TENTH ANNUAL REPORT

OF THE

International Association of Dairy and Milk Inspectors

INCLUDING PAPERS READ AT THE ANNUAL
CONVENTION IN NEW YORK CITY
NOVEMBER 14-15-16, 1921

"We can only be valued as we make ourselves valuable."

COMPILED BY

IVAN C. WELD, Secretary-Treasurer
1120 CONNECTICUT AVENUE
WASHINGTON, D. C.

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 Associaton 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, who shall direct the affairs of the Association when not in Annual Session, shall consist of the President, the three Vice-Presidents, and the Secretary-Treasurer.

AMENDMENTS

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

BY-LAWS

ADOPTED OCTOBER 25, 1913

ORGANIZATION

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

ARTICLE 1

MEMBERSHIP

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

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

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

HONORARY MEMBERS*

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

ARTICLE 2

OFFICERS

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

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

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

ARTICLE 3

DUTIES OF OFFICERS

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

*Adopted October 29, 1915.

all committees unless otherwise directed by vote of the Association, and perform such other duties as usually devolve upon a presiding officer, or are required of him by the Association.

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

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

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

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

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

ARTICLE 4

MEETINGS

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

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

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

ARTICLE 5

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

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INDEX TO ADVERTISERS

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

OFFICERS, 1920-1921

President, PROF. C. L. ROADHOUSE..................Davis, Calif.
First Vice-President, H. E. BOWMAN........Somerville, Mass.
Second Vice-President, DR. CLARENCE E. SMITH
Greenville, S. C.
Third Vice-President, GEO. E. BOLLING......Brockton, Mass.
Secretary-Treasurer, IVAN C. WELD........Washington, D. C.
Auditors:
THOMAS HOLT......................................Hartford, Conn.
THOMAS F. FLANAGAN........................Hartford, Conn.

COMMITTEES

Subjects which they will study and regarding which they will report at the tenth annual convention.

BOVINE DISEASES.—Their Relation to the Milk Supply and to the Public Health.

Dr. J. B. Hollingsworth, *Chairman*
Dr. Frank P. Dorian
Dr. C. W. Eddy
Dr. Fred Evans
Dr. G. H. Grapp
Dr. Harry S. Lucas
Dr. Clarence E. Smith
Dr. Hulbert Young

DISEASES OF MAN.—Their Relation to the Milk Supply and to the Public Health.

Horatio N. Parker, *Chairman*
Dr. A. O. Diaz
Dr. W. H. Phipps
Dr. Wm. H. Price

Transportation and Marketing of Milk and Milk Products.

H. E. Bowman, *Chairman*
Dr. C. W. Eddy
Thos. Holt
Prof. C. B. Lane
Prof. W. P. B. Lockwood
James E. Thomson
Willard E. Ward

Methods of Bacterial Analyses of Milk and Milk Products.

Geo. E. Bolling, *Chairman*
R. W. Archibald
Prof. L. H. Cooledge
Dr. J. R. T. Gray, Jr.
Dr. David Wilbur Horn
Chas. H. Kilbourne
Horatio N. Parker
Dr. William H. Price
Dr. Harry W. Redfield
Dr. G. C. Supplee
Geo. B. Taylor

City Milk Contests.

Russell S. Smith, *Chairman*
Harry J. Campbell
C. H. Chilson
H. O. Daniels
J. E. Foster
A. N. Henderson
Ira V. Hiscock
Dr. John F. Miller
Andrew McPherson

REMADE MILK.

O. L. Evenson, *Chairman*
Prof. James O. Jordan
Prof. C. B. Lane
Dr. William H. Price
Dr. Harry W. Redfield
A. F. Stevenson
Geo. B. Taylor

PASTEURIZATION OF MILK AND CREAM.

Chas. H. Kilbourne, *Chairman*
C. E. Clement
L. B. Cook
Thomas C. Gault
Prof. H. A. Harding
F. H. Johnson
E. C. Krehl
Chris. J. Sheridan
A. E. Talbot
Alexander R. Tolland
Benjamin Vener

RESOLUTIONS.

A. W. Lombard, *Chairman*
A. N. Henderson
Prof. James O. Jordan
Ernest Kelly
Dr. Wm. H. Price

FOOD VALUE OF MILK AND MILK PRODUCTS.

Geo. B. Taylor, *Chairman*
Raymond C. Colwell
Dr. Hugo Cornehl
Mrs. G. H. Hoxie
Prof. W. P. B. Lockwood
Prof. R. M. Washburn
H. A. Whittaker

Dyer, R. E.........Chief, Dairy Inspection Div., Health Dept. ....Boston, Mass.
Earnshaw, Jackson E. Food and Dairy Commissioner ....Kansas City, Mo.
Eddy, C. W.........With Telling-Belle Vernon Co. ....Cleveland, O.
Estes, Howard R....Dairy and Food Inspector, Health Dept. ....Flint, Mich.
Evans, Fred.........City Veterinarian ....Sioux Falls, S. D.
Evenson, Oscar L...Asst. Chemist, U. S. Bureau of Chemistry ....Washington, D. C.
Fee, Kenneth F......Director, Bureau of Dairy Products, Dept. of Farms and Markets ....Albany, N. Y.
Ferris, Leslie W.....Asst. Chemist, U. S. Bureau of Chemistry ....Washington, D. C.
Flanagan, Thos. F...Food and Milk Inspector.....Hartford, Conn.
Forrest, Augustus...Chief, Bureau of Food and Dairy Inspection ....Birmingham, Ala.
Foster, J. E.........Chief Dairy and Milk Inspector ....Houston, Texas
Gamble, James A....Professor of Dairy Husbandry, University of Maryland ....College Park, Md.
Gaub, John.......................................Washington, D. C.
Gauhn, Emmett R...Chief Milk Inspector........Rochester, N. Y.
Gault, Thomas C....Chief, Dairy and Food Div., Ohio Board of Agriculture. Columbus, O.
Grapp, G. H........State Dairy Inspector........Baltimore, Md.
Gray, J. R. T., Jr...City Bacteriologist ....Chester, Pa.
Harding, H. A....................................Urbana, Ill.
Hartnett, Daniel P...Inspector of Milk............Holyoke, Mass.
Henderson, A. N.....With Davis-Watkins Dairymen's Mfg. Co.............San Francisco, Cal.
Hiscock, Ira V.......Instructor in Public Health, Yale University, School of Medicine ....New Haven, Conn.
Hollingsworth, J. B..Chief Food Inspector..........Ottawa, Canada
Holt, Thomas.......State Dairy and Food Commissioner ....Hartford, Conn.
Horn, David Wilbur. Chemist and Bacteriologist in charge of milk work......Bryn Mawr, Pa.
Hornaday, W. A.....Dairy and Milk Inspector....Greensboro, N. C.
Hoxie, Mrs. G. H...Chairman of Milk Committee, Kansas City, Mo., Consumers' League ....Kansas City, Mo.
Irwin, Ralph E......Asst. Engineer, State Dept. of Health ....Harrisburg, Pa.
Johnson, F. H.......Chief of Milk and Food Division, Health Dept........Louisville, Ky.
Jones, A. C.........Meat and Dairy Inspector.... High Point, N. C.
Jordan, James O.....Inspector of Milk............Boston, Mass.
Kelly, Ernest........Market Milk Specialist, U. S. Dept. of Agriculture........Washington, D. C.
Kilbourne, Chas. H..Food and Sanitary Specialist. New York, N. Y.

Krehl, E. C.	With Detroit Creamery Co.	Detroit, Mich.
Lane, C. B.	With Supplee-Wills-Jones Milk Co.	Philadelphia, Pa.
Lockwood, W. P. B.	Head, Dairy Dept., Massachusetts Agricultural College	Amherst, Mass.
Lombard, Alfred W.	Massachusetts Dept. of Agriculture	Boston, Mass.
Loomis, Frank J.	Inspector of Milk and Meat	Watertown, N. Y.
Lucas, Harry S.	U. S. Public Health Service	Miami, Okla.
MacNair, D. W.	State Dairy Inspector	San Jose, Cal.
McInerney, T. J.	Milk Inspector	Ithaca, N. Y.
McNeil, J. C.	Supt., Bureau of Food Inspection	Pittsburgh, Pa.
McPherson, Andrew	Chief Milk Inspector, Health Department	Detroit, Mich.
Marcossen, Wm. H.	Director Laboratories, Borden's Farm Products Co.	New York, N. Y.
Melican, George D.	Milk Inspector	Worcester, Mass.
Miller, John F.	Chief Milk Inspector	Albany, N. Y.
Parker, Horatio N.	City Bacteriologist, Health Department	Jacksonville, Fla.
Pease, Herbert D.	Director of Pease Laboratories	New York, N. Y.
Phipps, W. H.	Supervisor of Production, Missouri Dairy Co.	Kansas City, Mo.
Price, Wm. H.	With Detroit Creamery Co.	Detroit, Mich.
Redfield, Harry W.	Food and Drug Laboratory, U. S. Dept. of Agriculture	New York, N. Y.
Roadhouse, C. L.	Professor of Dairy Industry, University of California	Davis, Cal.
Robertson, Fred L.	Milk Inspector and Chemist, Health Dept.	Springfield, Mass.
Schofield, Earle F.	Milk and Food Inspector	Greenwich, Conn.
Seaman, Carl O.	Milk Inspector	Manchester, N. H.
Sharwell, Samuel G.	Chief Dairy and Food Inspector	Newark, N. J.
Sheridan, Chris J.	Milk Inspector	Yonkers, N. Y.
Simpson, C. W.		Delamere, Beltinge, Herne Bay, England
Smisek, M. J.	Milk and Dairy Inspector	St. Paul, Minn.
Smith, Clarence E.	Commissioner of Health	Greenville, S. C.
Smith, Russell S.	Market Milk Specialist, Dairy Div., U. S. Dept. of Agriculture	Washington, D. C.
Spoon, J. P.	Milk and Meat Inspector	Burlington, N. C.
Stevenson, A. F.	With The Borden Co. Mfg. Dept.	New York, N. Y.
Strauch, Thomas J.	Chief Dairy Inspector, Bureau of Health	Richmond, Va.
Supplee, G. C.	Director of Research Laboratory, The Dry Milk Co.	Adams, N. Y.
Talbot, A. E.	Dairy Specialist	Kansas City, Mo.
Taylor, Geo. B.	Bacteriologist, Chestnut Farms Dairy	Washington, D. C.
Testerman, H. L.	Food and Dairy Inspector	Colorado Springs, Colo.

Thomson, James E.	Chief of Div. of Milk Inspection, Dept. of Health	New York, N. Y.
Thompson, O. P.	State Dairy Inspector	Waterloo, Iowa
Tolland, Alex. R.	Dairy Inspector, Health Dept.	Boston, Mass.
Trickey, Chas.	Chief Dairy and Food Inspector	Highland Park, Mich.
Vener, Benjamin	With Tait Bros.	Springfield, Mass.
Walmsley, F. D.	Chief Veterinarian, Borden's Farm Products Co., Inc.	New York, N. Y.
Ward, Willard E.	Agent, Board of Health, for Milk and Food Inspection	Brookline, Mass.
Warner, W. J.	State Milk Inspector	Andover, Conn.
Washburn, R. M.	Director of Laboratories, International Dry Milk Co.	Minneapolis, Minn.
Weld, Ivan C.	Investigator for Chestnut Farms Dairy	Washington, D. C.
Whittaker, H. A.	Director, Div. of Sanitation, Minnesota Board of Health	Minneapolis, Minn.
Widmayer, Fred J.	Food and Milk Inspector	Scranton, Pa.
Woodman, M. J.	Food and Dairy Supervisor	Evanston, Ill.
Yates, J. W.	Farm Dairy Inspector	Kansas City, Mo.
Young, Hulbert	Manager, Walker-Gordon Laboratory	Baltimore, Md.

Honorary Members

Evans, Wm. A.	Editor, Health Dept., Chicago *Tribune*	Chicago, Ill.
Pearson, Raymond A.	President, Iowa State College	Ames, Iowa
Woodward, Wm. C.	Commissioner of Health	Boston, Mass.

