the spread of tuberculosis from animal to animal through feeding skim milk and whey, many States have made it compulsory that these products from creameries and cheese factories be heated or pasteurized to a degree that will render them safe for animal feeding before they are returned to the farm. We believe all States should have similar legislation.

With the tuberculin testing of cattle under the accredited herd plan, tuberculosis has been reduced 50 per cent during the past six years, as revealed by a map issued by the United States Bureau of Animal Industry.[1] In 1922, four per cent of cattle were tubercular, while in 1928 the infection is shown as two per cent. During the year ending June 30, 1928, 10,828,280 cattle were tuberculin tested, over a million in excess of any previous year. The total number of herds under supervision at the beginning of the fiscal year July 1, 1928, was 2,290,752, containing 21,418,979 head, with 3,000,000 cattle on the waiting list. These figures speak for themselves as to the work being done to control bovine tuberculosis at its source.

It has been estimated that the losses from contagious abortion in our cattle industry in the United States approximate $50,000,000 annually. The disease is widespread and probably no section is immune from its ravages. Now that tuberculosis is becoming more and more under control, contagious abortion is undoubtedly our largest animal disease problem. Some States are already engaged in control work, and now that evidence points to the possibility of its becoming classed as a milk-borne disease, transmissible to man, this work is bound to develop rapidly.

In studying or investigating milk-borne diseases, it is interesting to note that an organism causing a specific disease in animal or man may manifest itself—as shown by symptoms—in widely dissimilar manner in each species. Thus in contagious abortion in cattle the parts involved are largely the genital and mammary tissues, while in man the symptoms are those of fever, hence the name, undulant fever.

In man septic sore throat affects tissues of the throat, while in cattle it is manifest by an inflammation of the udder, commonly called mastitis. Mastitis, however, is a general name for an inflammatory condition of the udder, and may be caused by a number of organisms. The hemolytic streptococcus of septic sore throat, which may cause mastitis in cattle, is of human origin—undoubtedly transmitted to cattle through a milker harboring this specific germ. Each year sees some outbreak of this disease. Such an outbreak occurred this year in the Berkshire region of Massachusetts. Pasteurization of the milk supply, however, apparently destroys this disease-producing organism.

The literature this past year contains articles showing that the hemolytic streptococcus causing scarlet fever may, under certain conditions, be transmitted from man to cattle and affect the milk supply in a similar manner to septic sore throat. Such reports have come from the Rockefeller Institute for Medical Research at Princeton, N. J.,[2] and from the Connecticut State Department of Health.[3] More evidence is needed to establish the fact before this disease is included in those milk-borne diseases which may be transmitted through milk from animal to man.

Last year your Committee reported that Dr. James F. Couch, of the U. S. Bureau of Animal Industry, had definitely proved that white snake root, which grows in our Central and Eastern States, was the cause of trembles in animals. The symptoms of trembles are due to a poison named tremetol found in this weed. In the

September issue of the Journal of the American Veterinary Medical Association is an article by Dr. Couch[4] in which he describes experiments carried on with sheep. The disease known as trembles was produced in sheep by feeding tremetol extracted from white snake root. Milk sickness in man is associated with trembles in cows when milk from animals suffering from this disease is used. In a recent Associated Press clipping it is stated that four persons died within eight days in a small town in Missouri. The diagnosis was milk sickness from using milk of cows suffering from trembles.

According to Professor Albert A. Hansen, Purdue University,[5] white snake root is probably the most important stock-poisoning weed found in Indiana. It has also been found that this weed seems to vary in toxicity in different sections. Specimens gathered around Washington, D. C., showed very little tremetol content, while plants growing in the vicinity of Lafayette, Ind., yielded a large amount of tremetol and were extremely toxic. With the discovery of tremetol a simple method of detecting its presence in milk, butter, and in plants has been developed.

The control of diseases milk-borne from animal to man, with the exception of those caused by poisonous weeds, appears to be accomplished by pasteurization of our fluid milk supplies. Certified milk, although not pasteurized, can well be classified with the pasteurized product, as the controls thrown around certified raw milk supplies leave little chance of danger from bovine diseases. Condensed, evaporated, and powdered milks are all heated in the process of manufacture to a degree that renders them safe from suspicion of disease transmission. In addition, most of the cream from which butter is churned is pasteurized, and with cheese where the milk or cheese is not subjected to pasteurization, the curing process seems to either destroy or render disease organisms harmless. As already pointed out, skim milk and whey returned from creameries and cheese factories should be heated or pasteurized before they are returned to the farm so as to eliminate the possibility of disease transmission through this source to other live stock. With these controls practiced, disease transmission can be held to a minimum.

This does not, however, excuse milk of poor quality. Milk should always be produced by healthy cows, refrigerated, and kept clean from the time it is drawn until delivered to the consumer or manufacturing plant.

References

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2. Bulletin of the Dairy Research Division of Mathews Industries, Inc., Detroit, Mich., Vol. 7, No. 26, Aug. 15, 1928.
3. Connecticut Health Bulletin, Hartford, Conn., Vol. 42, July, 1928, No. 7.
4. The Toxicity of Tremetol, James Fitton Couch, Pathological Division, Bureau of Animal Industry, Washington, D. C. Journal of the American Veterinary Medical Association, Sept., 1928, issue, pp. 603-7.
5. The Latest Developments in the Stock-poisoning Plants Situation in Indiana, Albert A. Hansen, Lafayette, Ind.; Purdue University Agricultural Experiment Station. Journal of the American Veterinary Medical Association, Aug., 1928, issue, pp. 471-2.

"It is by a series of successive steps that we approach the truth, each step reached with the help of that which preceded it."

THE ECONOMIC ADVANTAGE OF ABORTION CONTROL

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The economics of abortion control has a very important bearing upon the whole subject, perhaps more so than has the question of the susceptibility of man to *Brucella abortus* infection. Many of the best investigators are still in doubt relative to this subject, one group being positive *Brucella abortus* is infectious to man, while another group thinks differently. Some feel that the different strains, caprine, bovine, and porcine, have their relative places in the public health programs. There is no doubt but that *Brucella melitensis* is a very serious infectious agent, but the question of the relative virulency of the bovine and porcine strains is as yet not definitely decided.

Dr. K. F. Meyer, Hooper Foundation, San Francisco, through the reporting of some sixteen cases of so-called undulant fever in California since March, 1927, began late in that year a series of experiments to determine if possible the toxicity of the various strains of *Brucella abortus* through the use of monkeys. His work has not progressed far enough to draw any definite conclusion. At present, the conclusions are that only by heavy infestation is the disease transmitted, since no case of undulant fever has been reported in man in a person under thirteen years, and most cases so far observed have been in people past middle age suddenly placed on a forced milk diet using large quantities of milk. This seems sufficient reason for the dairy industry and the dairy inspector to take active part in the program of abortion control among dairy cattle.

In view of the decided agitation in the medical literature relative to human infection by *Brucella abortus,* the California Milk Commission's Association deemed it wise, over a year ago, to begin a program of eradication of bovine infection due to *Brucella abortus* in our herds. We incorporated in our State methods and standards a requirement that our herds be entirely free from *Brucella abortus* infection by July 1, 1930.

We in our work in Southern California are at present dependent upon separation of our animals on the premises. The manner of operation is that of dividing the herd into two groups (you, of course, understanding that we in Southern California do not have access to fields and pastures, but our cows are kept in corrals the year around) including milking cows. Each side has maternity barns, dry cows, and a hospital unit. The separated animals pass back and forth from a common milking barn, not used as a permanent home, but a milking barn in which the cows are tied during a two-hour milking period only, with separate milkers handling the cows in the barn. So far, we feel that perhaps with the number of animals involved—in one instance 1,800 animals on one ranch, nearly 900 on another, and about the same on a third—we are probably carrying on in this plan the largest program under this system in the United States. In other words, we secure complete isolation without removal.

We are using an antigen made from the Number 80 strain. It is being used entirely in California in our work in agglutination findings, and we feel that by using a particular strain for our base of antigen in all tests, that we may expect all of our work to coördinate, and with a correlated uniformity of the readings of these tests we may be able in another year to give you the results from 20,000 to 30,000 animals, following that program.

We have in our group in Southern California 3,000 cows, and a total of practically 4,000 cattle, including young cattle and bulls. Our first bleeding early last year showed a result of 35 per cent positive. Pending preparations for the separation of these animals, the negatives from the positives, they remained in contact for perhaps three months. During that interval, arrangements were made for complete separation as nearly as we could on the premises, which, in one instance, contains 800 animals on 17 acres. That program was virtually completed at the end of the three-months period.

When the second bleeding was completed, including only animals that were negative to first bleeding, we found 10.9 per cent positive. On the third bleeding of 1,500 head of what are now classed as negative animals, the percentage of positive animals was 3.5.

The San Francisco group of certified dairies have been following the same program, except that they have removed all positive animals from the premises and have in one year entirely removed from their herds all positive animals and now have only those negative to agglutination test left on their dairies.

The place to begin abortion control is with the young animal. One of the most striking illustrations of which I know of the benefits of that procedure is an instance which occurred at a farm south of San Francisco, where seven years ago they began a program of tuberculosis control by the isolation method. The herd, as far as tuberculosis is concerned, were 80 per cent positive to test. Calves were removed in accordance with their policy of tuberculosis control at birth and a calf herd established. When these calves began to become cows, the University of California, in their program of study of abortion control, bled and ran agglutination tests and found all to be negative. At the present time there are 1,000 animals, from calves three to four weeks old up to cows three to seven years old, on this ranch which up to the present have had but two positive agglutination reactions. These two instances are traceable to escaping from their premises and coming in contact with other animals.

Regarding some observations in our work relative to the decrease in productive ability due to *Brucella abortus* infection, I have some very outstanding features that came to our attention. On one of the farms when we began our first bleedings, there were 72 heifers of practically the same age, all coming into freshening and all later than six months in pregnancy, some of them within six weeks or less of freshening. Our first bleeding of these animals showed a definite positive reaction of 54 per cent. The history of that instance is that with this herd of heifers were some nonbreeding cows which had been delinquent in service, but had good records behind them and had been turned out in a nonproductive hilly pasture, where they were forced to exercise themselves. Through that contact, we figured the infection occurred. Of the 54 per cent, 70 per cent actually aborted before the full term period. On second bleeding of those animals, after the removal of all the positives, we had 26 per cent positive. At the present time, there are, as far as I have been able to ascertain, 18 apparently normal heifers from the original 72.

Other instances which came to our attention with regard to the influence of *Brucella abortus* infection upon production are:

1. Sixteen aged cows with five years' fat production records available. Two years prior to an abortion and two years following, the production average of the 16 cows was 436 pounds of fat per year, while the year of abortion the production average was 290 pounds of fat, or a loss of 33-1/3 per cent.