Tenth Annual Convention

COLONIAL ROOM, HOTEL MCALPIN
NEW YORK CITY

MONDAY, NOVEMBER 14, 1921

FIRST SESSION

The Tenth Annual Convention of the International Association of Dairy and Milk Inspectors was called to order by President C. L. Roadhouse, of California, at 11 o'clock.

Dr. Royal S. Copeland, Health Commissioner of the city of New York, welcomed the Association to the city, and Ex-President Prof. James O. Jordan, of Boston, responded for the Association.

First Vice-President H. E. Bowman was called to the chair while President C. L. Roadhouse delivered his presidential address.

President Roadhouse, on resuming the chair, introduced Dr. J. B. Hollingsworth, Chief Food Inspector, Ottawa, Canada, who as chairman presented a report of the Committee on Bovine Diseases—Their Relation to the Milk Supply and to the Public Health.

In the absence of Horatio N. Parker, City Bacteriologist, Jacksonville, Fla., his paper on the subject, "A Comparison of the A. P. H. A. Standard Milk Agar of 1920 with Ayers Milk Powder Agar A," was read by Dr. Clarence E. Smith, after which a recess was taken.

SECOND SESSION

The afternoon session was called to order at 2.15 o'clock, President Roadhouse presiding. H. E. Bowman, Inspector of Milk, Somerville, Mass., chairman of the Committee on

Transportation and Marketing of Milk and Milk Products, presented the report of that committee.

In the absence of Howard R. Estes, Dairy and Food Inspector, Flint, Mich., his paper, "Practical Methods in Improving a City Milk Supply," was read by Dr. De Klein, health officer of Flint.

A paper, "Some Misinterpretations of the Government Score Card," prepared by Willard E. Ward, Agent, Board of Health, Brookline, Mass., was read by A. W. Lombard.

Dr. G. C. Supplee, Director of Research Laboratory, The Dry Milk Co., Adams, N. Y., presented a paper on "Bacterial Quality of Machine and Hand Drawn Milk."

Russell S. Smith, of the Dairy Division, U. S. Department of Agriculture, Washington, D. C., presented a paper, "The Value of Milk."

At 5 o'clock a recess was taken.

THIRD SESSION

The evening session of the convention was called to order by President Roadhouse at 8.15. Ole Salthe, Director of Bureau of Food and Drugs, Department of Health, New York City, presented a paper on the subject of "New York's Milk Supply and its Control."

Mr. M. D. Munn, President of the National Dairy Council, Chicago, Ill., delivered an address on the subject of "Filled Milk," and Dean H. E. Van Norman, President of the National Dairy Association, addressed the Association on the subject of "Milk and its Relation to Human Welfare," and outlined briefly the plan for the World's Dairy Congress, to be held in the United States in 1923.

The evening session closed at 10.30 o'clock.

TUESDAY, NOVEMBER 15

FOURTH SESSION

President C. L. Roadhouse called the convention to order at 10.15. A paper on the subject of "Cooperation in Dairy

Inspection," by F. D. Walmsley, Chief Veterinarian. Borden's Farm Products Co., Inc., New York City, was in Mr. Walmsley's absence read by F. D. Halford.

C. E. Clement, of the Market Milk Section of the Dairy Division, U. S. Department of Agriculture, presented a paper on "Milk Distribution by Producers' Cooperative Associations."

Russell S. Smith, of the Dairy Division, U. S. Department of Agriculture, presented a report of the Committee on City Milk Contests.

In the absence of O. L. Evenson, Assistant Chemist, U. S. Bureau of Chemistry, Washington, D. C., Dr. Thom, of the Bureau of Chemistry, presented the report of the Committee on Remade Milk.

The report of the Committee on Pasteurization of Milk and Cream was presented by Charles H. Kilbourne, New York City, Chairman.

A report of the Committee on Food Value of Milk and Milk Products, by George B. Taylor, Washington, D. C., Chairman, was received.

At 12.30 o'clock the convention adjourned, to meet in the dining room adjoining, where a luncheon was served in honor of Prof. James O. Jordan, of Boston, a former president and for many years a leader in efforts for the regulation and control of milk supplies. Addresses expressing appreciation of Prof. Jordan's work were made by former president Wm. H. Price, of Detroit, Dr. Hollingsworth, of Canada, H. O. Daniels, of Connecticut, and former president A. W. Lombard, of Boston. Mr. Lombard, on behalf of those present, presented Prof. Jordan with souvenirs of the occasion, after which Prof. Jordan in appropriate words expressed his surprise and pleasure at being called upon to participate in such an unexpected event.

At the conclusion of the luncheon the party adjourned to the roof of The McAlpin, where a group photograph was taken.

FIFTH SESSION

The convention reconvened at 2.30 o'clock. President Roadhouse called the First Vice-President, H. E. Bowman, to the chair to preside for the remainder of the afternoon.

C. H. Kilbourne read a paper on "A Suggested Modification in the Public Control of Milk Supplies."

A. W. Lombard, State Department of Agriculture, Boston, Mass., read a paper entitled, "Why the Milk Inspector Should be a Showman."

Prof. T. J. McInerney, Milk Inspector and Assistant Professor of Dairy Industry, Ithaca, N. Y., presented a paper on the subject of "Detecting Sources of Milk Contamination by Means of the Direct Microscopic Method."

Dr. G. H. Grapp, State Dairy Inspector, Baltimore, Md., presented a paper on the subject, "Contagious Abortion."

H. A. Whittaker, Director, Division of Sanitation, Minnesota State Board of Health, Minneapolis, Minn., read a paper on "The Supervision of Milk Pasteurization in Minnesota."

"Milk Regulation by a Milk Regulation Board" was the subject of a paper by Thomas Holt, State Dairy and Food Commissioner, Hartford, Conn.

A paper by Prof. R. M. Washburn, Director of Laboratories, International Dry Milk Co., Minneapolis, Minn., "Powdered Milk and Public Health," was read by Mr. Ralph E. Irwin, of Harrisburg, Pa.

A recess was taken at 5.20 P.M.

SIXTH SESSION

The evening session was called to order by President Roadhouse at 8.20 o'clock. The first paper of the evening was on the subject of "Production of Certified Milk and its Results," by Augustus Forrest, Chief, Bureau of Food and Dairy Inspection, Department of Health, Birmingham, Ala. In Mr. Forrest's absence the paper was read by Dr. Schofield.

President Roadhouse stated that unless otherwise ordered, it would be understood that all papers, committee reports, and reports of discussion be referred to the Executive Board. As no objection was offered, it was announced this course would be followed in every case.

A report of the Committee on Serving Milk in the Schools was presented by the chairman, Dr. H. A. Harding, Urbana, Ill.

Dr. C. W. Larson, Chief, Dairy Division, U. S. Department of Agriculture, Washington, D. C., presented a paper on "The Production and Consumption of Milk and Milk Products."

Dr. Robert S. Breed, Bacteriologist, New York Agricultural Experiment Station, Geneva, N. Y., presented a paper on "Methods of Caring for Milking Machine Tubes."

The meeting adjourned at 10 o'clock.

Wednesday, November 16

SEVENTH SESSION

President Roadhouse called the Association to order at 10.25. A paper on the subject of "Health Department Supervision of Pasteurization Plants" was presented by I. V. Hiscock, of New Haven, Conn.

A paper on the subject of "The Relation between Milk Dealers and Milk Inspectors" was presented by Benjamin Vener, of Springfield, Mass.

A paper on the subject, "The Relation of the Agricultural College to Dairy and Milk Inspection," was presented by Prof. W. A. Stocking, of Cornell University.

A paper, "A Plea for Discrimination in the Selection of Milk Dealers," was presented by Prof. James O. Jordan.

The convention took a recess at 12.40.

EIGHTH SESSION

President Roadhouse called the convention to order at 2 o'clock. It was voted that all discussion be confined to the subject of the paper and limited to three minutes.

It was voted that all papers not read by the authors be presented at the close of the program.

A report of the Committee on Bacterial Analyses of Milk and Milk Products was presented by George E. Bolling, City Bacteriologist and Inspector of Milk, Brockton, Mass., chairman.

A paper prepared by Prof. W. P. B. Lockwood, Head Dairy Department, Massachusetts Agricultural College, Amherst, Mass., on "Educational Work and Advertising as an Aid to Marketing Milk," was in Prof. Lockwood's absence read by H. E. Bowman.

Samuel M. Heulings, of New York City, presented a paper on "Safe Milk, the Object of Pasteurization."

Raymond C. Colwell, Chairman, Board of Food and Drug Commissioners of Rhode Island, Providence, R. I., presented a paper on the subject of "Vitamins in the Dairy Ration and Their Effect on Milk and Milk Products."

A paper by Prof. H. A. Harding, of the University of Illinois, on "The Effect of Pasteurization on Cream Layer," in Prof. Harding's absence was read by George E. Bolling.

A paper on the subject of "Transportation and Marketing of Milk" was presented by Dr. C. W. Eddy, of Cleveland, Ohio.

A paper having as its subject, "Pertinent Observations of Conditions at Country Creameries," by W. E. Ward, was presented, as was also a paper having as its subject "The Function of the Sanitarian in the Condensery," by John Gaub, of Lexington, Ky.

Papers and addresses presented were discussed by many members and others, including Mr. Irwin, Dr. Schofield, Dr. Smith, Prof. Jordan, Mr. Gauhn, Dr. Hollingsworth, Mr. Vener, Mr. Johnson, Mr. Strauch, Dr. Grapp, Mr. Holt, Mr. Hulquist, Mr. Faulkner, Mr. Bateson, Mr. Earnshaw, Mr. Yates, Mr. Seaman, Mr. Goldstein, Dr. Miller, Mr. Bolling, Mr. McGrath, Mr. Hartnett, Mr. Dinneen, Mr. Bowman, Mr. Bricault, Dr. Pease, Mr. Lacy, Dr. Supplee, Mr. Bremer, Dr. Loomis, Mr. Russell S. Smith, Mr. Clement, Mr. Widmayer, Mr. Lombard, Mr. Hiscock, Prof. Van Norman, Mr. Munn, Mr. Colwell, Dr. Dodge, Mr. Melican, Dr. Thom, Mr. Doolittle, Prof. McInerney, Prof. Fisher, Mr. Button, Mr. H. B. Lockwood, Mr. Fowler, Mr. Paine, Dr. Price, Mr. Ayer, Mr. Blanchard, Mr. Goehrig, Mr. De Con, Mr. Thomson, Mr. Kilbourne, Prof. Stocking, Mr. Fee, Mr. Thames, Mr. Carlton, Mr. Shaw, Mr. Daniels, Prof. Lane, Mr. Howard, Mr. Warner, Mr. Flanagan, Dr. Campbell, Mr. Jone, and Dr. Wills.

At 4.10 P.M. the convention went into executive session for the transaction of business.

BUSINESS SESSION

Brief reports were made by the officers. The report of the auditors was received and accepted, as was also the report of the Secretary-Treasurer.

The Association then proceeded to elect the following officers:

President, H. E. Bowman, Somerville, Mass.

First Vice-President, Geo. E. Bolling, Brockton, Mass.

Second Vice-President, J. B. Hollingsworth, Ottawa, Canada.

Third Vice-President, Jackson E. Earnshaw, Kansas City, Mo.

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

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

The officers elected made brief but enthusiastic addresses and pledged united effort to advance the interests of the Association during the coming year.

It was voted that Mr. Ward's paper be referred to the Committee on Dairy Methods.

The committee on resolutions reported, and the following resolution was adopted:

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

Resolved, That the International Association of Dairy and Milk Inspectors in annual convention assembled extends its appreciation and thanks to the following:

Dr. Royal S. Copeland,
Prof. H. E. Van Norman,
Mr. M. D. Munn,
Dr. C. W. Larson,
Dr. Robert S. Breed,
Prof. W. A. Stocking,
Mr. Samuel M. Heulings.

Invitations for the eleventh annual convention were received from Kansas City, Mo., New York City, Buffalo, and several other places.

It was moved and seconded that the Association express its thanks by a rising vote to the officers who have served the Association during the past year.

President Roadhouse expressed the pleasure which the officers have felt during the past year in serving the Association.

As no other business was suggested, the tenth annual convention finally adjourned.