2. Forty-four first-calf heifers from practically the same

parentage and with the same feed and care and over a period of lactation covering 10.5 months. The first group of 22, following abortion, had a production record for the entire lactation period of 248 pounds of fat, or 23.6 pounds per month, while the second group of 22, following normal calvings, within a lactation period of 10.2 months produced 310 pounds of fat, or 30 pounds per month, or 21 per cent increase over the abortion-infected heifers.

Of the first group on second lactation, six have no second calf, six have second abortion, and ten have normal second calves, while the second group give 20 normal calves and two abortions.

3. Making the figures still more comprehensive, we have 57 first-calf heifers with normal calves, making an average production per cow of 714 pounds of milk per month, and 31 first-calf heifers aborting, making an average production per cow of 529 pounds of milk per month; or a theoretical loss of 24 per cent in milk production by the aborting heifers. This is a definite proof that there is a very deleterious effect from abortion infection.

4. One hundred and forty-three cows, covering a production period of 30.8 months within three years, are divided into two groups:

a. Eighty-nine with complete normal calving history, with production records of 1,094 pounds of fat for the period, or 35.5 pounds average per month.

b. Fifty-four with a record of one or more abortions, with production records of 335 pounds total fat, a difference of 759 pounds of fat for three years, or a loss of approximately 70 per cent.

Sixteen of the 54 show second abortion; 23 of the 54 show normal calvings; 13 of the 54 were sold to the butcher as nonbreeders; three show abortion three times, and two show no history of disposition.

Therefore, it seems to me, in conclusion, disregarding the public health standpoint in this question, looking at it entirely with that in the background, forgetting there is a public health program, these figures point out definite proof of the injury by *Brucella abortus* to the production record of the dairy herd.

"The art of healing has no more solid base than experience."

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

HOWARD R. ESTES, *Chairman*

The information that milk is one of the most valuable and economical foods which can be used by man is a truth which is becoming known more and more throughout all communities where health is recognized as an asset. Decided increases in the use of dairy products are the usual results of any organized move to spread the knowledge of the food value of milk and milk products.

It is refreshing, therefore, to those who wish to see an increased use of clean and safe milk to know that milk-borne disease is apparently diminishing.

A comparison of the number of milk-borne epidemics occurring in the United States and recorded by the United States Public Health Service for the years 1926-1927 may prove interesting.

Disease	No. of Epidemics		No. of Cases		No. of Deaths	
	1926	1927	1926	1927	1926	1927
Typhoid Fever	49	23	1,189	421	83	35
Para-Typhoid Fever	2	2	19	53	1	0
Septic Sore Throat	6	0	1,518	0	7	0
Scarlet Fever	5	5	271	398	3	5
Diphtheria	2	2	24	15	0	0
Others	4	4	32	65	1	1
Totals	68	36	3,363	952	95	41

Raw milk was the carrying medium in every one of the above mentioned epidemics.

It must be remembered, however, that these epidemics have been officially recorded. Undoubtedly others have occurred in the United States during the years 1926 and 1927 which did not come to the attention of the health authorities and even others which may not have been known to exist.

Sporadic cases of disease in widely separated localities may have a common start. An incident of this nature was brought to light recently. A number of cases of typhoid fever were reported in several Minnesota communities. The only thing in common in connection with these cases was the date of onset of the disease. To the individual health officers of these communities nothing definite had been revealed because of the isolated number of cases in each community.

The Bureau of Preventable Diseases of the State Health Department, in due course of time, received the reports of the contagion and recognized the one thing in common—the date of onset of the disease.

Detailed investigation finally indicated that a person, who has since been revealed as a typhoid carrier, came in contact with a shipment of cream, part of which was used in the manufacture of a lot of cream cheese which was sold in several different communities. This carrier, as has been stated, has been identified and is now regulating his activities under the direction of the State Department of Health in a manner that removes a menace to the health of the people of the State.

An epidemic of some interest to milk improvement officials occurred about September 12, 1927, in Troy, Missouri. It was caused by milk from a so-called "one-cow dairy," of a type with which most inspectors come in contact at some time. Dr. W. Scott Johnson, Chief Sanitary Engineer of the State Board of Health of Missouri, writes as follows:

"We are giving you herewith essential facts regarding the only identified milk-borne epidemic in Missouri since the Lebanon outbreak.

Place	Troy, Missouri
Date	About September 12, 1927
Epidemic	Typhoid Fever
Number of Cases	7
Deaths	1

"Three families were involved, the only persons using milk from a one-cow dairy. No cases of typhoid occurred outside of these three families. Dairyman's family consisted of man, wife, and three children. Stool examinations of entire family indicated that the man was a typhoid carrier. Sale of milk was stopped and no additional cases of typhoid fever developed."

This outbreak is quoted to show the importance which should be attached to every dairy from which milk is distributed. The practice of exempting the one-cow dairies from the provisions of a milk ordinance should not be tolerated.

The following is an extract from a letter by Dr. C. H. Halliday, Chief Epidemiologist of the California Department of Health.

"Very recently we had a small epidemic in San Francisco, which has been traced to a carrier. As this carrier worked on a bottling machine, the milk was contaminated after pasteurization. * * * The fact should be emphasized that milk may become contaminated after passing through efficient pasteurization.

"In 1917 we had 50 cases of typhoid fever from a plant where the thermometer was out of order, and no check on the efficiency of the 'pasteurization' was made.

"In 1920 there were 35 cases of bacillary dysentery which occurred on a certified dairy. A milker on this farm was found to be a carrier.

"These outbreaks in pasteurizing and certifying plants only emphasize the necessity for having careful personal hygiene among milk handlers, and should indicate the necessity for having milkers and milk handlers constantly examined as to the possibility of their being carriers of pathogenic organisms."

The foregoing letter contains information of importance in showing the danger of contamination of both pasteurized and certified milk through contact of carriers of the germs of various diseases. We should therefore bend our efforts toward the proper pasteurization of a clean and wholesome milk supply, making as sure as possible that every chance of contamination is reduced to a minimum, especially after pasteurization.

Milk-Borne Poliomyelitis

Three outbreaks of milk-borne poliomyelitis (infantile paralysis) have come to notice in the literature of this disease and are listed below.

Dingeman, John C. Report on a possibly milk-borne epidemic of infantile paralysis. *New York State Journal of Medicine,* 16: 589-590, 1916.

Knapp, A. C., Godfrey, E. S., Jr., and Aycock, W. L. An outbreak of poliomyelitis apparently milk-borne. *Journal of the American Medical Association,* 87: 635-639. 1926.

Aycock, W. Lloyd. A milk-borne epidemic of poliomyelitis. *American Journal of Hygiene,* 7:791-803. 1927.

Scarlet Fever Epidemics

Through the kindness of Dr. Millard Knowlton, State Department of Health of Connecticut, we are able to quote the following:

"Recent experiences have indicated the advisability of modifying somewhat the procedure in handling milk-borne outbreaks of scarlet fever and septic sore throat.

Heretofore the procedure has been based upon the idea that streptococci of human origin are not pathogenic for cows and that streptococci of bovine origin are not pathogenic for man. Information gained in a study of two recent outbreaks has changed this view.

"A milk-borne outbreak of scarlet fever occurred last winter (1927-1928) in Unionville. While investigating the outbreak it was learned 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 a mastitis at the time of the investigation. From the milk produced by this cow, from the throat of the milker, and from the throats of patients there were isolated hemolytic streptococci which were identified as the streptococcus of scarlet fever. The new point is that a cow may become infected by the scarlet fever streptococcus and that this germ may be discharged into the milk and carried to consumers. While studying this outbreak it was learned that others have had a similar experience and a paper on the subject was published in the *Journal of Experimental Medicine* for June, 1928.

"In another milk-borne outbreak of scarlet fever which occurred in Avon, a hemolytic streptococcus was isolated from the milk of one of the cows which appears to be the streptococcus of scarlet fever. This is the second milk-borne outbreak of scarlet fever in Connecticut since the first of the year (1928) in which udder infection with the scarlet fever streptococcus has been found in a member of the herd supplying the milk."

The article in the *Journal of Experimental Medicine* for June, 1928, is one of a series by F. S. Jones, V. D. M., and Ralph B. Little, V. D. M., covering various phases of the matter of infection of cows' udders with scarlet fever streptococci. In discussing their results the authors state in part:

"The view usually held covering milk-borne epidemics of scarlet fever is that the streptococci originate in the throats of the milk handlers and through contamination gain access to the supply. It is difficult to explain on such grounds the heavy incidence of infection among the consumers of pooled supplies, since relatively few organisms would gain access to limited amounts of milk, and when this was mixed with other milk the dilution would be so great that the probable incidence of human infection would be relatively small. It might be argued that the contaminating streptococcus would multiply rapidly in the milk provided the temperature was favorable and that the product reaching the consumer would thus contain large numbers of the streptococci. But to explain severe outbreaks of scarlet fever through milk contamination one would have to assume that the organism gained access in goodly numbers and multiplied rapidly. However, certain experiments here to be reported indicate that streptococci of the scarlet fever type are acted upon adversely by milk. * * *

"That a few individuals may contract the disease through direct human contamination of milk is possible, but the occurrence of epidemics would imply a heavy inoculation of the milk. Infection of the udder of a single cow with the scarlet fever streptococcus and the resultant seeding of large numbers of the organisms into the milk—phenomena recorded in our foregoing papers—afford a more reasonable explanation of milk-borne epidemics."

The following clipping from the *Boston Herald* relative to the recent epidemic of septic sore throat in Lee, Massachusetts, contains items of interest along this same line. We read:

"About 700 persons have been made ill by milk which had been contaminated by this infected cow, which was one of a herd that had been imported from northern Vermont by a Lee producer about three weeks before the epidemic began. Milk from this cow had been distributed in Lee between June 29th and July 8th. About July 1st the spread of a mysterious malady was first noted and it gained daily in severity. On July 4th, five persons visited Lee. Two drank ginger ale at a drug store and three had milk shakes. The latter three became ill, while the first two did not. That gave the clew to the epidemic's cause.

"For three weeks the death list mounted. The number of new cases increased until July 10th, when the effect was noted from the health officials' order that all milk be either boiled or pasteurized.

"The Lee High School was converted into a 75-bed emergency hospital. Business men estimate that $30,000 was spent for nurses, doctors, and medical supplies. In addition, it is believed that the loss to business amounted to $100,000.

"There are still 75 nurses on duty. Only 12 cases remain in the emergency hospital. No new cases have developed in the last ten days."

We should stop and think what a terrible catastrophe was experienced by this city of 4,000, located in western Massachusetts—a total of about 700 cases of illness, affecting about one person out of every six, with 40 deaths, or one death to each 100 inhabitants.

Epidemics Spread by Dairy Products other than Milk

Attention is directed to a number of epidemics spread by dairy products other than milk. Dr. C. H. Halliday, epidemiologist of the California State Health Department, writes of those in California as follows:

"No. 1. 1926. Twenty-three cases, from chocolate ice cream prepared by a woman found to be a typhoid carrier.