ADDRESS OF WELCOME

DR. ROYAL S. COPELAND, *Commissioner of Health,* New York City.

I have thought milk, talked milk, drunk milk, dreamed milk, for the past several weeks. As you know, we are in the midst of a serious strike on the part of the milk deliverymen here in New York that has seriously interfered with and hampered the distribution, and of course, curtailed the use of milk. I am glad to say the situation has greatly improved, and every day sees new progress in the restoration of delivery service, which I think at the present time has become about 80 per cent normal.

A man was hit by an automobile on Broadway and taken to a hospital. On entering the hospital he was asked whether he wanted a pay ward or a free ward. He replied he did not care so long as the ward was safely Democratic. As you know, we have in addition to our other activities recently had an election here in New York City. I may say it is a very Democratic city to which I bid you welcome. If it were possible Mayor Hylan would present you with the keys of this Democratic city, but as his representative I am pleased to be here and for the second time during my office as Health Commissioner perform that very agreeable duty for the Mayor.

During a recent trip to Europe I was astonished to find that the methods of milk handling and distribution were extremely crude. The supply there lacks the protection with which modern scientific methods have surrounded it in this country, and it is safe to say that the supply there is by comparison far less desirable. An examination of the milk supply showed ten per cent of it to be infected with the germs of tuberculosis, and evidence of fecal matter was found in practically all the milk sold in London.

We are proud of the quality of the milk at present supplied to New York City. When we are through with strikes and other things, we will erect some monuments to the memory of those who have given us a better milk supply, as well as to those who have achieved success in various other undertakings. Practically all of our present milk supply is either certified or pasteurized, and our death rate is only 74 per 1,000 at the present time, which is a very low rate; and you, gentlemen, are responsible for these improvements and for other similar improvements in various parts of the country. Such results can only be obtained by eternal vigilance and constant watch must be kept to keep adulterants out of milk.

We are having a great health exposition at the Grand Palace during the present week, where we will be glad to welcome you and where we will be glad to have you look over the exhibits, which represent the various activities of the Health Department of New York City and which we hope will offer some helpful suggestions to you which may be made of benefit to the communities from which you come. Mr. Salthe and Mr. Thomson will see that you are all supplied with tickets to this health exposition.

We hope your sessions will be productive of much good. We are glad to have you here, and we hope you will come again.

"Behind every business which keeps up with the times must be some individual who keeps ahead of them."

RESPONSE TO ADDRESS OF WELCOME

PROF. JAMES O. JORDAN, Boston, Mass.

The International Association of Dairy and Milk Inspectors is fortunate in being welcomed to New York City by its energetic Health Commissioner, Dr. Royal S. Copeland. This is the second time that our organization has deliberated in this city; it is the second time that Dr. Copeland has extended a cordial greeting to the organization, and it is the second time that I have had the honor of replying to his words of welcome. I desire to assure Dr. Copeland, in behalf of the members, that we appreciate his continued interest in the welfare of the organization. His previous appearance must have been a good omen, for no more successful meetings were ever held by the association than those which followed his extension of hospitality. To have him assume the same duty today gives assurance that the present proceedings will be equally auspicious.

This Association is engaged in an undertaking of great magnitude. Its members are responsible for the condition of the world's most important food. The welfare of communities is largely dependent upon the safeguards employed in protecting milk supplies from harmful influences. This is the task in which we are occupied; one who enlists in this effort can only do his duty in one way, and that is well. Such important endeavors can best be carried on through cooperation, organization. That is the purpose of this meeting. That has been the motive of previous gatherings. What have we accomplished through these efforts, and what interest is displayed in our activities? This is the tenth annual convention. Consequently it is fitting at this time that we indulge in the retrospective. On this basis the brief record cited affords ample proof that our deliberations are valuable contributions to the effort for improved milk supplies, and that these endeavors are receiving substantial appreciation.

Since its inception the Association has published nine annual reports, containing a total of 2061 pages and including 243 papers. Five hundred copies of each report have been printed and distributed, chiefly in this country, but some in foreign countries.

Two committee reports, because of their importance, were printed in pamphlet form for immediate distribution.

One important committee report, containing the result of original investigation and comprising 32 printed pages, was published and distributed separately.

By request the annual reports are regularly supplied to the Congressional Library and the libraries of such cities as Cleveland, New York, Oakland, Seattle, and Spokane and to many smaller cities; to the State Libraries of California and New York; to the libraries of the U. S. Department of Labor, the Dairy Division of the U. S. Department of Agriculture, and the Office of Experiment Stations of the U. S. Department of Agriculture. They are also desired by and supplied to the libraries of between fifty and sixty universities and colleges in this and other countries.

In addition to the above, requests for annual reports have been received during the past year from the following:

The New York Academy of Medicine Library.
Yale University Library.
University of Chicago Library.
Columbia University Library.
International Institute of Agriculture, Ottawa.
Massachusetts Institute of Technology Library.
University College, Reading, England.
University of British Columbia, Vancouver, B. C.

Foreign countries represented by requests for copies of the annual reports include France, England, Canada, New Zealand, Australia, India, Japan and Holland.

Enviable recognition! The past may well be a guide for future achievements. Let us lead in the movement for sound improvements in milk sanitation. Let there be a decided expansion in membership, so that the service we are striving to render will benefit a larger proportion of humanity.

"Always do more than is expected of you, and do it willingly."

PRESIDENTIAL ADDRESS

Dr. Chester L. Roadhouse, Davis, Cal.

It is more pleasing than I can tell you for me to stand before the members of this Association as your President. When I attended the Annual Meeting in Washington four years ago I had no thought of being your Presiding Officer at a later date. Since I was not present at the meeting at which you elected me your Chairman, I wish to express now my appreciation of the honor you have given me.

We are gathered here for our Tenth Annual Meeting, and with nine years of the history of our accomplishments on record in our published annual reports, we have reason to be proud of the progress we have made. At the National Dairy Show this year, I am told that Wisconsin had an exhibit showing the progress in dairying in that state during the past fifty. years. If this Association should picture the progress that has been made in dairy sanitation in the past ten or fifteen years it would be surprising to the public and to those who have come into dairy inspection work more recently.

This meeting marks our tenth anniversary. Great credit is due the members who have carried the Association through this first decade. The influence of this organization has been great, and this influence should be increased as our membership is increased.

The world has never been in greater need of men of knowledge who can render efficient service than it is to-day. The success of business enterprises, our great industries, our professions and our public service is based upon knowledge and service.

The service which the members of this association are rendering, and our success is based upon a knowledge of the principles of sanitation and our ability to render the service of protecting the wholesomeness and healthfulness of milk and its products.

The importance of milk as a food for man, for the adult, as well as for the infant and the child, is becoming so greatly emphasized by our nutrition experts that the position of the dairy and milk inspector has been enhanced. His service is gaining in importance and he is receving greater encouragement and increased opportunities.

Former Chief Rawl has said that *if* the dairy inspector's only compensation was the salary he received he would be poorly paid, but from the standpoint of service to humanity the expert in dairy sanitation is rendering a public service of paramount importance to the vigor and health of our future citizens.

The type of public service that is most enjoyable is that which will encourage us to work overtime and not feel imposed upon; to make our work enjoyable the organization of the work must be right. I have known of instances where a city dairy inspection organization has been restrained by having some of its rightful duties taken from it by a Health Department official not placing full responsibility in the hands of a Chief Inspector. Such restraint will stagnate any inspection service. The city milk problem is of sufficient importance to justify the exclusive attention and study of a man upon whom all responsibility is placed. If he feels the responsibility of his position he will become more proficient and become a more valuable man to his city or state. He will look upon his position as having greater promise of permanency, and will be more inclined to seek membership in this Association and to assist in organizing local dairy and milk inspection associations, which should increase his knowledge and enthusiasm in his work.

If the institution with which we are connected is not properly organized it is not out of order for us to suggest changes. I have known of men workng under conditions that were discouraging without trying to correct the conditions. We must carefully study our problem to know that our plan is correct, and when we are sure that it is, then use our best efforts to accomplish it. A squeaky wheel always receives first attention. Let's become squeaky wheels if it is necessary to establish the best results, and if we are worthy the assistance is apt to be forthcoming.

I have stated that knowledge and service are essential factors to success. Knowledge will be gained by study. In dairy and milk inspection the knowledge of our local conditions and needs is important, but this is not sufficient. We must have a knowledge of the principles of sanitation, dairy bacteriology and chemistry. This, I take it, is accepted by all, but there is something more. We should have a knowledge of what is being accomplished in other cities and states, and know the opinions of others engaged in the same work. This is the knowledge supplied by membership in this Association. Those who have attended the meetings of the Association realize the value gained from them and the published proceedings in standardizing our opinions and procedure. It has seemed to me, though, that our influence should be greater.

To increase the influence of this Association, the membership should be increased. An effort to accomplish this has been made this year by appointing a special membership committee. My recommendation is that the membership committee this coming year be instructed to put on a campaign of "Every Member Get a Member," as has been done by the American Dairy Science Association. This will tend to draw stronger men into the Association and gradually its influence will be extended, and its accomplishments increased.

A committee was appointed this year to report on serving milk in schools. In many parts of this country State Dairy Councils and others have encouraged the serving of milk to school children. Many of us have little knowledge of the conditions surrounding the care of milk served in the schools. Personal experience in delivering milk to private customers and cafeterias from our college creamery emphasizes to me the advantage of delivering milk in the original container. I believe that the committee's Report on Serving Milk in the Schools, which will be presented during the Convention, will be of interest to the members.

My interest in city milk quality dates back to the time before city milk supervision became general in this country. At that time when going into a public eating place I would hesitate to order milk, but in many instances I did order it with a feeling that perhaps the particular milk supply in question was satisfactory. Later I became Chief Dairy Inspector of San Francisco and visited some of the dairies from which I had consumed milk. They had not been supervised previously and after seeing some of these dairies I resolved that I would never drink milk again unless I knew its source.

Conditions have changed materially in our state, due largely to the influence of the 60,000 women club members, who have the right of suffrage. A pure milk law was passed by the state legislature, which provides that all milk produced for sale for human consumption in the state must come from animals that have passed the tuberculin test, or it must be pasteurized. Butter and all other dairy products except cheese must be produced under the same conditions. There are other important provisions which have been reported in a previous session of this Association.

The condition which I have described in California should prevail throughout the United States. Why should we not have prohibition of tubercle bacilli in milk in this country? This point occurred to me as I came across the continent and as I limited my consumption of milk and cream because of the lack of faith in its quality.

The United States Bureau of Animal Industry has made marked progress in the certification of tuberculosis free herds in the different states. The breeders of pure bred cattle are realizing the value of this development. It seems to me that the time is here when this Association should go on record as favoring legislation providing for the pasteurization of all milk and cream used as such for human consumption when it has not been produced from cows that are free from tuberculosis as shown by the tuberculin test.

When the public realizes the greater safety of dairy products there will be increased consumption, and eventually greater prosperity to the dairy business.

The California Pure Milk Law has been in effect for five years, and has stood with little change through two sessions of the legislature. Oregon passed a similar law two years ago. The law has been carried out with such general satisfaction and with so little opposition that we can recommend it to this Association with the hope that it may be adopted in other states.

The principle of cooperation is being more and more emphasized in many lines of business, in labor organizations and agriculture. Cooperation applies to the membership of a single organization and to the membership of one organization with another.

The American Hotel Association, meeting in New York City at this time, has adopted a plan of cooperation with certain universities, Cornell, California and Stanford, whereby the Association will designate certain hotels to be used as training schools for university students while taking their college course, in order that a better educated group of men may be trained in the details of operating and managing large hotels.

As members of the International Association of Dairy and Milk Inspectors we will do well to be good cooperators. We should cooperate with worthy producers and distributers of milk in encouraging higher attainment. We should cooperate with the women's clubs of our city in encouraging their study of the milk supply, and the value of milk as food. In smaller communities where financial support of the inspection department is limited, the organization of interested citizens into a Milk Improvement Association has proved a valuable aid in increasing the public interest in milk quality, and it can be looked upon as being one of the best means of creating appreciation of the importance of dairy and milk supervision.

The Secretary informs me that we have a full program. Discussions are of great value and I trust that our visitors, as well as our members, will feel free to discuss the reports and papers that are presented.

"Germs are frequently caught on the fly."

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

J. B. Hollingsworth, D. V. S., *Chairman*

The importance of obtaining a hygienic and wholesome milk supply is recognized by all intelligent people. Milk is a food, and of all foods comes nearest to meeting all demands of the body. Although milk is normally such a desirable and excellent food, it is, like other foods, subject to various modifications and fermentations, depending upon the condition under which it is produced and subsequently handled. This abnormality may be merely a slightly bad odor and flavor or it may be some very marked undesirable characteristic of color consistency, odor or taste. Again, the milk may appear and taste perfectly normal but at the same time contain pathogenic organisms or toxic properties that may prove serious and even fatal to the consumer.

Probably the first legislation that pertained to the sale of milk was enacted in 1863 at Washington, D. C.

Today every city has its regulations which should govern all milk sold in the city directly or indirectly to be afterwards sold by dairy companies.

Probably no other phase of preventive medicine has engaged the attention of public health administrations for the past five years at least to the same extent as has the efficient safeguarding of the public milk supply—and advisedly so, for in a modified form it is the most efficient substitute we have for mothers' milk as a food for infants. It constitutes over 16 per cent of the food used by civilized man.

We have, however, the well recognized danger of transmission of disease, especially that of tuberculosis. In addition to this there have been numerous outbreaks of typhoid fever, scarlet fever, diphtheria, septic sore throat, and dysentery traced directly to an infected milk supply.

The milk regulations of the City of Ottawa, Canada, which became operative five years ago, compelled all milk to be pasteurized save that which comes from tuberculin tested cows. The test is conducted by an official of the Federal Government under the direction of the Veterinary Director General, and all reacting cows are destroyed. The Government pays two-thirds of their value (value not to exceed $80.00 for grade and $250 for pure breed), along with salvage to the owner. We have in this way been able to clean up all our dairies supplying raw milk. Many of our producers supplying pasteurizing plants have applied to have their herds tested, as they realize fully from an economic standpoint it pays to keep the herd healthy, to say nothing of the protection of their families.

Of bovine diseases tuberculosis is no doubt the greatest source of danger. It is an insidious infection. Cows may have the appearance of perfect health. They may eat well and show no symptoms of the disease and still be affected with it.

To the late Professor Koch we are indebted for the discovery that the great white plague in man and beast is due to a germ known as the Koch Tubercle Bacillus. This germ may gain access to the milk through a lesion in the udder or the germ be discharged through the bowel through the existence of an intestinal lesion. Thus the milk problem becomes the health problem and the dairy business becomes necessarily a life saving or a life destroying business as the case may be.

The possibility of transmitting tuberculosis of cattle to the human being is now well accepted and the safeguarding of the milk supply in this respect is a necessity, for perhaps the greatest number of cases of tuberculosis is developed in childhood when susceptibility is far greater and during a period when milk bulks large as an article of diet. Tuberculosis among cattle has both an economic and a sanitary aspect. The loss of live stock from this disease is difficult to measure.

Cattle suffering from tuberculosis lose in value whether they are beef producers or milkers. They lose in flesh and the quantity of milk is materially reduced.

A most prolific way of spreading this disease is the practice of distributing whey from cheese factories throughout the country and skimmed milk from butter factories. In some countries the distribution of these by-products is prohibited by law unless they are safeguarded by pasteurization. It can be readily understood that through the distribution of raw skimmed milk or whey tuberculosis can be spread from one herd of cows to another. To eliminate all tuberculous cattle from the herd or to pasteurize all milk coming from untested cattle is therefore an essential requisite in the safeguarding of human health.

Tuberculosis may and very often has developed in a herd through the dairyman trying to improve his stock by the introduction into his herd of a pure bred bull. It should be compulsory that the owners of pure bred stock furnish the purchaser with a certificate of health in order that his herd be kept clean. The day is not far distant when this will be compulsory. Also, cattle exhibited at exhibitions and fall fairs will have to produce a certificate of health. Then, and only then, will our clean herds be reasonably well protected.

Considerable interest has been aroused during the past few years as the result of the high mortality from septic sore throat. One author declares that outbreaks have been traced directly to the milk supply; possibly partially through contamination by the handlers of the milk who were afflicted or were carriers, and partially through an organism which is found in the diseased udder of the cow.

With so much overwhelming evidence of the dangers of the transmission of diseases through milk, we have the problem confronting health departments of how most efficiently to remove these dangers. The united opinions of those who have for years been carefully studying the relation of bovine diseases to a sanitary milk supply is that all milk should be scientifically pasteurized save that which comes from tuberculin tested cows, and even that would be safer if pasteurized.

Contagious abortion has assumed an economic importance second only to that of bovine tuberculosis. It is in the vast majority of cases a specific infection which runs its course in a period of four to five years, resulting in either sterility and an economic loss of no small importance, or recovery after which pregnancy and production are normal. Professor Bang of Copenhagen found a specific microorganism which has since been recognized as the cause of the infectious type.

Investigators have shown that with the use of a living vaccine the period required to carry an animal through the infection is shortened and that the cases of incurable sterility have been greatly lessened. In conjunction with the vaccine, which should be administered only under the direction of a competent veterinarian, it must be remembered that an examination is essential to determine whether malformations have been established by this as other infections or disease processes. Attention to absolute sanitary conditions in and out of stable is equally essential.

Individual experiences with contagious abortion have been almost as many and varied as there are breeders of high producing and pure bred cattle.

It would be an oversight to present a paper of this kind without giving the most careful consideration to some of the economic aspects of milk production. But one objective is in the mind of the producer, namely, how can the greatest financial return be secured from a given investment with the least expenditure of money and labor. This can be answered very simply by the concise statement, "Do not have any but profitable producers in your herd. Eliminate the boarders."

Many producers strive hard to get ahead. They are conscientious, labor diligently early and late, yet, when analyzing the results, find that the profit resulting is scarcely sufficient to feed and clothe themselves and their families.

Milk production is a business proposition. Like other business propositions it must be carefully studied. There must be a knowledge of feeds and feeding, the method by which a ration may be balanced as well as the relative merits and actual values of different foods. No business can be profitable if a part of the machinery is operating at a loss. In the dairy business the main machine is the cow. Points of merit by which production may be anticipated are known to all of you. The knowledge of these points does not go far enough. They must be supplemented by actual performance, which means that the successful producing dairy is one that records the performance of each animal, not periodically but continually. By this method a comparative record is available. Profit is distinguished from loss and boarders are not permitted to consume the profits and occupy valuable space. With a profit being assured from the operation of the dairy conducted along hard and fast business lines, the improvement along sanitary lines is an advantage in making the work more healthful and interesting.

To recapitulate, my theme in the foregoing has been to create a better conception of the means for improvement of the dairy industry, as it is here that the dairy inspector is of greatest value, who is able to impress upon the producer the importance of a healthy herd and proper farm sanitation, showing himself as an interested instructor rather than as a police officer.

The marked change of attitude on the part of the producer towards the official is a fact within the experience of all men officially connected with the important work of eliminating to all possible extent bovine diseases and by so doing safeguarding the public health.

The intimate connection between the purity of the milk supply and the health of the people dependent on it as an article of food, I have already touched on, but I would crave your indulgence in allowing me to emphasize the educational value of our work. In the old days, to the ordinary farmer a cow was merely an animal to be regarded with no particular interest so long as she supplied milk the quantity of which or the quality of which was to be regarded largely as a matter of chance. Today, if I may be permited to refer to the district surrounding the City of Ottawa with which I am personally familiar, the individual cow has become an entity in herself. Our producers have become, to a degree at any rate, scientists and specialists and each cow stands or falls on her own merits. Her health, her pasture, her winter quarters, her milk producing qualities, her intimate relation to the health of the public at large, are at least in general terms understood by her owner as matters worthy of special study and consideration, and I may safely say that the officials guarding the city's milk supply are looked upon by the producers not as foes or spies but as allies and friends. When all is said and done concerning our duties, it resolves itself into this fact, that we are the producers' friends.

I take it that our object is not to destroy the producer's herds because they are diseased but educate him to protect them against disease, and so to perform our initial duty, namely, to protect the public health.

To the average producer the object in keeping cows is to make money out of them. We are, to use a popular term, the efficiency experts, aiming at not only aiding him in his perfectly proper idea but also as specialists educating him along scientific lines, in following which he not only carries on to realization his own idea but is also guided by us to the elimination of those bovine diseases which, to a degree that we of all men most clearly realize, are jeopardizing the public health.

The best asset a nation has or can have is its children and as from the physical viewpoint, the unquestioned deteriorating influence of civilization lessens the human milk supply, the increasing value of our work in improving the food on which the infant must subsist grows even greater.

Those who guard the food of the nation's babes, who give study and care and time, who spend themselves often enough under difficult circumstances in educating our milk producers as to the infinite value of the quality of the food they supply to the nation's children, have, at any rate, if I may voice my own opinion, a vocation and a work which is worth a man's while. Education along any line is always a matter of time but if, as the result of a society work or a man's life work, there has been the improvement of chances for the children's health by the elimination of any of the evils which attack the citadel of their health and of their life, the effort, to say the least, has been worth the expenditure of the best that is in any man. It is not necessary to quote statistics to you who are all men of special training.

After all, science is only *special knowledge* and the specialist, if he is true to his vocation, must necessarily be the teacher of others who have not had his special opportunities.

We all realize, you in your great Republic, I and others in our great Dominion, the relation of the milk supply to the public health.

May I simply request in bringing this paper to a close without being considered presumptuous in so doing, that we may all consider ourselves teachers in transmitting to posterity the best inheritance which our children can enter upon, the inheritance of a sound constitution and good health, which, let me insist, depends upon good food; and as the infant in the wise dispensation of Providence can only take one kind, it means simply, pure milk.

DISCUSSION

Question............................

Dr. Hollingsworth: In Canada all compensation is from the Federal Government.

Question............................

Dr. Hollingsworth: The ocular, intradermal, and subcutaneous tests are used. In Canada cattle are stabled nearly six months. About 8 per cent of the cattle tuberculin tested have reacted. The improvement of dairies was under way before the tuberculin test was required. In some cases herds of cows supplying milk to invalids and hospitals were found to produce 97 per cent of reactors, about 50 per cent of which were generalized cases of tuberculosis.

Dr. Grapp: In the United States all three tests for tuberculosis are indorsed by the Federal Government, and each State selects its official test.

President Roadhouse: Why are not all herds tuberculin tested? If 50 per cent of the cattle in a herd react to the test, all members of such a herd should, in my opinion, be condemned. All herds should be tuberculin tested after enough have been tested to provide a supply of milk.

"The production of milk involves, first, an investment in the cows and the land necessary to grow their food; second, an equipment of sanitary stables and utensils essential to the best physical condition of the cows and a flow of milk consistent with the labor and money expended; third, constant care 365 days in the year, milking twice each day, feeding and caring for the general welfare of the herds."

A COMPARISON OF THE A. P. H. A. STANDARD MILK AGAR OF 1920 WITH AYERS' MILK POWDER AGAR A

HORATIO NEWTON PARKER, *City Bacteriologist,* Jacksonville, Fla., and KATHRYN BYERS

To test the milk powder agar A proposed by Ayers,* a series of samples of bottled milk from four dairies producing "Baby Milk" and from five dairy depots, two of which sold raw milk, one raw milk one-third of the time and pasteurized two-thirds of the time, and two pasteurized milk only, were plated out simultaneously on both the standard and Ayers medium A during the months of June, July, August, and September of 1921. In this paper the standard agar will be called extract agar, and Ayers' agar, milk agar.

The milk was 18 to 24 hours old and was produced within a radius of 15 miles of Jacksonville. However, the milks of the several dairymen and depots are not alike, for they are produced and handled differently.

Baby Milk is a raw milk produced under close observation of the City Board of Health and must consistently carry not more than 15,000 bacteria per c. c. It is the equivalent of certified milk, though less meticulous rules attend its production. All of the Baby Milk dealers produce and bottle their own milk and all distribute it except V. C. Johnson & Bros., who distribute through the Certain-Thyson Co. Of the four Baby Milk dealers, two have been remarkably successful in keeping their counts within the prescribed limit. The two other producers were less successful because part of the time they lacked adequate refrigeration and their hired help was not entirely satisfactory.