"No. 2. 1916. In an epidemic of 112 cases of typhoid fever, there were two sources, one an ambulatory case on a dairy and the other a typhoid carrier serving ice cream in a sweet shop. Ten patients who gave a history of having had the ice cream had not had the infected milk. Forty-four had had both the ice cream and the milk.

"No. 3. 1917. Fifty cases among users of milk from one particular dairy, or ice cream made from milk and cream from that dairy."

Dr. Guy Kiefer, of Michigan, calls attention to a typhoid fever epidemic traced to cheese, which involved 64 cases, and one to ice cream involving 128 cases.

Dr. Millard Knowlton, of Connecticut, writes of two ice-cream-borne epidemics of typhoid fever which occurred in his state.

Dr. H. M. Guilford, of the Wisconsin State Board of Health, reports:

"The following is an account of an epidemic occurring in Wisconsin this year: One hundred twenty-four cases of paratyphoid fever B occurred in Beloit, Wisconsin, betwen April 1 and July 1, 1928, and 27 cases occurred in the territory adjacent to Beloit. The source of this was found to be ice cream. The ice cream was a product from a pasteurizing milk plant, and according to custom the mix was heated to 160° F. The employee who wrapped the brick ice cream and placed paper over the cans of ice cream prior to capping it with a metallic cover was found to be a carrier. No cases occurred where the mix was sold. The epidemic subsided on schedule time when the carrier was removed from the plant."

Undulant Fever Cases

Effort was made by your committee to determine the progress in identifying cases of the disease of man variously known as undulant or Malta fever as due to the germ of infectious abortion of cattle. Dr. Wm. F. King, of the Indiana State Board of Health, under date of August 13th advises as follows:

"In regard to your inquiry concerning cases of undulant fever in Indiana, you are advised that up to the present time we have 30 cases that have been positively identified as undulant fever, in all of which the disease has been apparently caused by the germ of infectious abortion in cattle. There were 14 cases in the outbreak at South Bend, 13 in the outbreak at Earlham College at Richmond, one case at Valparaiso, and one at Michigan City. A case in Fort Wayne has been reported within the past week, diagnosed from a blood test in the Fort Wayne laboratory. Undulant fever has been responsible for the adoption of pasteurizing ordinances in South Bend, Michigan City, and Richmond."

Information about the study of undulant fever in Indiana is supplemented by a letter from Dr. M. E. Farbar, resident physician of Earlham College, Richmond, Indiana, under date of August 19, 1928:

"In January and February there occurred 15 cases of undulant fever positive by blood agglutination tests done by Dr. E. Francis, United States Public Health Service."

The status of the herd at Earlham College, as a result of the work done by Dr. Frank Mathews, of Purdue University, was reported by Dr. Farbar as follows:

"There were seven positive reactors, four doubtful, and 12 negative. Milk was examined from five of the positive reactors; the other two were dry. Guinea pig inoculations proved that three of the five reactors were eliminating *B. abortus* with the milk. Direct isolation of *B. abortus* from the milk proved that two of the three were eliminating the organism in the milk. Three of the five reactors had mastitis."

Undulant fever has also been discovered apparently by means of agglutination tests in Maine, Iowa, Minnesota, Missouri, Michigan, Pennsylvania, and Oregon.

Five cases of undulant fever were discovered in the State tuberculosis hospital in Salem, Oregon. The institution herd gave a positive history of infectious abortion. Pasteurization of the milk supply was used to prevent the further spread of the disease to those who used the milk.

A paper on "Malta Fever in Iowa," by Dr. A. V. Hardy, contains the following statement:

"The findings made at the Iowa State Hygienic Laboratories as a result of the routine examination for Malta fever of blood specimens sent for Widal tests have been reported. The significance of these examinations is better realized when compared with the results of typhoid examinations. During the three months 46 positive Widals were reported from 41 cases, while the number of agglutinations for Malta fever was 56 from 31 cases. The figures indicate that in Iowa, at least, Malta fever presents a health problem comparable to that of typhoid fever.

"The advisability of adopting the routine described (that is, the regular application of the abortus agglutination test to all Widal samples) is emphasized by this report. Of the 38 positive cases, in only 10 did the physician consider Malta fever as a possibility and request the agglutination test."

Conclusion

With the above data merely showing by repetition that milk-borne disease has been, is, and will be with us until definite safeguards are used to a greater extent, it may be of some value to state again a few definite steps which may be used to eliminate this needless amount of suffering and economic loss.

Among the recommendations aimed to bring about better conditions we can include the following:

1. The proper pasteurization of municipal milk supplies.

2. The sale of bottled milk only in public eating establishments.

3. The use of properly pasteurized milk only in milk-in-schools service when such milk is available.

4. The regular tuberculin testing of cows, milk from which is used for human consumption.

5. The proper handling of milk before and after pasteurization.

6. The elimination of carriers of disease germs from food-handling occupations.

7. The spreading of information, properly worded, relative to the greater safety in the use of pasteurized milk.

8. The reporting to the proper health authorities of all milk-borne epidemics, together with the cause, kind of milk, and other information of value to epidemiologists.

9. The routine testing of all Widal specimens by State, city, and private laboratories for indications of undulant fever agglutinins.

References

1. Weekly Health Bulletin, Connecticut State Department of Health, Vol. 10, No. 28, July 9, 1928.
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3. American Journal of Public Health, Vol. 13, No. 3, March, 1923.
4. American Journal of Hygiene, Vol. 5, p. 669, Sept., 1925.
5. Public Health Reports, Vol. 43, p. 503, 1928.

Discussion

Mr. Irwin: We had trouble in getting samples to the laboratory, and so we put a laboratory on wheels. We equipped a truck as a laboratory, and in this way we could take the laboratory and the laboratory work directly to the point where work should be done.

"Nothing can be lasting when reason does not rule."

THE DISTRIBUTION OF FAT IN GRAVITY CREAM

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During the latter part of the nineteenth century the factors influencing the gravity separation of the fat from milk assumed great importance, because this was the method used for obtaining cream. With the development of the centrifugal separator, interest in gravity separation of cream was lessened. More recently the rapid development of the market milk industry and the sale of milk in glass bottles has renewed our interest in gravity creaming. The volume of cream on the milk bottle is one of the best selling points for the milk dealer, and consequently, he desires to carefully avoid any treatment of the milk which adversely affects the cream volume.

The early investigations of gravity separation had, as their object, the establishment of conditions which would insure the most exhaustive creaming. During these early investigations many data were collected on the fat content of gravity cream. The gravity creaming investigations of today center around the volume of cream formed on milk.

The importance of the clumping of the fat globules as influencing the raising of cream has been recognized by Rahn (1), van der Burg (2), van Dam and Sirks (3), and Troy and Sharp (4). The latter called particular attention to the influence of the clumping of the fat globules on the volume of cream formed on milk.

Marquardt and Dahlberg (5) found that the mean depth of cream layers formed on normal milk from Holstein and Jersey cows was directly proportional to the percentages of fat in the milk. The percentage of the total volume of the milk represented by the cream layer was 4.1 times the percentage of fat in the milk.

Theoretically, at least, the percentage of fat in the cream on a milk bottle should decrease progressively from the top to the bottom of the cream layer, because the upper layers of clumps of fat globules are subjected to a greater packing force, due to the crowding from the clumps beneath. For a given set of conditions, the deeper the cream layer the more the upper layers would be packed, and, consequently, the fat content of the upper layers would be higher.

The literature contains the reports of a few attempts to determine the fat content at various depths after gravity creaming, but these data are of little value in demonstrating the fat distribution in gravity cream.

Attempts were made to draw off the various layers of the milk and cream after gravity creaming, but all such attempts resulted in so much mixing of the different layers that the results were considered of no value. This difficulty was finally overcome by first cooling the milk, then adding a small amount of rennet extract, allowing the milk to cream at a cold temperature, and warming the milk to near room temperature to cause the rennin to coagulate the milk. The various layers were then removed for fat analysis. Two methods for progressively removing the layers of coagulated material were tried: (1) cutting and dipping off the layers of the coagulum with a knife blade attached to a perpendicular rod, and (2) removing the layers by means of a suction tube, the layer removed being caught in a trap and saved for analysis. The first method caused considerable separation of whey. The suction tube method was more rapid and convenient and was used to obtain the data reported in this paper. The details of the procedure actually used were as follows:

Immediately after milking, the samples of milk were placed in 1500-c.c. cylinders. These cylinders were then placed in ice water at a temperature of 2.8° to 4.4° C. In less than 30 minutes the milk was cooled to the same temperature as the water. The cylinders were removed from the ice water twice during the half hour and inverted so that the entire contents of the cylinder would be cooled uniformly. The cylinders containing the samples of milk were then placed in a cold room kept at about 4.4° C. At this point 5 drops of rennet extract were added to each sample of milk for the purpose of coagulating the milk after the cream had risen. The reason for this was to make it possible to remove each layer of cream without mixing. Each sample was mixed to distribute the rennet. They were then left in the cold room. A sample of the milk was also taken for the fat test.

After standing in the cold room about 18 hours, the cream line was measured. The cylinder and contents were then placed in a water bath at a temperature of about 33° C. until coagulated. The rapid coagulation was produced at the higher temperature by the rennet added, at the time the milk was placed in the cold room.

The cylinder was marked for the measurement of 30 c.c., and a volume of 30 c.c. of cream was removed by a suction tube for each sample.

Some difficulty was found in removing the last layer of cream without also removing some of the skim milk. This is indicated in the fat content of the sample.

After removing the entire cream layer, samples were also taken from the skim milk. These succeeding skim milk samples represented each succeeding 100 c.c. layer of skim milk.

All cream and skim milk samples were then tested for fat by the Babcock method. The skim milk samples were tested in whole milk test bottles because the fat percentage in these samples of skim milk was so high that readings could not be made in the ordinary skim milk test bottles.

Typical results obtained are given in Table I. On the whole, the fat content decreases progressively from the top to the bottom of the cream layer. The fat content of the different layers of skim milk, on the other hand, remains about constant. Actually a very thin layer near the bottom of the cylinder showed a distinct decrease in fat as compared with the other layers, but this layer was not deep enough to make an appreciable decrease in fat when mixed with the last 100 c.c. or so of skim milk of the higher fat content.