Of the dairy depots the Springfield Dairy and the Lily

*Milk Powder Agar for the Determination of Bacteria in Milk, by Ayers and Mudge, Jour. Bact. V. 5, No. 6, pp. 565-588.

White sell only raw milk. The Springfield Dairy buys milk from one or two patrons and bottles it in a plant that scores 62 on the U. S. Government Milk Plant Score Card, while the Lily White Dairy buys from half a dozen patrons and bottles the milk in a plant that scores 53.5. Milk is handled more expeditiously and particularly in the Springfield than in the Lily White plant.

Palmer Bros. Depot sold raw milk until July 26th, on and after which day it sold only pasteurized milk. This plant and the two others that sell pasteurized milk use the held or positive process of pasteurization and heat at 142°-145° for 30 to 45 minutes. The plant has a dozen patrons, scores 76, and is operated in a commendable way.

Yeager's Dairy Depot sells only pasteurized milk. It has a dozen patrons, scores 73, and maintained a creditable record all summer.

The Certain-Thyson Depot distributes V. C. Johnson & Bros. Baby Milk, but all of the milk put out by the firm in its own name is pasteurized. The plant has 20 patrons, scores 63.5 and is operated under the handicaps of having a cold storage plant incapable of furnishing sufficient refrigeration in summer, and other adverse factors.

The bacterial counts obtained on the media under comparison are set forth in tabular form and are summarized as follows:

J. FRANK BARTHOLF

77 samples. Two samples over 15,000 per c. c. on extract agar; four on milk agar.

47, or 61 per cent of counts on the two media not more than 15 per cent apart.

13, or 17 per cent of counts on milk agar more than 15 per cent higher than on extract agar.

17, or 22 per cent of counts on extract agar more than 15 per cent higher than on milk agar.

Greatest percentage increase over extract agar, 525.

Greatest percentage increase over milk agar, 53.

Median of percentages increase of milk agar over extract agar, 11.

Median of percentages increase of extract agar over milk agar, 14.

V. C. JOHNSON & BROS.

80 samples. Five samples on extract agar over 15,000 per c. c., and five samples on milk agar over 15,000 per c. c.

59, or 61 per cent of counts on the two media not more than 15 per cent apart.

19, or 24 per cent of counts on milk agar more than 15 per cent higher than on extract agar.

12, or 15 per cent of counts on extract agar more than 15 per cent higher than on milk agar.

Greatest percentage increase over extract agar, 167.

Greatest percentage increase over milk agar, 45.

Median of percentages increase of milk agar over extract, 16.

Median of percentages increase of extract agar over milk, 11.

W. NOLAN

64 samples. Seven samples on extract agar over 15,000 per c. c., and seven samples on milk agar over 15,000 per c. c.

29, or 45 per cent of counts on the two media not more than 15 per cent apart.

23, or 36 per cent of counts on milk agar more than 15 per cent higher than on extract agar.

12, or 19 per cent of counts on extract agar more than 15 per cent higher than on milk agar.

Greatest percentage increase over extract agar, 172.

Greatest percentage increase over milk agar, 263.

Median of percentages increase of milk agar over extract agar, 22.

Median of percentages increase of extract agar over milk agar, 16.

60 samples. Eleven samples on extract agar over 15,000 per c. c., and nine samples on milk agar over 15,000 per c.c.

32, or 53 per cent of counts on the two media not more than 15 per cent apart.

12, or 20 per cent of counts on milk agar more than 15 per cent higher than on extract agar.

16, or 27 per cent of counts on extract agar more than 15 per cent higher than on milk agar.

Greatest percentage increase over extract agar, 1,680.

Greatest percentage increase over milk agar, 237.

Median of percentages increase of milk agar over extract agar, 22.

Median of percentages increase of extract agar over milk agar, 10.

SPRINGFIELD: PLANT SCORE 62

35 samples.

8, or 23 per cent of counts on the two media not more than 15 per cent apart.

24, or 69 per cent of counts on milk agar more than 15 per cent higher than on extract agar.

3, or 8 per cent of counts on extract agar more than 15 per cent higher than on milk agar.

Greatest percentage increase over extract agar, 2,823.

Greatest percentage increase over milk agar, 153.

Median of percentages increase of milk agar over extract agar, 55.

Median of percentages increase of extract agar over milk agar, 22.

LILY WHITE: PLANT SCORE 53.5

47 samples.

12, or 25 per cent of counts on the two media not more than 15 per cent apart.

21, or 45 per cent of counts on milk agar more than 15 per cent higher than on extract agar.

14, or 30 per cent of counts on extract agar more than 15 per cent higher than on milk agar.

Greatest percentage increase over extract agar, 1,411.

Greatest percentage increase over milk agar, 328.

Median of percentages increase of milk agar over extract agar, 50.

Median of percentages increase of extract agar over milk agar, 21.

PALMER BROS: PLANT SCORE 76

First sixteen samples were of raw milk. Thirty-three other samples are of pasteurized milk.

16 raw samples.

4, or 25 per cent of counts on the two media not more than 15 per cent apart.

10, or 63 per cent of counts on milk agar more than 15 per cent higher than on extract agar.

2, or 12 per cent of counts on extract agar more than 15 per cent higher than on milk agar.

Greatest percentage increase over extract agar, 366.

Greatest percentage increase over milk agar, 115.

Median of percentages increase of milk agar over extract agar, 60.

Median of percentages increase of extract agar over milk agar, 103.

33 pasteurized samples:

9, or 27 per cent of counts on the two media not more than 15 per cent apart.

23, or 70 per cent of counts on milk agar more than 15 per cent higher than on extract agar.

1, or 3 per cent of counts on extract agar more than 15 per cent higher than on milk agar.

Greatest percentage increase over extract agar, 5,500.

Greatest percentage increase over milk agar, 115.

Median of percentages increase of milk agar over extract agar, 170.

Median of percentages increase of extract agar over milk agar, 8.

YEAGER: PLANT SCORE 73

57 samples.

12, or 21 per cent of counts on the two media not more than 15 per cent apart.

30, or 53 per cent of counts on milk agar more than 15 per cent higher than on extract agar.

15, or 26 per cent of counts on extract agar more than 15 per cent higher than on milk agar.

Greatest percentage increase over extract agar, 7,828.

Greatest percentage increase over milk agar, 161.

Median of percentages increase of milk agar over extract agar, 53.

Median of percentages increase of extract agar over milk agar, 48.

CERTAIN-THYSON: PLANT SCORE 63.5

94 samples.

9, or 9 per cent of counts on the two media not more than 15 per cent apart.

75, or 80 per cent of counts on milk agar more than 15 per cent higher than on extract agar.

10, or 11 per cent of counts on extract agar more than 15 per cent higher than on milk agar.

Greatest percentage increase over extract agar, 100,900.

Greatest percentage increase over milk agar, 1,185.

Median of percentages increase of milk agar over extract agar, 217.

Median of percentages increase of extract agar over milk agar, 25.

CONCLUSIONS

So far as it is justifiable to draw conclusions from a series of observations no more extended than this, it would seem that:

1. The colonies on milk agar at the end of 48 hours are larger and more easily counted than those on extract agar.

2. That with fresh raw milk running counts of under 10,000 per c. c. there is not material difference in the counts on the two agars.

3. That with raw milks running counts of 50,000 per c. c. or more, the milk agar gives on the whole higher counts.

4. That with pasteurized milks giving counts that indicate fairly satisfactory operation, the milk agar gives higher counts with considerable regularity, and with milk from plants that are not functioning properly the counts are enormously higher. So, the use of milk agar in control of pasteurizing plants is indicated. The milk agar counts suggest that pasteurizing plants are not accomplishing as complete bacterial reduction as extract agar counts have led us to suppose they were.

On the whole we are favorably impressed with milk agar because of the larger colonies it gives and because it seems to bring out the acid producing colonies better than the extract agar. The qualitative separation of the colonies for which milk agar provides is not commented on in this paper, but at times this feature of the medium might prove most useful, though difficulty is experienced from spreaders and from either the alkali or acid formers predominating and making it impossible to distinguish other forms. Further study of this feature of the medium is desirable.

Some trouble was experienced from precipitation of casein in the milk agar. In conversation Mr. Ayers pointed out that this might be due to incomplete solution of the milk powder, to heating the agar too high, to letting it stand melted too long before pouring, to too much phosphate, or to an incorrect hydrogen ion concentration. A caution here seems needed.

Milk agar has many good points and is worthy of extensive trial.

"Every failure teaches a man something if he will learn."

REPORT OF COMMITTEE ON TRANSPORTATION AND MARKETING OF MILK AND MILK PRODUCTS—PART I

TRANSPORTATION

W. E. Ward, *Agent,* Board of Health, Brookline, Mass.

During the recent summer an investigation was made of country processing plants and methods of handling dairy products, including transportation, in New England and Canada, in conjunction with Dr. Wm. C. Woodward, Health Commissioner of Boston. Although we found conditions as regards interstate shipments of milk and cream materially improved as regards schedules, placement of cars, and additional trainmen, the results of inadequate supervision and lack of any definite regulations as to icing cars in summer or heating in winter were painfully apparent. The care of the milk in transit, and of the returned empty containers, is still left wholly to the discretion of the car men without any attempt at sanitary supervision. Many of such employees are irresponsible and impervious to the principles of sanitation. They perform their work in the easiest, which is generally the slackest, manner.

The major deficiencies noted were, insufficient and unequal distribution of ice in cars, acceptance of milk with punctured and leaky covers and cans, walking over the tops of cans while storing and unloading in cars, lack of facilities for protection at receiving platforms, throwing cans on dusty roadside from moving trains to avoid stopping, and other misuses; also the use of unclean cars, and in many cases, ordinary box cars, which are not insulated, some being found with the interior sheathing partially destroyed.

There were but two cities that made regular train inspections, and as the representative of one, I have ascertained this work to be of great value in improving the supply.

In seeking cooperation in matters affecting milk transportation I have found that railroad officials are usually men of high standard, responsive to reasonable requests. They have willingly sent their inspectors to distant parts of their systems to work with our men and many permanent corrections have thus been effected.

Through the incessant endeavors of committees and individuals connected with this and other public health organizations, the Interstate Commerce Commission has taken some steps towards ameliorating the conditions. Such actions have apparently been without intelligent investigation and are entirely inadequate, no constructive rulings having been promulgated to eliminate the unsatisfactory conditions or insure permanency in such reformations as have been started. The spoilage and deterioration of milk and cream in transit entails an enormous economic loss, tends to nullify the work of milk inspectors, and presents such elements of real danger to the public health as to warrant our making concerted efforts to solve this problem.

The following lines of action are suggested:

1. Study the problem from all angles that we may be in a position to give facts to those having authority to remedy conditions.

2. Use our best influence with Federal officials and others to induce the Interstate Commerce Commission to provide and enforce a more adequate and definite ruling for the protection of milk and cream in transit.

3. Advocate such Federal legislation or other action as will insure the use of refrigerator cars for the transportation of milk and cream in carload lots for any considerable distance.

4. Broaden the scope of our field work to include a systematic inspection of milk transportation.

5. Use our influence with railroad executives to improve conditions.

REPORT OF COMMITTEE ON TRANSPORTATION AND MARKETING OF MILK AND MILK PRODUCTS—PART II

Transportation of Milk in Connecticut

Thomas Holt, *State Dairy and Food Commissioner,* Hartford, Conn.

The transportation of milk in Connecticut from source of supply to cities is for the most part accomplished by trucks. Some cover eighty miles or so, and the milk is received in very good condition by using ice on cans and having covered trucks, or cans covered by tarpaulin. In a goodly portion of the State we have been instrumental in having small receiving houses established by the roadside, easy of access to trucks, where the cans of milk, and in turn empty cans, are protected from dust and the hot rays of the sun. These are largely for individual farms, but in a few cases crossroad locations have a building that will accommodate the product of five or six milk producers. A wonderful improvement in the transportation of milk has been the direct result.

We have carried on an extensive campaign during the last two summers with our inspectors to accomplish the proper cooling of milk at the farm. The regulations of the Milk Regulation Board provide that milk must be cooled to 55° within one hour after milking, and not to exceed 60° at any time prior to delivery.

During the summer of 1920, after due warning, we commenced to prohibit the sale of any milk having a temperature higher than 60° when delivered and we continued the prohibition the past summer. We sent back to the farms a great many hundred cans of milk, and there is now in prospect more new ice houses than have been erected in the last twenty-five years.

Some cities are publishing the bacteria counts of dealers' milk supplies, and dealers are now cooperating with our inspection department in an effort to secure a better supply. Heretofore, many dealers have been indifferent as to their supply for pasteurization, and in some cases have conspired to prevent our department from obtaining good, hearty cooperation from the producers.

We are endeavoring to get into the minds of both producer and consumer the fact that the better they care for milk the more it will be appreciated by the consuming public; consequently, more milk will be used and increase the profits of both, as well as rendering a real service to humanity.

Such milk as is transported by rail in Connecticut has to have considerable care from the shippers or it would not arrive at destination in good shape. I believe that the railroads should be held to a stricter accountability as to icing, or leave it entirely to the shipper. Railroads carry only a very small proportion of the milk to the cities of Connecticut. There are, however, a great many cars of milk going from the Eastern part of Connecticut to Boston and Providence. We see to it that this milk has the same initial farm care as the milk consumed in our own State. The companies receiving this milk I understand see to it that cars are properly iced en route, and similar conditions exist on our Western border where the milk goes to New York. While Connecticut is a small State we do ship out three times as much milk as we ship in.

To my mind the outstanding points in transportation and marketing of milk in Connecticut are (1) proper sanitation and initial cooling at the farms; (2) provision for suitable receiving stations on truck routes, as the trucks used are too large to go into most yards, even where farm buildings are located on main roads; (3) proper protection from weather while traveling, and icing of cans during the hottest portion of the summer; (4) maintenance of a low temperature after being received at distributing plant until delivered to the consumer either as pasteurized or natural milk; (5) cooperation between civic bodies and milk distributers to effect a more economical method of delivery that would at least cut out most of the duplication of effort in getting the product to the public. Cost of delivery is entirely too high and until the public is educated to the fact that it is costing them real money to be served by so many different dealers on the same street, we will be unable to make progress towards a more economic distribution. Civic bodies, such as chambers of commerce, wield a great influence with the public.

Milk inspectors can do real missionary work in explaining the merits of cooperation in delivery of milk, also in showing up the food value, and really become public benefactors to the human race to a larger extent than ever before.

REPORT OF COMMITTEE ON TRANSPORTATION AND MARKETING OF MILK AND MILK PRODUCTS—PART III

MARKETING

PROF. W. P. B. LOCKWOOD, *Head Dairy Department,* Massachusetts Agricultural College, Amherst, Mass.

Marketing of milk has been treated by this association, heretofore, as the actual process of collection of milk in the country, transporting it to the city, processing in the city plant, delivery to the consumer and finally the collection of bills and bottles. This has been the mechanics of marketing. There is another side of the marketing question that is receiving a great deal of attention; namely, the creating of the demand for more milk through increased consumption by present users as well as the increasing of the actual numbers of users through advertising and educational work.

Previous to the last four years, individual companies have gotten out some good material, but the very fact that the company's name appeared once or more times in it depreciated its value to the public. Much of the advertising was so gotten up as to show that a certain company's milk had exceptional merit that milk of other companies either did not or could not attain. The general result of this type of advertising was not to increase the per capita consumption of milk, but for one company to take business from another company, according to which had the most aggressive advertising and sales force.

The old ideas held by consumers were that milk was necessary for babies, might be good for small children, but was not needed for older children, and was an actual added expense when used by adults. They did not realize that milk had actual economic food value whether used by baby, child or adult.

The work done by Dr. McCollum and others has shown conclusively that milk is necessary for the proper physical and mental development of growing children and that its use is beneficial to adults. The presentation of these facts during the war, a period when all possible attention was being focused on economical foods and health, and when the United States Department of Agriculture, State and local authorities were working on the food and health problem, put milk and dairy products before the public in such a way that it accomplished more for the industry than the industry itself could have accomplished in many years.

The industry itself learned many things from this war work. Among them it learned that dealers and producers could work together; that the public will accept the facts about milk and dairy products when these facts are presented through organizations rather than by individual distributers or producers; that all kinds of organizations, Health Departments (local and state), can and are glad to cooperate when material is presented by group organization instead of by individuals; that group commodity advertising and educational work builds up per capita consumption and the industry.

For a moment let us consider the possibilities as to consumers. From the best data available, it is found that the underweight or undernourishment of children in the schools, as shown by weighing and measuring, varies from 10 per cent to 40 per cent; that it is found among country as well as city children; and that it is found in all classes—in the families of the so-called "well-to-do" as well as in the families of the poor. One authority states that only about 4 per cent of the total undernourishment is due to inability to purchase proper food, the balance being due to improper selection of foods. Dr. McCollum says that every growing child needs a quart of milk a day. Others say that a child needs at least one pint per day, but all agree that children need milk and much more than they are getting today.

Growing boys and girls need milk, young people and adults should take it. In other words, every person is an actual or a potential milk consumer. The problem, then, is to make proper approaches and appeals to each group to make present consumers use more milk and to change potential consumers into actual consumers.

So far, the best results have been obtained by educational methods along with proper advertising. The hesitancy of the public in accepting private companies, educational work and the obvious difficulty of public officials, social workers, nurses, principals, and teachers, and organizations cooperating with such work has led to the trial of cooperative advertising and educational work.

This cooperative educational and advertising work is usually financed by the industry. The distributer contributes a stated amount per a given unit on milk purchased and the producer contributes a like amount on his milk sold, the distributer deducting these amounts from producers' checks and sending both his own and the total amount deducted from all producers to the treasurer of the organization having charge of the work. The amounts vary from ½ cent per 100 pounds of milk to 5 cents per 100 pounds of milk. In some places this is done by agreement, while in others on a contract.

In some places dairy councils, composed of state health and agricultural officials, distributers, and producers have charge of the work; in others committees of distributers and producers have charge but call in the National Dairy Council to take charge of the work; while in still other instances, the state and local Home Demonstration Agents have had charge of the work.

The work itself may vary from campaigns lasting from a week to twelve weeks or it may be organized as permanent year round work. The main thing in either method is to organize the work thoroughly, making contacts with the largest number of groups. Both the Dairy Division of the United States Department of Agriculture and the National

Dairy Council have definite plans for campaigns that will fit the needs of towns and cities of different sizes. The Dairy Division also has plans for country communities. These are available for those interested.

The fact that milk is necessary for the best physical and mental development of the child and its qualities as a protective food has led to the development of material and methods that interest both children and parents; the children from the standpoint of healthy bodies and the parents from the standpoint that they owe their children the best body and mind development they can give them. The interest of the school authorities in underweight and undernourished children has caused the putting of milk into many schools as a mid-morning lunch. The superintendent of the schools in one city writes that the milk drinking children have done 10 per cent better work. The results of the survey of the milk-using children in the Los Angeles schools, under the direction of the school physician, brought out the fact that the milk-using children stood better in their class work; that they excelled in athletic contests; and that the delinquents were, as a class, non-milk-users. The writer understands that as a result of this work a movement is on foot to try to get free milk furnished to the children at school the same as free text books.

Stores and industrial plants are also making milk available for their workers. Some say it has been a distinct benefit. Others have not satisfied themselves yet but are still doing it. The American Manufacturing Association in compiling statistics on accidents found that before the Volstead Act went into effect, the largest number of accidents occurred at 8 o'clock in the morning. They attribute it to the "hang-over" from the night before. Now they find the largest number of accidents occurring at about 11 o'clock. They are wondering if this is not a depression or fatigue period previous to the stimulation that comes from looking forward to the noon meal hour. Milk served at 10.30 would furnish food to carry over this period and on the other hand not be sufficient to interfere with the appetite for a good meal at noon.

As those interested in sales of milk, you will be interested in the results of this type of work. The following from the Weekly News Letter of the Department of Agriculture tells part of the story.

"MILK DRIVE INCREASES USE OF DAIRY PRODUCTS"

"Consumption of milk is on the increase as a result of the milk campaigns of the United States Department of Agriculture and the State agricultural colleges and local agencies, inaugurated to extend and increase the use of milk and other dairy products in cities, towns, and rural districts. The increases in sales of milk as a result of these educational campaigns carried on during the past year in 11 states, 15 cities, and 4 counties range from 3.5 to 35 per cent, the average increase being 15 per cent. The health of the children has been improved while undernourishment has been reduced.

"Nutrition clinics have been held, and underweight, poorly fed children have improved greatly in health as a consequence of the more general and intelligent use of milk as a daily food. In Kansas City a previous survey showed a condition of 30 per cent undernourishment among the children, while after the milk campaign and regular instruction in health habits, a second investigation showed that mal-nutrition had been reduced to 15 per cent. Of late milk campaigns have been held in Madison, Wis.; Wheeling, W. Va.; Seattle, Wash.; Greenville, S. C.; Akron, Ohio; Warren, Ohio; Winston-Salem, N. C.; Springfield, Mass.; Oskaloosa, Iowa; Baltimore, Md.; Oakland, Mich.; Cumberland County, Md.; and Jacksonville and Duval County, Fla.

"Despite disturbed industrial conditions, increases in milk consumption have been effective, and even in

> places of much unemployment the quantity of milk used has been kept up to normal. In nearly all cases the milk consumption subsequent to the milk campaigns has been greater than ever was before."

The National Dairy Council gives reports of good results. The writer has a copy of a letter from one of the distributers in a city where a milk campaign had been put on. He figured that over 60 per cent of the increased business of his firm that year had come from the work done in the milk campaign.

Nearly continuous work has been done in Boston since 1916. The amount of milk and cream coming into Boston by railroad during the period 1916-1919, inclusive, increased 28 per cent. During this period the price raise was practically 88 per cent.

During the present serious business depression and period of unemployment the Boston market is nearly holding its own, while some other markets are reporting from 5 per cent to 10 per cent loss. Previous to the starting of this work there was a large fluctuation in milk sales. Since the work has been going on there has been a steady increase in sales up to the present business depression.

The health authorities and welfare workers are pleased with cooperation of this kind that helps for better living and better health, and those in the milk industry are pleased as it helps their business.

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

REPORT OF COMMITTEE ON TRANSPORTATION AND MARKETING OF MILK AND MILK PRODUCTS—PART IV

H. E. Bowman, *Chairman*

In studying the problem of transporting milk, this committee has taken into consideration the various agencies used to convey milk, and the conditions governing the quality of the product when delivered at its destination. We have also endeavored to make a few constructive suggestions to dealers and to the common carriers. Milk is being constantly carried from the time it is produced until it reaches the lips of the ultimate consumer.

The agencies employed are: Carrying by hand in pails or other containers, transportation in cans or jugs, by teams or auto, forwarding by steam train, steamboat, electric car or motor truck, and the final distribution at the market end. The cost of transportation is a study by itself, and this paper will not touch upon that point except to say that tariffs have very little influence on the amount of shipments.

Regardless of costs, the public must be supplied, and sufficient milk will be brought to our cities to fill the demand. In the early days of the business most of the milk was placed in a wagon and delivered to the customer within a short time after production, and the various precautions were not observed with the same detail and care which is necessary under modern conditions. As our centers of population have grown, the production of milk has been crowded further and further away, and more and more of our milk supply comes by truck, railroad and steamboat. Probably 90 per cent of the supply of greater Boston is now brought from a distance of from fify to several hundred miles.

A little history may be interesting at this point. Whitaker states in Parker's "City Milk Supply" that "Boston was probably the first city in the United States to transport milk by railroad, the first shipment being made over the Boston and Worcester road in 1838, and the first milk car was run soon afterward. In 1843, history tells us, a single dealer sent to Boston over this same road 200,000 gallons of milk in one year. In 1847 the first milk train entered New York City from Orange County."

Merritt states that "Prior to 1870 all milk used in Boston came from not over sixty-five miles distance." In 1890 milk was transported a distance of one hundred and fifty miles, and in 1910 the Boston and Maine hauled milk two hundred and seventy-five miles, and the New York, New Haven, & Hartford two hundred and eleven miles.