TABLE I

FAT DISTRIBUTION AFTER GRAVITY CREAMING OF 1,500 C.C. OF MILK IN A GRADUATED CYLINDER

		Experiments				
Layer No.	Volume Removed for Analysis	5 Holstein Milk Fat	6 Guernsey Milk Fat	7 Guernsey Milk Fat	8 Jersey Milk Fat	9 Jersey Milk Fat
	c.c.	%	%	%	%	%
	Cream					
1	30	22.00	22.50	24.50	27.50	28.00
2	30	18.00	18.00	21.50	23.50	23.00
3	30	18.00	17.00	19.00	19.00	19.00
4	30	16.00	16.00	19.00	15.00	17.00
5	30	16.00	15.50	19.00	15.00	17.00
6	30	16.00	14.00	19.00	15.00	16.50
7	30	7.50	14.00	19.00	15.00	15.00
8	30		12.00	19.00	15.50	15.00
9	30		12.00	18.00	15.00	15.00
10	30		10.50	18.00	15.00	15.00
11	30		10.50	17.50	14.50	14.50
12	30		10.00	14.00	13.00	13.00
13	30		10.00	10.00	13.00	13.00
14	30		10.00		13.00	13.00
15	30		10.00		13.00	13.00
16	30		6.00		11.50	11.00
	Skim Milk					
17	100	1.2	2.0	1.2	1.8	2.0
18	100	1.2	2.0	1.2	1.8	2.0
19	100	1.2	2.0	1.2	1.8	2.0
20	100	1.2	2.0	1.2	1.8	2.0
21	100	1.2	1.5	1.2	1.8	1.8
22	100	1.2	1.5	1.2	1.8	1.8
23	100	1.2	1.5	1.2	1.8	1.8
24	100	1.2	1.5	1.2	1.8	1.8
25	100	1.2	1.5	1.2	1.8	1.8
26	last	1.2	1.5	1.2	1.8	1.8

Experiments of a similar nature were also carried out, using one-quart milk bottles. Typical results obtained are given in Table II. These results are in essential agreement with those obtained when the creaming was carried out in cylinders.

TABLE II

FAT DISTRIBUTION AFTER GRAVITY CREAMING IN ONE-QUART MILK BOTTLE

		EXPERIMENTS				
Layer No.	Volume Removed for Analysis	14 Jersey Milk Fat	15 Guernsey Milk Fat	16 Guernsey Milk Fat	17 Guernsey Milk Fat	18 Holstein Milk Fat
	c.c.	%	%	%	%	%
	Cream					
1	25	28.00	29.50	26.50	24.00	24.00
2	25	23.50	23.50	21.50	23.00	23.00
3	25	20.00	23.00	21.00	23.50	22.00
4	25	20.00	23.00	21.00	23.00	20.00
5	25	20.00	23.50	20.00	20.50	15.00
6	25	19.00	22.00	19.00	20.50	7.00
7	25	19.00	20.50	19.00	15.00	
8	25	17.50	20.50	17.00	15.00	
9	25	15.50	7.50	15.00	14.00	
10	25	15.00		4.00	4.00	
11	25	8.00				
12	25	7.50				
	Skim Milk					
13	100	1.60		1.20	1.80	0.7
14	100	1.60	1.30	1.20	1.80	0.7
15	100	1.60	1.30	1.00	1.80	0.7
16	100	1.60	1.20	1.00	1.80	0.7
17	100	1.60	1.20	1.00	1.80	0.7
18	100	1.60	1.20	1.00	1.80	0.7
19	last	1.60	1.20	1.00	1.80	0.7

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"Spurn not a seeming error, but dig below the surface for the truth."

SOME LABORATORY STUDIES ON THE SANITARY QUALITY OF CONCENTRATED MILK*

J. H. SHRADER, PH. D.

In connection with our considerations of the increasing importance of powdered and evaporated milks in our milk products dietary, our attention has been directed to the need for methods to determine the sanitary quality of a given remade milk. Our work on milk powders has been published in detail elsewhere (1) and was reported to this association at the last meeting (2). During the past year, we have extended this work to evaporated milk as prepared in the laboratory, preliminary to applying it to samples commercially prepared.

Our analytical methods were based on the idea that bacterial life in milk must leave telltale biochemical changes of the milk, to which we attempt to give some degree of qualitative and quantitative expression.

Our method of procedure was to divide several well-mixed quarts of certified milk into several portions; one portion would be analyzed at once, whereas the others would be analyzed after being held for varying lengths of time to allow the natural processes of bacterial growth to assert themselves. In several cases, the certified milk was inoculated with some low-quality milk. In each case the sanitary quality of the original milk was determined by the following tests: Breed (direct) bacteria count, agar plate bacteria count, and reductase test by both the methylene blue and Janus green methods. Then the milk was placed in a glass distilling flask and concentrated in vacuo in the propor-

* The determinations were made by Mr. C. L. Ewing and Mr. A. E. Nock, of the Bureaus of Bacteriology and Chemistry and Food respectively, Baltimore Health Department.

tion of a little less than three to one, at a temperature of about 158° F. In each case, the distillate was collected in order to ascertain whether any ammonia was boiled out of the milk during concentration, and if so, to what extent. The concentrated milk was then treated with an excess of sodium carbonate and distilled into standard sulphuric acid for quantitative determination.

The volatile acids were determined in the raw milk by the method of Lisk (3). Some amino acid nitrogen was determined, but the results were so very scattered that this phase of the study was discontinued.

The data from this part of the work is presented in Table I.

TABLE I

Before Concentration							After Concentration
	Bacteria Counts						
Days Held	Breed	Plate	B. Coli	M.B. Hrs.	Catalase c.c.	Volatile Acids c.c. N/10 KOH per 100 c.c.	Ammoniacal Nitrogen Mg. per 100 c.c.
0	2,900	800	.2	5.5	1.9	——	0.111
4	28,000	1,000	100	5.5	2.0	——	0.173
11	23,000,000	——	——	3.5	13.9	1.5	0.320
18	——	440,000,000	10,000,000	.3-	——	5.56	5.757
0	2,900	2,300	.5	5.5	1.9	——	0.105
4	3,500	900	10	5.5	2.0	——	0.172
12	21,000,000	400,000	100	2.5	13.10	1.770	1.095
18	——	9,600,000	——	.3-	13.45	2.913	5.035
0	18,000	900	.5	5.5	1.95	1.283	0.177
8	61,000,000	303,000,000	100,000	.3-	3.55	3.644	1.048
15	——	1,200,000,000	10,000,000-	.3-	——	5.218	2.457
0	23,000	5,000	1	5.5	2.65	2.62	0.193
2	90,000,000	69,000,000	1,000,000	.3-	——	4.03	1.385
4	138,000,000	4,800,000	——	.3-	——	4.58	1.499
0	10,000	41,000	10-	5.5	2.25	3.54	0.275
1	375,000	130,000	10,000	7.5	2.40	3.46	0.253
3	106,000,000	71,000,000	10,000,000	1.3	2.80	4.59	0.356
4	363,000,000	350,000,000	100,000,000	.5	5.55	5.40	0.956
7	354,000,000	340,000,000	100,000,000	.3	6.50	10.73	1.410
8	824,000,000	600,000,000	100,000,000	.2	——	——	3.781
inoc.	606,000,000	400,000,000	1,000,000	.1	——	4.88	8.547
inoc.	407,000,000	380,000,000	1,000,000	.1	——	7.68	6.266
inoc.	131,000,000	54,000,000	10,000	.5	2.3	6.76	1.385

The Janus green determinations were omitted because they so closely checked the methylene blue determinations.

When the logarithms of the bacteria counts by either the Breed (direct) method or the agar plate method were plotted against the logarithms of the ammoniacal nitrogen, it was noted that a fairly smooth curve could be drawn through the points, although no correction was made for variation in the degree of the concentration, ranging as it did in those cases where determined from 2.2 : 1 to 2.7 : 1.

In Table II are tabulated the results obtained by making bacteria counts of the milk both before and after evaporation, with the attendant ammoniacal nitrogen content:

TABLE II

Before Condensing			After Condensing				
Breed Count	Plate Count	Total Solids	Breed Count	Plate count	Total Solids	Ratio of Concentration	NH_3 Nitrogen
90,000,000	69,000,000	13.25	34,000	6,600	......	....	1.385
138,000,000	4,800,000	13.30	43,000	100,000	......	....	1.499
10,000	41,000	13.8	32,000	25,000	37.3	2.7	0.275
375,000	130,000	13.4	59,000	15,000	30.8	2.3	0.253
106,000,000	71,000,000	13.8	5,500,000	1,900,000	34.5	2.5	0.356
363,000,000	350,000,000	14.0	571,000,000	400,000,000	30.5	2.2	0.956
354,000,000	340,000,000	13.6	18,000,000	185,000	31.1	2.3	1.410
824,000,000	600,000,000	13.2	354,000	100,000	35.3	2.6	3.781
606,000,000	400,000,000	13.45	14,000,000	3,000,000	......	....	8,547
407,000,000	380,000,000	11.15	2,500,000	1,000,000	25.5	2.3	6.266
131,000,000	54,000,000	13.4	82,000,000	59,000,000	36.2	2.7	1.385

The detailed procedure will be presented elsewhere. The work was not continued over a long enough time nor comprised enough samples to draw conclusive results, but such work as was done warrants the following deductions:

1. The methylene blue reductase test is again demon-

strated to be applicable to determine the bacterial quality of a milk.

2. The content of ammoniacal nitrogen constitutes a fair measure of the original bacterial infection before concentration. If the ammoniacal nitrogen is in excess of 1.00 milligram per 100 c.c. of evaporated milk, the original milk contained over 400,000 bacteria per c.c. by the plate count.

3. The determination of the bacterial content by the Breed (direct) and agar plate methods indicates that in both respects there is an enormous destruction of organisms, so that if either of the counts is high in the finished product, it may be safely concluded that the bacterial count in the raw unconcentrated milk was even far greater, assuming, of course, that there has not been subsequent inoculation and growth after the evaporation.

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"Man can learn nothing unless he proceeds from the known to the unknown."

POWDERED MILK AND THE PUBLIC HEALTH

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In ten years the production of dried whole and dried skim milk in this country has nearly quadrupled, an advancement surpassing all other articles in the dairy industry. During the same decade, from 1918 to date, our total milk production has increased more than 40 per cent, a propitious and healthful expansion, but obviously less striking than the increment in powdered milk alone.

The great increase in the production and use of powdered milk has occurred chiefly because of economic reasons, though the benefit from the standpoint of public health may have been an inducement, and certainly has been in some degree a result. (1) On the economic side, industrial leaders are beginning to realize that it is not particularly good business to utilize valuable space for the shipment of fluid milk containing approximately 87 per cent water when the same whole milk in a powdered form with only about two per cent water can be transported in about one eighth the space.

Not only does powdered milk offer an economic saving in bulk, but it presents a method of storing and keeping a perishable food, and making it readily available in a convenient and inexpensive form. It also offers an efficient method to avoid waste, particularly in the skim milk field, where most of the skim milk residue from butter making is now utterly wasted and not utilized for the valuable food which it is.