From these small beginnings has grown one of the greatest industries of the day, and at the present writing, milk is hauled from inconceivably long distances, and millions of gallons are imported into the United States from Canada, partly for the manufacture of cheese and butter, but in time of shortage to be used as fluid milk.

Having established the importance of the common carrier in its relation to the milk business, let us now consider how the dairy and milk inspector will function in his effort to guarantee to the public a safe and adequate supply. I use the term, "adequate," because the regulation of any industry should not be carried beyond a point where details become burdensome. Business must be profitable or it will die, and the economic interests of all parties should be considered as fully as is consistent with the result required. Improper handling causes an immense amount of waste and may be a menace to health.

The points to be observed through the life of the milk are: *Refrigeration, promptness in handling, and precautions against contamination.* The inspector's duty is therefore plain. The science of bacteriology has disclosed dangers lurking in the milk supply. It has shown that ditry milk is very probably dangerous milk, particularly to infants, and may be fatal where resistance is at a low ebb.

It is therefore the duty of the inspector to see that the initial contamination is reduced to a minimum and that chances of contamination during transit are nil. Bacteriological examination of milk again plays an important part in checking the temperature of milk.

Bacteria increase rapidly when milk is not properly refrigerated, or in old milk, so another duty of the inspector is to see that cans are received in proper condition (no old or sour milk sticking to their sides), and that the transportation agencies keep milk at the proper temperature (the initial cooling should be done at the farm), and finally, that cans be sealed or that milk be safeguarded in such a manner that contamination during transit is impossible.

In a previous report rendered to this association on this subject, the following question was promulgated to milk dealers shipping long distances. "In your opinion what are the principal causes for spoilage of milk under shipping conditions?"

Eighty per cent of the answers blamed the producer for this trouble.

To the questions "What changes in the present services or equipment of transporting agencies do you consider as necessary for the dairy industry?" and "What suggestions would you make to transportation agencies for stopping spoilage in milk?" I gleaned the following:

"Hauling milk on all trains and faster trains in South."

"Provide covered terminals and junction points."

"More ice and better cars or refrigerator service."

"Icing stations 'en route' or carry ice car with each train."

"Eliminate errors causing delay, lost cans, wrong delivery, adequate records and correct way bills."

"By refusing to ship milk not properly cooled" and "prompt unloading at destination."

In Mr. Holt's paper he suggests the following:

1. "Proper sanitation and prompt cooling at the farms."

2. "Provision for suitable receiving stations on truck routes."

3. "Proper protection from weather conditions while traveling, icing during hottest portion of summer."

4. "Maintenance of low temperature after being received at distributing point."

5. "Cooperation between civic bodies and milk dealers to effect a more economical method of delivery."

Mr. Ward suggests:

1. "Study the problems from all angles that we may be in a position to give facts to those having authority to remedy conditions."

2. "Use our best influence with federal officials and others to induce the Interstate Commerce Commission to provide and enforce a more adequate and definite ruling for the protection of milk and cream in transit."

3. "Advocate such federal legislation or other action as will insure the use of refrigerator cars for the transportation of milk and cream in carload lots for any considerable distance."

4. "Broaden the scope of our field work to include a systematic inspection of milk transportation."

5. "Use our influence with railroad executives to improve conditions."

By this it will be seen that the needs of today are no different than they were a year ago. I would add to the remedies already noted:

1. The personal effort of each individual milk inspector, and urge the exclusion of all milk which does not meet the requirements of modern methods of sanitary production.

2. A strict supervision of milk at the terminals as to temperature and condition of containers.

Urge the necessity of better cars, properly refrigerated, and better schedules, thus eliminating unnecessary delays and spoilage.

If these things can be accomplished much will have been done to remove the friction between the producer, transportation agencies, the milk dealer and inspector.

North, South, West and East have different problems and the committee realizes that we must each adopt methods which meet the peculiar requirements of our section. When this has been accomplished, we will have gone far toward the goal of a safe and adequate milk supply.

DISCUSSION

Mr. Bowman: Conditions referred to in the report are New England conditions, in long hauls where milk is picked up at small railroad stations and refrigerated in box cars and ice is used.

President Roadhouse: In California we are in some places using insulated glass-lined steel tanks, placed on large trucks, the two tanks together carrying about 3,000 gallons of milk. A route may cover 100 to 125 miles The milk previously collected at the receiving stations twice daily is cooled at the collecting station to about 40°, so that the milk does not churn in transportation, and the increase in bacteria during transportation at that temperature is very slight.

Mr. Holt: Our State regulations call for cooling milk within an hour, regardless of the New York regulations, which permit it to remain uncooled for a longer time.

Mr. Bowman: Some pasteurize milk at once without cooling.

Mr. Vener: At one of our stations in New York milk received at 7 A.M. within two hours after milking need not be cooled.

Mr. Flanagan: I believe milk should be cooled if it is to be shipped at all.

"Who goes softly goes safely, and he who goes safely goes far."

PRACTICAL METHODS IN IMPROVING A CITY MILK SUPPLY

HOWARD R. ESTES, *Milk Inspector,* Flint, Michigan.

The supervision of a community milk supply, like every other problem, may be approached from various angles. We are, however, usually inclined to approach it from our own personal viewpoint. The bacteriologist usually views the milk question from the technical standpoint. He thinks of milk in terms of kinds of bacteria and the number per cubic centimeter, and their influence upon the quality of the milk.

The milk inspector sometimes thinks of his work in the terms of the police officer or detective. He looks upon the producers and distributers as classes that need close supervision and he proceeds to collect evidence against the offenders who fail to produce good milk.

The health officer frequently holds similar views, except that in addition he thinks in terms of milk-borne epidemics and he is inclined to place the blame for such epidemics on the producer or distributer.

The consumer looks at the milk question from an entirely different angle. He judges the milk from its general appearance, cleanliness, odor and taste, the cream line, the cleanly appearance of the bottle and the price per quart, etc.

The distributer and the producer also hold their individual views. The former makes his entire living selling milk and his interests are therefore a little broader. He wants to sell a clean and fresh milk because it is to his own interest to do so. He is anxious to please the consumer, not so much because of his altruism but rather because it helps his business.

The producer's viewpoint varies in accordance with his intelligence and experience. If he specializes in the milk business, he generally is interested in producing a good grade. If the milk is only one of the by-products of his farm, he frequently considers it of minor importance and he handles it in the easiest way possible.

The producers generally class the milk inspector as a meddler, an aggravating nuisance or a necessary evil. Comparatively few are really interested in him.

Each one of these widely different viewpoints should be seriously considered by a department of milk supervision. We cannot hope to be reasonably successful in this effort without this broad attitude toward the work. Our own personal views arbitrarily forced upon others who hold opposite opinions cannot bring the best results. The producer, the distributer, the consumer, the milk inspector, the bacteriologist and the health officer each has his own individual opinions. Each one of these viewpoints must be regarded if a community is to be safeguarded with an abundant supply of safe and wholesome milk.

The milk inspector occupies a very responsible position in the control of the milk supply. His work is valuable or otherwise depending upon his viewpoint of the milk question and his aggressiveness. If he is only a detective engaged in accumulating evidence against ignorant milk producers and stubborn distributers, his work cannot be very valuable. If on the other hand he tactfully plays the role of an instructor and helpful director, his work will become of extreme importance.

He comes in close contact with the producer who occupies the most strategic position in the defence line for a clean and wholesome milk. The dairyman either produces a clean or dirty milk and no one can change it if it is dirty. His methods are of the most extreme importance, and yet he is usually neglected the most of all those who take part in the handling of milk.

It is sometimes remarked by milk inspectors that they are serving the consumers and not the producers. They argue that they are employed by the consumer class and for that reason they are not interested in the welfare of the producer. I believe that the first duty of the wide-awake milk inspector is to help the producer. The logical way for him to help the consumer is to first help the producer The farmer who has been tactfully shown how to improve his dairy farm, and still more important, his methods of producing milk, is the best protection the consumer can have against a contaminated milk. Pasteurization may protect them against disease carried by milk but it will not undo the damage done to the milk by the producers. We need a clean, cold and fresh milk before it is pasteurized just as much as we need a clean water supply before we chlorinate it as a final safeguard. The producer is the only individual in the whole line of milk handlers who is in a position to deliver such a wholesome milk. Why not direct a little more attention to him? The majority of milk producers are right minded and willing if they are tactfully directed.

I do not know how much emphasis is placed in other communities on bacterial counts as a method to distinguish between a good and a bad milk. I am seriously questioning this as a method of much practical importance. I am not underestimating the importance of bacterial studies of milk. I am now speaking of practical field methods and I believe the attack upon the producer by the bacterial route is wrong and should be discarded entirely.

Bacteriology means about as much to the average producer as the Einstein theory of relativity does to the average layman. If we ever hope to convince the farmer of the fact that he is contaminating the milk by the methods he uses, we must speak to him in his own language and not that of the technical laboratory. Our approach to him must be on his own ground and in his own way.

There are other ways in which to show him the condition of his milk than by means of bacterial counts. A simple sediment test pad will show him how much dirt there is in his milk can. When practicable run the test on his own farm. He can see it with his own eyes. You can then reason with him and perhaps convince him that it came from dirty cows, his dirty hands, his stable, his clothes, the pail or cans, etc. With the right approach he can be made to improve his methods, provided you show him how. Teach him to think in terms of dirt over and over and not in terms of bacteria. He will eventually begin to see the dirt, visualize it, so to speak, in the cans and on the pads, and then try to do away with it. If you speak to the producer in terms of bacteriology, he does not think at all. He does not know how he will ever keep bacteria out of milk. He can, however, keep the cans clean and the dirt out. Gross macroscopic field methods are better than laboratory methods for this purpose.

I don't want to be misunderstood in my interpretation of the sediment test pad. A clean pad is no guarantee that the milk has always been free from sediment. A dirty pad is evidence in itself. When a clean pad is obtained, it is up to the inspector to carry his testing apparatus to the producer's milk house and perform the test there or investigate the condition of the producer's strainer cloth. A clean pad should not deceive the wide-awake milk inspector. It does not necessarily mean pure milk.

I know of no better way to show the producer how to remove dirt from the milk than by demonstrating with a modern well devised strainer. I have heard the technical laboratory man criticize this. He has the laboratory viewpoint. He says that we teach the producer to remove the visible dirt and leave the milk contaminated. This is where the visit of the milk inspector at milking time is extremely fruitful.

I wonder if we have ever stopped to think that if you can induce a producer to use the very best methods of straining his milk, that you then have him in a receptive frame of mind to adopt other methods of improvement. If he will do one thing, he will likely do more. He will buy small-top milk pails perhaps, and all the other helpful equipment. What is more, I would rather have the consumer buy clean looking milk, than milk with sediment in the bottle. The consumer's viewpoint is that he wants a clean looking milk and not dirty milk. We should consider that, too. If he constantly sees dirty milk, he is inclined to buy less and neglect his children who need milk in their daily diet. Removing dirt from milk by means of a strainer may not seem theoretically correct, but practically speaking it does help to satisfy the consumer and it starts the producer perhaps on the road to using better methods. He has been approached on a sane and sensible basis and it appeals to him. It is then up to the milk inspector to carry on and get these improvements by degrees. It is impossible to get them all at once.

Another useful field instrument is the thermometer. By means of it you can show the producer just how cold the milk is and it can be demonstrated to him on his own premises. He has no grounds for the usual argument that it was cold when it left the farm but became warm in transit. A thermometer shows it to him in black and white.

I want to say here a word in regard to the use of the small-top milk pail. I know of no one single piece of equipment taken by itself that will keep dirt out of milk better than will the small-top pail. I believe that every milk inspector should make a special drive to introduce the small-top milk pail on as many dairies as possible and I think it should be made compulsory to use it.

A similar drive should be made on modern methods of cooling the milk to 60 degrees or lower. One of our distributers made such a drive upon all his producers. He purchased a number of coil-coolers and sold them at actual cost by personally visiting his producers. He informed us that his milk supply was materially improved by it. Make it easy for the producer to get this equipment by inducing the distributer to handle it.