The statistics of the United States Department of Agriculture on dried milk (2) reveal that the manufacture of powdered whole milk in this country increased from about four million pounds in 1918 to nearly eleven million in 1926, while powdered skim milk made the remarkable expansion from some 26 million pounds in 1918 to nearly 92 million in 1926. Dried buttermilk showed a similar increase, from five million pounds to more than 31 million during the same period, and malted milk went forward from somewhat over 15 million pounds to more than 20 million. Exact figures for this period are shown in the accompanying table. In 1927 the total production of all dried milk products amounted to 186,393,000 pounds, or 50,000,000 more than in 1926.

When it is considered that processes for the desiccation of milk date from 1855, when Grimwade received his patent in England, and that malted milk was a commercial success in 1883, this recent development of the dried milk industry is all the more significant. Most of the successful schemes for powdered milk have, moreover, been patented during the twentieth century, beginning with the spray process of Stauf in 1901 and the roller process of Just in 1902. The Merrell brothers and Gere invented another spray process in 1905, and after 1913 Gray and Jensen secured patents on still another. Today, the spray system of drying milk is the most popular, fully 90 per cent of all powdered milk manufactured in the United States being produced by this process.

In the Merrell-Soule spray process, tested milk is condensed in vacuum and then pasteurized, or vice versa. It is next forced under high pressure through fine nozzles into a steel chamber, heated to a temperature of about 270 degrees Fahrenheit. This high temperature causes the remaining moisture to evaporate rapidly and pass out at the top of the chamber. The resulting milk powder collects at the bottom and is immediately, or frequently, removed in order to prevent cooking and other unfavorable effects. In the roller process, pre-condensed milk is poured in a film upon revolving steel drums, heated to a high temperature. In some cases this drum is enclosed in a vacuum chamber, in others it is not. The moisture evaporates and the resulting powder is scraped from the drum.

Although the greater part of the powdered milk now produced is made by the spray process, much of the scientific literature which has been published on the bacterial content of dried milks seems to deal chiefly with those manufactured by the roller process. The principles resulting from these studies are, however, applicable in a general way to all powdered milks and a brief review of them will be of value.

The bacterial content of dried milks was apparently first studied by Delephine in England in 1914. In a report to the Local Government Board (3), he stated that milk received from the farm had more than 14,000,000 bacteria per gram, while after the spray process the finished product had only 154,000. Another sample containing 588,000 bacteria had only 14,600 after the hot roller process, while a third, with the astounding

TABLE I*

PRODUCTION OF DRIED MILK IN THE UNITED STATES

(Thousand pounds, *i. e.*, 000, omitted.)

Product	1918	1922	1926
Powdered whole milk	4,006	5,599	10,768
Powdered skim milk	26,202	40,617	91,718
Powdered buttermilk	4,951	9,007	31,378
Dried casein (skim)	10,936	6,907	16,983
Malted milk	15,623	13,659	20,673
Totals	61,718	75,789	171,430

Powdered cream and dried casein (buttermilk) omitted.

* Data taken from Handbook of Dairy Statistics, U. S. Department of Agriculture, 1928.

bacterial content of 104,900,000, was reduced in bacteria to 4,900 after this same process. As was well pointed out by Dr. H. W. Redfield in commenting on these results in a paper on "Remade Milk," delivered before the International Association of Dairy and Milk Inspectors in 1919 (4), the whole milk supply of England showing such great contamination at that time needed urgent attention from a reputable group of sanitary inspectors.

Delephine reported in his 1914 paper that the tubercle bacillus was attenuated but not destroyed by the drying of milk. In 1925 two other British investigators, Hunwicke and Jephcott, conducted tests on the destruction of bacteria by the roller process (5) and found that the tubercle bacillus was destroyed or rendered avirulent, since they could get no tuberculosis in guinea pigs inoculated with powdered milk made from whole milk containing the bacillus. Since proper pasteurization is known today to be destructive to the tubercle bacillus, and the temperature used in drying is also usually above the thermostable limit of this organism, it can be stated with certainty that modern powdered milks are free from the tubercle bacillus, a fact confirmed by recent investigations by Shrader and others. (6)

During the war "reconstructed milk," made from butter-fat and skimmed milk powder, was used to advantage in a community of 25,000 persons employed in a Government ordnance plant. Studies of the bacterial content of this reconstructed milk showed it to be satisfactory from the health standpoint. (7) In 1919 the United States Public Health Service conducted an investigation of dried milk powder in infant feeding, in which 287 babies in Boston were divided into three groups, one fed on Grade A cow's milk, the second on whole milk powder, and the third on a reconstructed milk made from skimmed milk powder and sweet butter-fat. The conclusion was reached that the dried milk powders, and their remade products used in the study, were safe for infant feeding, and the statement was also made that a freshly opened can of whole milk powder had a count of 1,600 bacteria per cubic centimeter. (8) In these experiments a dried milk, made by the spray process, was used. During the hot days the count of the Grade A milk was said to have run as high as 200,000.

Powdered milk is invariably low in bacteria immediately after the drying processes, but it may be susceptible to contamination in later handling. Supplee and Ashbaugh (9) report that the bacterial content of powdered milk as it comes from the cylinder averages less than 1000, regardless of the original content, although some of the whole milk used had as many as 354,000,000 bacteria. These writers show that the powder may be recontaminated, but that the bacteria tend to be reduced by storage. In another paper (10) these writers report that the decrease in the original bacteria content of the milk after the roller process is about 45 per cent, as determined by the method of "microscopic examination." On the other hand, Jephcott, Hunwicke, and Ratcliffe state that the number of bacteria in stained centrifugalized deposits of reconstituted dried milk made by the roller process bears no relationship to the plate counts nor, apparently, to the number of bacteria in the original milk. (11)

The number of organisms in the original milk before drying and the number in the finished product are both matters of importance. According to Jephcott, Hunwicke, and Ratcliffe, (12) the number and nature of the living bacteria in the final product is regarded as the most useful method of judging purity, but Shrader, Ewing, Korff, and Conn have pointed out recently (13) that chemical analysis of milk powder showing the approximately proportional content of ammoniacal products indicates the bacterial content of the original milk supply, because excessive bacteria counts tend to decompose the milk.

The work of Shrader and his colleagues was done on 100 samples of commercial milk powders purchased at various places in Baltimore. Most of these samples were taken from large commercial packages, such as barrels and drums, in which these powders are shipped to the industry for use in baking, ice cream making, and similar trades. Plate counts of these samples ranged from several instances of approximately 1000 bacteria to one of 26,000,000, with an average of 750,000. The Breed counts were, of course, much higher.

While this study indicates that many of the commercial milk powders sent to the trade are either manufactured from milk high in bacteria or else are handled in an insanitary manner, it can be asserted that the larger and more reputable manufacturers of dried milks realize that there must be clean milk to begin with, and this is especially true of the concerns marketing milk powder for infant feeding in small receptacles. It is also true of their bulk goods. The evidence on this point seems clear from the authorities already cited, (15) as well as on theoretical grounds.

Although more than 1300 outbreaks of disease due to contaminated milk and milk products are on record, (16) no epidemic or outbreak of disease has ever been reported as due to any of the concentrated forms of milk, including condensed, evaporated, and dried. Safety seems, therefore, to have been and to be a leading characteristic of these forms of milk. In only one instance has suspicion even been directed at a concentrated milk. In that case a powdered protein milk was involved, but a careful consideration of the evidence shows that none of the circumstantial facts mentioned in a published report of the epidemic (17) are sufficient to justify a verdict of guilty against this milk powder.

In the summer of 1927, an epidemic of enteritis occurred at an institution in Chicago caring for homeless infants. According to the paper on this unfortunate event by G. F. Dick, G. H. Dick, and J. L. Williams, (18) 88 babies were stricken and 27 died. Investigations by the authors determined that this epidemic was primarily due to an intestinal infection and was caused by the Morgan dysentery bacillus, which was isolated from several bodies on autopsy.

When precautions were finally taken to prevent any possible further dissemination of this intestinal disease, the epidemic came to an abrupt end. These precautions consisted of eliminating the possibility of contamination by the fingers of the nurses, and the using of boiled fresh milk preparations for feeding. The infants had been receiving powdered protein milk. This milk is made by inoculating pasteurized skimmed milk with a selected culture containing several strains of lactic acid bacteria, with the *Streptococcus lactis* predominating. The cultured milk stands until the acidity reaches a pH value of 4.8, when the whey is drained and cream is added. The product is then dried.

A bacteriological examination of this powdered protein milk was made by the Dicks, who reported (19) that they found green-producing streptococci. They failed to report, however, whether these streptococci were of the human or bovine type, a good example of superficial science. Most bacteriologists differentiate between hemolytic streptococci of the human type, such as the pyogenes, which are pathogenic to man, and the hemolytic streptococci of the bovine type, such as the mastiditis, which are not pathogenic to man. The Dicks did not report the presence of the Morgan dysentery bacillus in the powdered milk, though this was stated to have been the cause of the epidemic. Any inference that the powdered protein milk was in any way implicated in this epidemic is, therefore, obviously erroneous.

Powdered milk is a real factor in modern public health. Milk is the most nearly perfect of all the foods of man, because it is the only single article of diet which contains practically all the elements necessary to nourish the human system. When it is said that milk is the most nearly perfect of foods, pure milk is, of course, meant. Powdered milk distributed for individual use is invariably pure milk, as is that produced for commercial purposes by the reputable concerns. As the professions and the public realize the many advantages of milk in powdered form, this kind of concentrated milk will enjoy a popularity even more remarkable than at present.

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Discussion

Dr. Tobey, in answering questions and closing the discussion, said in part as follows:

Milk used for drying should be of the best possible quality. Some milk dried may not be of suitable quality.

Dr. Shrader: You may depend on this, that milk advertised for infant feeding is of suitable quality. Other brands on the market are of a more questionable quality.

"Science increases our power."

APPROVED DAIRIES, AND SOME NEW THOUGHTS ON DAIRY INSPECTION WORK

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In 1925 there were some seventy-five approved dairy farms supplying milk for Cleveland, and the ordinance covering them had been passed a little over a year. Today there are some four hundred such farms. In 1925 no dealers were handling this grade of milk exclusively, and none of the producers was receiving a premium for his product. Today there are three dealers handling only approved dairy milk, each of these dealers paying the producer a premium. This in turn has caused other dealers to pay a premium for the approved dairy milk they are receiving, even though as yet they are not receiving their entire supply of that grade. They are benefiting, though, by holding their supply of good milk and keeping it from going to other dealers who are working to obtain their entire supply of this grade.

In many lines today, the trend is toward a better product and larger volume on a closer margin. This modern and progressive tendency should be applied to the milk business to the benefit of all. It would seem that it would even more especially apply to the milk business because it is a so-called repeat order business, and a good product on a closer margin at a fair price would tend to stabilize customers and eliminate overhead expenses.

Under old methods, milk was bought by the gallon as just plain "milk," practically the only specification being that it be not sour or of such abnormal condition as to be readily detected by the eye. This was obviously unfair, and was tending to lower the quality or reduce the percentage of fat of the milk produced. The more progressive dealers began to buy on a butter-fat basis. In a few years Ohio passed a State law that all milk be bought by test, and the simple classifying and buying of milk by test has raised the butter-fat percentage of the milk sold in Cleveland five to six points during a period of five or six years.

Why then should not milk be graded as to quality? I am sure you will agree with me that there are many tendencies along this line at the present time. Each community and district has its local problems and minimum requirements for quality. While a plan might work well in a certain district, it might not do at all in another. Certain fundamental principles, though, will work even though the grading of milk for quality is not such a simple arrangement as the grading of milk by butter-fat percentages.

The present somewhat general system of buying milk under the so-called pool plan would seem to be an injustice to the public and also a discouraging factor in the production of better milk. Today in most sections dairymen share and share alike as long as their milk is sweet and not abnormal. Under this arrangement there is no incentive for the poor dairyman to raise his standards, but on the other hand there is a seeming tendency under this plan for the good dairyman to lower his. The fairer way would be for milk to be sold on quality. With the development of approved dairies, factors to be checked for a better quality of milk have all been placed under one heading by dealers handling only this grade of milk. A beginning has been made by the elimination of the practice of mixing all milk together and paying each producer the same price per gallon.

One of the big problems in milk production is to have an adequate supply at hand at all times. When a dealer takes up the Class 1 classification, it is essential that he have even production, or base contracts with his producers. By "base" we mean that a producer whose usual average is five cans of milk will set his base at five cans, and that if he goes over his base when there is any other Class 1 milk available, the amount over the five cans is sold at the prevailing market price for milk for manufacturing purposes.

To have a supply always available along this line, reserve stations at a distance are planned and at these stations two complete and separate platforms are provided. There is a list at this station, and each approved dairy is listed by number according to the date when the certificate was obtained. When more milk is needed, the reserve stations are able to ship out the milk from their better dairies and at all times have a reserve supply.

A good many have indicated that this is too complicated and that it will not work. As to that, time will tell. However, the same principles involved have long been tried in other lines and have stood the test. In some cities this principle has been in effect for several years in the sale of Golden Guernsey milk at a premium, there usually being a number of Guernsey herds on the waiting list.

In the development of approved dairies, when regular inspections are made through the country dairy districts and an up-to-date, progressive, and interested dairyman is visited, an application is filed and in turn is given to the veterinarian in the district. He then visits the dairy, goes over the same with the owner or manager, and if conditions are found to check, the certificate is issued. This is an entirely different procedure from the old method of police power, for here you are obtaining co-operation under a grading giving the producer a label to which he is entitled, but one that he had never before received.

In the sale of approved dairy milk, the overhead is kept as low as possible so that it may be sold at a fair price. With this in mind, each plant is limited to the sale of one grade of pasteurized milk of the same butter-fat content. This in practice means that any milk plant handling approved dairy milk will have its entire supply only from approved dairy farms. Milk coming into such plants is labeled with a special tag giving the name of the dairy, together with the number of the certificate, the reverse side of the tag bearing the notation "Approved Dairy Milk." The caps used on the bottled product are also marked "Approved Dairy Milk." Under this arrangement as yet there has been no increase in price of this grade of milk. It is sold at the standard price of 14 cents per quart delivered and 12 cents per quart at stores.

Instead of exercising police power only, inspectors should develop lines of work that improve conditions by giving credit where credit is due.

Of late there has been a tendency to advertise dairy products in a misleading way, setting up high standards which investigation in many cases would show to be not true. While many dairy products for some time to come will probably come from farms and plants that are not under inspection, yet companies advertising such products and setting standards of their own should provide for some means for a check when there is a question as to the truthfulness of statements made.

I believe there should be an inspection of creameries and condensaries and other manufacturing plants doing an interstate business somewhat along the line of the United States Bureau of Animal Industry meat inspection service.

In an effort to control special brands of milk, the following ordinance was passed, effective in Cleveland:

> "Ordinance No. 84460. Section 591-A. Classification of milk and cream. No milk or cream

shall be sold, kept for sale, delivered, or permitted to be sold as a special grade or quality of milk, by any person, firm or corporation, until all standards and requirements intended to govern the handling of such milk or cream are set forth in a sworn written statement by the party so bottling or labeling such milk, and which sworn statement must be filed with the official charged with the enforcement of this chapter, or with such representative as he may designate.

"Violation of standards or requirements as set forth in such sworn statement shall be sufficient cause for revocation of authority for sale of such milk or cream as being of special grade or quality, in addition to the penalty prescribed for violation of the provisions of this chapter.

"No advertising or other information shall be extended to the public unless in conformity with filed sworn statements relating to any special grade or quality of milk.

"The official charged with the enforcement of this chapter shall have the power to make and enforce such proper regulations as he may deem necessary from time to time to control the production and handling of the milk hereinbefore referred to."

"I hold every man a debtor to his profession."

EFFECT OF INCUBATION AT 145° F. ON BACTERIAL PLATE COUNTS OF MILK

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Frequent high bacterial plate counts of the product of certain pasteurizing plants, when the methylene blue reductase tests indicated that they were receiving a low count raw milk, led to an attempt to determine the cause of these persistent high counts.

Samples were taken at various stages in the passage of the milk through these plants and in numerous instances we were surprised to find the pasteurized milk gave a higher bacterial plate count than the same milk before pasteurization. These findings strongly suggested the presence in this pasteurized milk of bacteria able to grow at pasteurizing temperatures.

Previous work, reported by Harding and Ward in *Abstracts of Bacteriology,* Volume 8, Page 19, had shown the possibility of cultivating thermophilic bacteria on agar plates incubated at 145° F. Accordingly, an attempt was made to estimate the number of thermophilic bacteria in the pasteurized milk from our local plants by preparing duplicate sets of agar plates and incubating one set at 145° F., while the other set was incubated at 100° F. (37.5° C.), as prescribed by the Standard Methods.

Methods Used

All milk samples used in this study were collected by the regular city milk inspector. These samples had been pasteurized (held at 142–145° F. for 30 minutes) the previous day and were taken from the delivery wagons as the milk was being delivered to the consumer.

These samples were iced as collected and delivered to the laboratory, where the duplicate set of plates were prepared about 9.00 A. M. each morning.

Bacto-Nutrient Agar Dehydrated was used for the culture medium and standard methods were followed throughout, except in the incubation of one set of plates at the higher temperature of 145° F. Control plates were invariably incubated at each temperature.

Up to February, 1928, the control plates held at 145° F. usually developed colonies indicating the presence in the media of bacteria capable of growing at this temperature. The corresponding control plates held at 100° F. were uniformly free from growth, indicating the inability of these thermophilic bacteria in the media to grow at this temperature. Because of this difficulty with media contaminated with thermophiles, the data covering the work of several months was rejected. After February, 1928, we were supplied with Bacto-Nutrient Agar Dehydrated, which remained sterile on incubation at 145° F.

In preparing the agar plates to be incubated at 145° F., approximately 35 cubic centimeters of agar were used for each plate. Dessication of these plates was also decreased by placing beakers of water in the incubator. The plates were counted at the end of two days, as in the case of those incubated at 100° F.

In tabulating the data it has seemed helpful to arrange them upon the basis of the size of the pasteurizing plant. The group of large plants includes six in which the pasteurizing process continues for six or more hours per day. The apparatus used includes one continuous flow outfit, one set of transformed Park holders, one set of coil vats, and three sets of glass-lined holders.

In the 16 medium-sized plants, the holders are filled two or three times each day. The pasteurizing outfits include nine with coil vats, three with glass-lined holders, two with spray vats, one with compartment holders, and one with transformed Park holders.

The ten small plants filled their holders but once each day. Four were equipped with glass-lined holders, four with coil vats, and the two others with a coil and a spray vat each.

From this enumeration it will be seen that the study covered a considerable range, both of size of plant and type of pasteurizing apparatus. The bacterial plate counts are given in the following table:

LARGE PLANTS

Plant No.	Date Plating	Plate Counts Incubated at 145° F.	Plate Counts Incubated at 98° F.
1	3/26/'28	980,000	720,000
	4/ 4/'28	350,000	250,000
	4/ 9/'28	720,000	490,000
	4/10/'28	140,000	96,000
	5/14/'28	0	12,000
	9/12/'28	280,000	300,000
	9/17/'28	0	11,000
	Total	2,470,000	1,879,000
	Average	360,000	270,000
2	3/26/'28	1,200,000	360,000
	4/ 4/'28	400,000	480,000
	4/ 9/'28	370,000	67,000
	5/14/'28	4,500,000	1,400,000
	5/16/'28	2,700,000	600,000
	5/17/'28	500,000	450,000
	5/17/'28	6,000	25,000
	6/12/'28	2,000,000	670,000
	6/12/'28	120,000	150,000
	9/13/'28	0	35,000
	9/13/'28	18,000	150,000
	9/19/'28	15,000	30,000
	9/19/'28	0	10,000
	Total	11,829,000	4,427,000
	Average	910,000	350,000
3	3/26/'28	30,000	34,000
	4/ 4/'28	120,000	11,000
	6/12/'28	0	14,000
	9/11/'28	4,000	120,000
	Total	154,000	179,000
	Average	39,000	45,000

LARGE PLANTS—*Continued*

Plant No.	Date Plating		Plate Counts Incubated at 145° F.	Plate Counts Incubated at 98° F.
4	3/26/'28		130,000	270,000
	4/ 4/'28		3,300,000	2,700,000
	4/10/'28		280,000	210,000
	5/14/'28		160,000	390,000
	6/12/'28		0	21,000
	9/12/'28		2,500,000	1,800,000
	9/12/'28		1,500,000	1,000,000
	9/13/'28		39,000	60,000
	9/13/'28		110,000	57,000
	9/18/'28		3,500,000	1,500,000
	9/18/'28		3,300,000	1,800,000
		Total	14,819,000	9,808,000
		Average	1,400,000	900,000
5	4/10/'28		0	91,000
	5/14/'28		0	5,000
	6/12/'28		0	22,000
	9/10/'28		0	15,000
	9/18/'28		0	6,000
		Total	0	139,000
		Average	0	24,000
6	5/14/'28		21,000	52,000
	9/11/'28		0	10,000
	9/17/'28		120,000	110,000
		Total	141,000	172,000
		Average	50,000	58,000
		MEDIUM SIZE PLANTS		
7	4/ 3/'28		800,000	550,000
	4/ 3/'28		900,000	480,000
	9/10/'28		1,100,000	400,000
	9/17/'28		4,000	34,000
		Total	2,804,000	1,464,000
		Average	710,000	370,000
8	4/ 4/'28		0	22,000
	5/14/'28		15,000	180,000
	9/10/'28		0	42,000
		Total	15,000	244,000
		Average	5,000	82,000
9	5/14/'28		0	8,000
	9/10/'28		0	15,000
	9/10/'28		0	25,000
		Total	0	48,000
		Average	0	16,000

MEDIUM SIZE PLANTS—*Continued*

Plant No.	Date Plating	Plate Counts Incubated at 145° F.	Plate Counts Incubated at 98° F.
10	5/17/'28	38,000	310,000
	9/12/'28	0	73,000
	9/19/'28	69,000	25,000
	Total	107,000	408,000
	Average	36,000	140,000
11	5/17/'28	0	18,000
	Total	0	18,000
	Average	0	18,000
12	9/10/'28	20,000	37,000
13	9/10/'28	0	10,000
14	9/10/'28	1,000	88,000
	9/18/'28	56,000	35,000
	Total	57,000	123,000
	Average	29,000	62,000
15	9/10/'28	0	6,000
16	9/10/'28	0	11,000
17	9/11/'28	2,000	180,000
	9/17/'28	4,000	96,000
	Total	6,000	276,000
	Average	3,000	140,000
18	9/11/'28	10,000	350,000
19	9/11/'28	0	38,000
20	9/17/'28	0	27,000
21	9/19/'28	0	10,000
22	9/17/'28	94,000	89,000
	SMALL PLANTS		
23	4/10/'28	0	5,000
24	4/10/'28	0	2,000
25	5/17/'28	0	16,000
	9/12/'28	0	87,000
	Total	0	103,000
	Average	0	52,000

SMALL PLANTS—*Continued*

Plant No.	Date Plating	Plate Counts Incubated at 145° F.	Plate Counts Incubated at 98° F.
26	9/11/'28	0	10,000
	9/13/'28	0	4,000
	Total	0	14,000
	Average	0	7,000
27	9/11/'28	0	250,000
	9/13/'28	0	29,000
	Total	0	279,000
	Average	0	140,000
28	9/13/'28	39.000	180,000
29	3/26/'28	0	93,000
30	9/18/'28	0	10,000
31	9/19/'28	16,000	20,000
Total of all small plants		55,000	706,000
Average of all small plants		4,600	59,000

DISCUSSION

In the data from the six large plants, it will be noted that from five of them the plates incubated at 145° F. show the presence of a considerable number of bacteria capable of growing at that temperature. There is every reason to believe that these bacteria would thrive in the holders during the holding process at 142–145° F.

A comparison between the counts of the plates incubated at 100° F. and those incubated at 145° F. shows that in the samples from three plants the counts at 145° F. were from 25 to 300 per cent the higher. In two of the remaining plants, the counts upon the two sets of plates were essentially the same. In the case of one plant no growth was obtained on the plates incubated at 145° F.

Among the 16 medium-sized plants thermophiles capable of growing at 145° F. were found in the case of one-half of them, or eight plants. However, the numbers of thermophiles found amounted to more than the bacteria shown on the plates at 100° F. in the case of only two of the 16 plants.

Likewise, in the ten small plants thermophiles were found by this plate examination in the case of but two plants, and in only one of these were the numbers present comparable with the numbers shown by the ordinary plate counts.

It will be noted that among the medium and small plants only a limited amount of figures is given in connection with many of them. As has already been explained, a study of these plants was carried on for several months during which time the contamination of the media made use of the data inadvisable. However, the results of these plates secured during this time showed very few thermophiles, agreeing quite closely with the data presented in connection with these smaller plants.

Varieties of Thermophilic Bacteria

From the data already presented it might be assumed that in this pasteurized milk there was a single form of heat-loving bacteria present. Microscopic examination of the growths upon the agar plates and of the milk itself indicates that there is really a group of different forms having in common this ability to grow at pasteurizing temperatures.

While it was not our purpose to enter into a detailed study of the cultural characteristics of these interesting forms, our studies progressed sufficiently to show that the bacteria present differed, not only in their form but also in their rapidity of growth in milk and in their effect upon the chemical reaction of the same. The usual effect of such growth is the development of acidity, which in some of our tests increased in milk held 6 hours at 145° F. from an original acidity of .18 to a final acidity of .31 per cent figured as lactic acid. With other heat-loving bacteria isolated from milk, the result of similar growth was either a reduction in the acidity or only a slight increase after six hours' incubation at 145° F.

Limitations of the Plate Counts

The data already presented indicated that by incubating at 145° F. the agar plates seeded with pasteurized milk, it is possible to demonstrate the presence of thermophilic bacteria in many cases. It is noteworthy from the data already presented that the thermophilic bacteria are found most abundantly in the product from the larger plants. However, in the samples from one of the large plants there was no evidence of the presence of these thermophiles in the pasteurized product.

Other data already mentioned show that these thermophiles constitute a group of differing bacterial forms which have in common the ability to grow at 145° F. and to produce colonies upon the agar used in these studies. These results suggest that there may be other thermophilic forms which are able to grow in the milk at 145° F. but which did not produce colonies upon the agar used in these studies.

The direct microscopic method offers a means of determining the amount of bacterial life present in the pasteurized milk. Accordingly, samples were collected from a number of the larger pasteurizing plants on October 4, 1928, and plates were made at the two temperatures, as well as direct microscopic counts of the milk itself. In order to illustrate the building up of the thermophilic bacterial content during the work of the day, a second set of samples was collected after an interval of approximately six hours' operation. Direct microscopic counts were made of the samples of milk collected late in the run of the day.

The results are given in the following table:

Plates at 100° F.		Plates at 145° F.		Direct Microscopic Count
Sampled 8:30 A.M.	Sampled 3:00 P.M.	Sampled 8:30 A.M.	Sampled 3:00 P.M.	Sampled 3:00 P.M.
40,000	35,000	1,000	25,000	2,000,000
30,000	180,000	3,500	190,000	6,000,000
75,000	270,000	3,000	380,000	4,000,000
45,000	240,000	1,000	200,000	2,000,000
150,000	120,000	37,000	230,000	5,000,000
	1,100,000		1,400,000	7,000,000

The data in the above table bring out a number of important points. One of these is the fact that the number of thermophilic bacteria which will be found in the product of a given plant varies widely, depending upon the point in the daily operations which the sample represents. Accordingly, samples of milk collected from the wagons without any definite knowledge as to the stage in the daily operations when the milk was processed may come far short of giving an accurate picture of the daily product.

It should be noted that these samples were plated promptly after bottling without the customary delay caused by holding in cold storage and on ice for approximately twenty-four hours. This eliminated most of the benumbing effect of refrigeration on the growth of thermophiles and resulted in higher counts than would have been obtained had the regular routine of collecting samples been followed.

The fact that the bacterial plate counts at 100° F. and at 145° F. give only a part of the total bacterial content is shown by the direct microscopic counts. A part of the increased numbers furnished by the direct microscopic count is, undoubtedly, due to the clumping of the bacteria as they grow in the milk. A part of it is also probably due to the fact that, as already shown, there are many different kinds of thermophilic bacteria in milk, some of which do not develop colonies even when incubated at 145° F. For example, the earlier tests of milk from the milk plant numbered 5 failed to develop any such colonies. However, when the later unrefrigerated samples were tested there was the development of colonies upon the agar plates incubated at 145° F. The direct microscopic examination of this milk showed the presence of over six million bacteria per cubic centimeter.

SUMMARY

The results here presented make it plain that incubating bacterial plates at 145° F. demonstrates the presence of considerable numbers of thermophilic bacteria in pasteurized milk. Accompanying observations make it plain that these bacteria include a group of different forms having in common the ability to grow at 145° F.

Comparison between samples collected early and those collected late in the daily operations of such plants show that the number of thermophilic bacteria in the pasteurized milk generally increases with the continuation of the pasteurization operation.

Direct microscopic examination of milk shows that the number of bacteria actually present in pasteurized milk is much greater than plate counts had led us to expect. There is every reason to believe that these high numbers are due to thermophilic bacteria.

The available information regarding the source and methods of control of thermophilic bacteria in pasteurized milk is as yet so limited that no successful way has yet been found for the control of them.

The fact that the thermophilic bacteria grow at temperatures very much higher than body temperature demonstrates that they are not disease-producing organisms.

"The man of science has learned to believe in justification; not by faith, but by verification."

CONDUCTING THE METHYLENE BLUE TEST AT 145° F.

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The methylene blue reductase test has come to be generally recognized as an index of the relative abundance of the ordinary bacterial flora in milk. We are here suggesting a modification of its application whereby it may be used in determining the presence of thermophiles in milk.

DISCOVERY OF METHYLENE BLUE REACTION

If one turns to the first book written to explain the bacteriology of milk, *Le Lait, études chimiques et microbiologiques,* by Duclaux, published in 1887, there will be found upon the first page the French equivalent of the following:

If one adds to milk which is only a few hours old a drop or two of indigo carmine so that it is just pale blue, and then completely fills a flask with it and sets it in a thermostat, it sooner or later loses its color, which returns if one pours it slowly in a thin stream into another flask. The indigo carmine has been reduced by the ferments of the milk, since these require oxygen to live.

This statement is made as though it were then a matter of common information, and we are left in doubt as to the origin of this knowledge that various chemical substances when mixed with milk are reduced when the mixture is held at temperatures favorable for bacterial action.

Development of Reductase Test at 100° F.

In 1900 Neisser and Weichsberg proposed a new method for observing the injury to living cells and organisms. This method consisted of observing the interval required to decolorize methylene blue, which they found well adapted to this test.

In 1902 Schardinger proposed the use of methylene blue with and without the addition of formaldehyde as a means of detecting the difference between raw and boiled milk.

The reductase test as we are familiar with it really dates from the publication by Barthel in 1908 of his paper upon the use of the reductase test for determining the hygienic properties of milk. In this paper he suggested the conduct of the reductase test at 40-45° C., which in our practice has come to be 100° F. The selection of this temperature for conducting the methylene blue reductase test undoubtedly arose from the fact that the test has been used almost exclusively in the examination of raw milk and for the purpose of obtaining a measure of the activity of the bacterial flora most common in such milk.

The methylene blue reductase test conducted at 100° F. is being seriously considered by many students of city milk problems as the most promising available test of the keeping quality of raw milk.

Recognition of the Thermophilic Flora in Milk

Beginning about 1922 at Kansas City, Missouri, there has been a steady succession of observations of outbreaks in pasteurized milk of large numbers of bacteria. These outbreaks were usually of short duration and they happened without much regard to what was commonly considered good plant management.

While the presence of large numbers of bacteria in city milk supplies is forbidden by most city ordinances, the presence of these thermophilic bacteria in numbers of a million or more per cubic centimeter has not been followed by undesirable results viewed either from the sanitary or from the commercial angle. Not even a suspicion of undesirable reaction upon the public health in connection with any of these outbreaks has come to our attention. Likewise, pasteurized milk containing a million thermophilic bacteria per cubic centimeter seems to be accepted by the consuming public as of entirely satisfactory commercial quality. However, there is some evidence that when these numbers increase to 50 to 100 millions per cubic centimeter, some undesirable effects upon the flavor of the milk may develop.

Lack of Methods for Studying this Flora

During the past three years there has been a growing recognition of the fact that in pasteurized milk there are at times many kinds of bacteria which thrive at high temperatures. Many varieties of these germs do not produce colonies upon the standard agar plate, or when they do these colonies are extremely small. Except in so far as they can be recognized by the direct microscopic observation, means have been lacking to detect their presence and to determine their numbers. Even when the direct microscopic examination of pasteurized milk shows the presence of considerable numbers of bacteria, it is not evident how many of them are thermophiles.

As a matter of fact, there has been no simple technic for locating these thermophiles in the pasteurized milk, and we have had even less success in finding them in raw milk. While there is considerable evidence that twenty or thirty different kinds of heat-loving bacteria occur in milk, the facilities for studying them have been so limited that at present little is known regarding the number present and still less regarding the sources from which they enter the milk.

Suggestions by Mr. Palmer

During the spring of 1928 the suggestion was made to us by Mr. Russell R. Palmer, Chief Milk Inspector of Detroit, Michigan, that when samples of milk collected at different stages of pasteurization in a plant under discussion were subjected to the methylene blue test at a temperature of 145° F., the reduction time of these samples tended to be shorter as the milk progressed through the plant. Our interest in this plant arose from our knowledge that it was experiencing an outbreak of thermophiles.

A little later, opportunity presented itself to study this interesting phenomenon with the result to be presented.

Desirable Modifications of the Technic

The European workers with the methylene blue test have placed some emphasis upon the desirability of checking the absorption of oxygen by the use of an oil layer. American experience seems to have been that such a precaution is not very important at 100° F. However, when the methylene blue test is carried out at 145° F. in test tubes which are open to the air, the rate of absorption of oxygen is sufficiently rapid to interfere with the rate of complete destruction of the blue color.

It has been found desirable to cover the mixture of milk and methylene blue solution in the test tubes with a layer of oil. In our work medicinal mineral oil has been used because readily available. A layer approximately one-quarter inch deep seemed to give satisfactory protection.

It was likewise deemed desirable to prepare the samples to be tested in duplicate or triplicate. However, it was found that duplicate samples protected by oil rarely varied more than five minutes in their reduction time, even when this time amounted to three or more hours. Ocassionally greater variations in reduction time of duplicate samples were observed, and further improvement of the technic is undoubtedly desirable.

Comparision of Reduction Time at 100° F. and 145° F.

In order to illustrate the differences in the reduction time experienced from subdivisions of one sample of milk handled according to the two different methods, attention is requested to the results given in the following table. In this case the samples of milk were collected approximately simultaneously at five points in the process of pasteurization. These points were: 1. The raw milk as entering the pasteurizing system at about 40° F. 2. "Out of Regen." represents the milk as it flowed from the bottom of the regenerator at a temperature of approximately 110° F. 3. "Into Holder" represents the milk which had been heated to approximately 144° F. and was about to enter the holder. 4. "Out of Holder" is the milk after being held at pasteurizing temperature for about 33 minutes. 5. "After Cooler" is the same milk after being cooled to approximately 40° F. The lower column in the table gives the period of operation of the pasteurizer, which totaled slightly over 10 hours.

A comparison of the records obtained in each set of samples from the tests made at 100° F. and 145° F. shows that quite uniformly the reduction time at 100° F. increased as the milk progressed through the pasteurizer. The + sign before some of the observations indicates that reduction had not taken place when the observations were terminated.

REDUCTION TIME IN MINUTES
OF METHYLENE BLUE TESTS AT 100° AND 145° F.
FROM SAMPLES OF MILK COLLECTED AT VARIOUS TIMES AND POINTS
DURING PASTEURIZING PROCESS

Time of Sampling	8:30		9:30		10:30		11:30		12:40		1:30		2:45		3:18	
Temperature of Incub.	100°	145°	100°	145°	100°	145°	100°	145°	100°	145°	100°	145°	100°	145°	100°	145°
Raw Milk	86	294	24	328	111	354	121	318	116	348	117	322	99	388	—	—
Out of Regen.	51	160	89	211	92	184	89	275	77	219	160	164	71	169	—	—
Into Holder	169	135	458	258	313	188	304	158	+340	216	+271	196	283	188	—	—
Out of Holder	476	93	491	62	468	55	463	59	+524	84	417	62	+393	58	87	12
After Cooler	480	103	+517	78	582	100	540	92	+519	94	454	98	+388	86	344	36
Period of Operation	220		280		340		400		460		520		595		618	

It will also be observed that in the case of the samples kept at 145° F. the reduction time shortened progressively as the milk passed through the process. It should be noted that the pasteurizer had been in operation 220 minutes at the time of taking the first set of samples. Had a set of samples been taken at more nearly the start of pasteurizing operations it is entirely possible that this shortening of the reduction time might have been much less or have been entirely absent.

If one considers the records of the successive samples of pasteurized milk as taken from the outlet of the holder, it is seen that there is a shortening of the reduction time and this shortening is most marked toward the close of the process.

In the case of the samples held at 100° F., the shortening of the reduction time in this series of samples of pasteurized milk is probably due to the increasing development of bacterial life in this milk and to the fact that some of this bacterial activity continued when the samples were held at 100° F.

The rapid decrease in the reduction of the successive samples held at 145° F. points to the presence of increasing numbers of thermophiles in the pasteurized product and the continuation of their activities in the samples held at 145° F. The decolorization of the final sample after an interval of only 12 minutes suggests the presence of large numbers of bacteria.

The presence of large numbers of bacteria in such milk is clearly shown by the direct microscopic examination of the milk. However, the counting of this germ life is much complicated by the fact that these germs are so abundant. To state that more than 25 million per cubic centimeter were present is to put the matter conservatively. In many cases the numbers present probably exceed 100 millions per cubic centimeter.

Possibility of Locating Thermophiles in Raw Milk

The knowledge that at times pasteurized milk contained large numbers of thermophilic bacteria has been fairly widespread since about 1922. Since that time our information regarding them has been accumulating slowly, and this is probably the first attempt to bring home to you the fact that large numbers of thermophiles are fairly constantly present in pasteurized milk and in many cases they are present in numbers quite exceeding former ideas upon this subject.

The slowness of our appreciation of these facts is due primarily to the difficulty experienced in demonstrating their presence in milk. This applies especially to raw milk, and to date we have been lacking any simple and applicable method of tracing their numbers in unpasteurized milk. As a result of this situation we have little or no information as to the sources from which these thermophiles are derived further than to have much circumstantial evidence that they come commonly with the raw milk supply.

The observation that their presence in pasteurized milk might be detected by the application of this hot methylene blue test suggested the possibility of using this same technic to search the raw milk supplies for sources of thermophiles.

Samples for this purpose have been examined in connection with the raw milk supply of a number of milk plants. In all cases these samples represented the blended milk from a considerable number of dairies. The reduction time of these samples when held at 145° F. varied from 40 minutes to 697 minutes, indicating that there is a wide variation in the number of thermophilic bacteria present in different samples of raw milk. More extended observation of the reduction time of milk from single dairies is needed before it will be possible to form a satisfactory estimate of the usefulness of this technic in locating the points at which thermophilic bacteria gain entrance to raw milk supplies.

Summary

During the past six years there has been a growing appreciation of the large number of thermophilic bacteria occasionally present in pasteurized milk.

The available methods of determining their presence have given erratic results, and it is commonly believed that outbreaks of thermophiles in pasteurizing plants occur at irregular and widely separated intervals.

By the use of the methylene blue reductase test at a temperature of 145° F., it has been found that thermophiles were present in all pasteurized milk which has been tested. At least in the larger plants the number of thermophilic bacteria in the pasteurized product tends to increase with the length of the pasteurizing operation. In plants which operate five or more hours there is commonly in the milk pasteurized last more than a million per cubic centimeter of these interesting and harmless thermophilic bacteria.

To date little or no progress has been made in determining the sources from which the thermophilic bacteria enter the raw milk because of the lack of a technic by means of which their presence in raw milk could be recognized conveniently.

Tests by the methylene blue reductase test at 145° F. have uniformly shown the presence of thermophilic bacteria in raw milk as it reaches the milk plant, and the reduction time varied from 40 minutes to 11½ hours. This test has not yet been applied to the study of the relative abundance of thermophilic bacteria in milk at the various stages in its production and transportation.

It is believed that the methylene blue reductase test

at 145° F. offers a practicable means of locating the source or sources from which thermophilic bacteria find their way into the raw milk supply.

"In the last analysis, we see only what we are ready to see, what we have been taught to see. We eliminate and ignore everything that is not a part of our prejudices."

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

C. SIDNEY LEETE, *Chairman*

In one of the previous reports it was shown that there were two broad views held as to the primary value of the score card as used for dairy farm inspection. One was that the card should be used as an aid to the inspector in making an intelligent inspection. Associated with this was the thought that the card should be of educational value to the farmer. The other view of the card was that it should be of such a character as to indicate as nearly as possible the actual quality of the product produced on the farm.

The Committee on Score Cards and the Score Card System of Rating Dairies and Dairy Products has, this year, considered only the milk plant score card.

In the case of the milk plant score card, a survey of opinion of members of this committee indicates that the trend of thought is that the card should reflect the latter view in so far as is possible without lessening its value to the inspector in his inspection work. This viewpoint, however, is not unanimous.

The survey also showed that there is not now a milk plant score card which meets the approval of all.

The following opinions and recommendations have been noted in replies to letters sent to the committee:

1. That the milk plant score card as formulated by the United States Public Health Service and used in the enforcement of the Standard Milk Ordinance be studied.

2. That separate score cards are needed for milk plants, country stations, and ice cream plants.

3. That in any future score card greater emphasis than is now given be placed upon methods at the expense of equipment.

4. That the trend is away from actual percentage scoring and has turned toward scoring by notations of actual conditions found.

5. That a simplified score card with supplemental instructions indicating the different ways in which it can be used for different kinds of milk products plants is practicable.

6. That a tentative card be drawn up by the committee and placed in the hands of various members for trial; and that this card, together with observations made of its use, be discussed at the next meeting of the Association.

7. That a new card which can be accepted by the Association would be of real and practical value to the members and to the dairy industry.

This report is not constructive in nature or final, nor can one be until the members have a more common or fundamental basis upon which to work than now seems to be the case.

In view of the foregoing statements it is proposed and recommended that during the coming year the committee formulate a tentative card for milk plants, that this card be placed in the hands of members of the committee for trial, and that it be given a year's practical test.

If this is done, it is believed that the discussion which would follow at next year's meeting would be of value and that the whole subject might then be brought to a satisfactory status.

"Contemplation is necessary to generate an object, but action must propagate it."

W. F. ROBERTS CO. WASHINGTON D. C