The dairyman can be more easily induced to buy a thermometer, small-top milk pails, a cooler, a good strainer and in fact any reasonably priced equipment if he is made to feel that he is buying it at cost. I would strongly urge the distributers to cooperate with the milk inspector in order to place the necessary equipment in the hands of the producers at actual cost.

I wish also to say a word about systematic educational work. The average producer does not read very much except the daily newspaper. If we ever hope to induce him to use modern methods, we have to teach him what they are. This can be done in various ways. In our city we have made this effort by sending out short monthly letters. We do not send these through the mail but they are given to the distributors who place one in each envelope with the milk check. We have found that this is a good way to get the producers to actually read them. These letters cover one subject at a time and in the course of several months we are able to drive home a few modern ideas about the handling of milk. These letters have been very popular with the producers and have had a very wholesome influence upon the milk problem in our city.

The work of the milk inspector should be based on scientific common sense, taking carefully into consideration the opinions and views of all classes who are concerned in the milk problem. It should be constructive and not destructive in character. The producers should be made to feel that the milk business is extremely important; that milk is the most important food produced; that thousands of people need it; that it should be produced and kept as pure and wholesome as is possible and that it is largely up to them. Talk constructive things instead of threatening them. It is that sort of work that spells better cooperation and better relations between producers and departments of milk inspection and eventually will bring results.

DISCUSSION

Mr. Bolling: The paper emphasizes the sediment test rather than the bacterial count. In Massachusetts producers know what bacteria are and what they mean in milk.

Dr. De Klein: Each year we have a milk show and contest, and cups are awarded to the best producers. We do a lot of bacteriological and other laboratory work, but we also make a point of doing a lot of work with the producers.

Mr. Holt: Bacterial counts are so much discredited in Connecticut that we cannot seem to argue that point so well with our producers. The methods of collecting and caring for samples may be responsible in part for high counts. The more emphasis we place on bacteria counts, the more the farmers laugh at us.

President Roadhouse: I believe producers of milk for city consumption should understand fully the significance of bacteria in milk, while those producing for manufacturing purposes may be permitted to know less, and the sediment test may be more advantageously used.

"The only way we know of being able to use our physical strength less is to use our brains more."

SOME MISINTERPRETATIONS OF THE GOVERNMENT SCORE CARD

Willard E. Ward, *Agent*, Board of Health, Brookline, Massachusetts

It is not proposed to criticise the present government score cards for the inspection of dairies and creameries. They were both designed and amended by men whose experiences and judgment are not to be questioned. It is because of their value that uniformity in their interpretation and application should prevail. For several years I have endeavored to study the scorings accorded by different inspectors at numerous dairies and creameries. Many of the observances made were in conjunction with officials who are more expert in matters pertaining to milk control than am I. In the scoring it was found that many inspectors for city and state health departments pay little or no attention to the definite instructions printed on most score cards that "if any exceptionally filthy condition is found, particularly dirty utensils, the total score may be further limited" and "if the water supply is exposed to dangerous contaminations, or there is evidence of the presence of a dangerous disease in animals or attendants, the score shall be 0." Generally no action is taken if a dairy scores 50 points, regardless of whether the producer cools his milk in a trough from which animals drink, uses horse manure or sand for bedding, has holes in the barn floor which admit gases from filthy cellars, and various other deficiencies, any one of which should warrant the exclusion of the product. It was noted, too, that very little follow-up work had been done when dairies scored 50 points. Thus, no matter what the inspector tells the farmer, the latter is led to believe that, because he had received no official notice that corrections must be made and there had been no subsequent inspection, his premises and methods must be fairly satisfactory. In other words, his dairy had been passed by the board of health. Then again, it is apparent that the scoring of dairies is too largely done as a factor in determining under which grade dealers shall sell their milk, rather than to promote greater care in its production. Such perfunctory use of the dairy score card has, at least in some parts of the country, a retroactive effect upon producers and tends to place the scoring of dairies upon a commercial, rather than a sanitary basis.

In many cases the responsibility for such misinterpretation and misapplication of the score card rests with executives, while the views of practical field inspectors are not considered. On the other hand, many instances are found where apparently competent administrative officials do not advise with or check up the work of inspectors, and sanitary requirements are left to their individual discretion. Thus, between the various deficient adaptations, the score card is not serving us as efficiently as such a valuable adjunct should.

Some of the misuses to which the dairy score card is subjected have been pointed out in order to emphasize the necessity for reformation and uniformity in its use. I would suggest the adoption of minimum requirements which could be supplied separately to the producers, through dealers, in order to eliminate as much as possible the necessity for reinspections. Such requirements should be printed on the score card as causes for exclusion, as follows:

IF ANY OF THE FOLLOWING CONDITIONS EXIST THE MILK WILL BE EXCLUDED UNTIL CORRECTION IS MADE

The presence of dangerous disease among attendants.
Diseased cows, sores on udders or teats (unless they can be segregated in separate barns.)
Dirty cows, barn, or utensils.
The use of horse manure or sand for bedding.

Undue accumulation of manure or the presence of liquid manure in cellar, shed, or yard.

The keeping of horses in cow section.

Loose floors, walls, or scuttles admitting foul odors from manure cellar, shed, or yard.

Loose ceilings admitting dirt from loft.

Swine under cow barn or within 75 feet thereof.

An unsanitary toilet or open sewer on the premises.

Lack of facilities for cleansing milking equipment.

Cooling in water which can be contaminated by animals.

Lack of milk room or facilities for cooling to 50°.

It is true that some of the above appear in substance on the amended score card in question form, but they are not applied as causes for exclusion, except by those, seemingly few, who rightly interpret the blanket clause pertaining to contaminating conditions. While it is admittedly our duty to stimulate interest in the production of dairy products, are our methods sufficiently constructive? Are not the indicated requirements reasonable, and if generally applied would they tend to eliminate any but undesirable producers?

In the use of the government score card for the inspection of creameries, the same general conditions of misinterpretation and misapplication prevail. As I have been requested to give the results of a recent investigation made in conjunction with Health Commissioner Dr. William C. Woodward and Dr. Charles W. Delano, both of Boston, it seems necessary to mention only such conditions as should be used as a basis for exclusion or other corrective action. We found a large number of creameries with up-to-date buildings and equipment but with sanitary deficiencies which made the product unfit for human consumption. Yet these same creameries had been inspected and scored on the government score card at points varying from 55 to 72, showing a woeful lack of intelligent application and a gross misinterpretation of what the score card was intended to accomplish. As a further illustration, the eight creameries which the proprietors closed rather than comply with the health regulations had all been scored by two or more state or city inspectors. As in the case of the dairy score card I would suggest the adoption of minimum requirements which every creamery proprietor should be made to understand and comply with, and which should be printed in block type on the score card.

IF ANY OF THE FOLLOWING CONDITIONS EXIST COMPLETE CORRECTION MUST BE MADE BY THE (. . . . . . .) OR THE PRODUCTS WILL BE EXCLUDED

Filthy premises or equipment, or if the premises are badly infested with flies, mice, cockroaches, or other vermin.

If the water supply is not such as could be safely used for domestic purposes.

If convenient fly-proof toilets or washbowls are not provided.

If sewage or waste products are exposed within 200 feet of creamery.

If boilers, coal, or ashes, or other unsanitary equipment are used or stored in the processing section of plant.

If weighing tanks, aerators, holding vats, and other processing equipment are not properly protected from flies and dust.

Inadequate pasteurizing, sterilizing, or cooling.

Laxity in receiving milk with high acidity and temperature.

The conditions seem to indicate the desirability for remedial action. I, therefore, suggest that a committee be appointed to study the matter with a view of devising means for a more constructive application of the government score cards, this committee to report at the next convention.

DISCUSSION

Mr. Smith: The so-called Government score card as used by the U. S. Dairy Division is in fact a card prepared by the Official Dairy Instructors' Association.

Mr. Loomis: The card needs boiling down. I believe a committee should be appointed to consider the score card.

Mr. Lombard: The score card can be no better than the men who use it. We should help men to understand and use the score card properly. When we get our ideas standardized the card will be more useful.

Mr. Bateson: We have used the so-called Government score card for several years in Buffalo. It has enabled us to improve conditions on the farms supplying milk, as by its use we more readily note deficiencies that need correction. We exclude milk when such deficiencies are not corrected.

Mr. Dinneen: Mr. Ward's point is that certain dairies have been scored and passed by some inspectors, while others have found serious deficiencies. I believe a score card should have in it certain vital points that should be complied with.

Mr. Fisher: I will suggest cooperative work with the Dairy Science Association in an attempt to improve the dairy farm score card.

President Roadhouse: The kind of score card used is not so important as its use.

"Just as the flow of a stream of water is wholly dependent upon the source, so is the milk supply primarily dependent upon the producers on the farms who maintain and care for their herds of dairy cattle."

POWDERED MILK AND PUBLIC HEALTH

PROF. R. M. WASHBURN, *Director of Laboratories,* International Dry Milk Company, Minneapolis, Minn.

Milk inspectors are public health officials whose duties lie principally along the line of safeguarding milk and some of its products. Anything, therefore, which will protect or promote public health is within their field of duty, especially if it pertains to the products of the dairy.

But since public health is simply private health multiplied, and since the food and vitamine value phases of milk are just as real as the bacterial—in fact, since the beneficial effect of milk in the diet of growing children is far greater than the deterimental effect that even many bacteria of a non-pathogenic variety are at all likely to produce, it could well be argued that one duty of the milk inspector is to teach the greater use of milk. Too often, I fear, the inspector's mind has been so full of negative things that the positive have been neglected.

"In the United States recently, remarkable results have been obtained with a number of children of the undersized, illy developed and mentally backward class, encountered in sadly large numbers. Groups of these children were given extra milk every day at school whilst parallel groups were given an equivalent amount of food units (calories) in the form of bread and margarine. The acceleration on the growth of the children receiving milk, and the rapid development of the previously stunted powers as compared with the control group was most striking." (J. C. Drummond). Professor Gowland Hopkins, of London, "tested the matter of vitamines in a well known boy's school, where it was observed that the lads were not in their usual health, but were lacking in keenness for both work and games. The sanitary state of the school was found to be excellent and all possible solutions of the problem were investigated without success until the dietaries of the boys were examined. It then appeared that they were receiving practically no fresh fruit or vegetables of any kind, and that formerly they had been able to obtain fruit from an outside source with ease. The deficiency in their diet was made good by the inclusion of fruit and like magic the normal health and vigor of the lads returned."—(J. C. Drummond, in American Journal Public Health, July, 1921.)

The Board of Education of Los Angeles, California, in studying the conditions of their 8th grade pupils discovered that the regular milk consumers averaged two years younger than children in the same grade who did not drink milk.

In Seattle, Washington, Dr. Brown discovered 23 per cent of the students of the entire school physically deficient, scholastically uncertain, and brought them back to par by simply the feeding of milk.

Dr. W. R. P. Emerson, of Boston, is authority for the statement that about one-third of the school children of America are 7 per cent or more below what they should be physically, and many of these mentally backward as well, and that 97 per cent of this third can be cured or brought back to par by the use of milk. Instances like the above can be cited to fill volumes, but needless to go further here.

THE DAIRY COW is the most efficient converter of roughage and salvager of coarse wastes in the world. Because of the cow the dairyman salvages time mornings, evenings, rainy days, winter seasons, and in general fills in his hours with productive labor to a far greater degree than any other class of workmen.

Commercialized dairying is the stabilizer of agriculture and should be intelligently encouraged wherever the conditions will warrant, but it is useless to produce unless there is a market. On the other hand there are thousands, even millions of people living in sections where dairying is not carried on sufficiently to provide milk for the growing children.

The Northern sections need wider markets and the Southern people need more milk. Both are discouraged by the two great handicaps of milk, viz: its bulkiness and perishability and the answer to both these drawbacks is powdered milk, a product which has come to stay because badly needed both for economic and health reasons.

FOOD VALUE OF POWDERED MILK

"Dried milk was first suggested as a food for infants by the French in 1904, and in the same year a German used dried milk on himself and his infant son. * * * Dried milk was used in England in 1906 with success. * * * Some authorities, including numerous French and Belgian doctors consider it (dried milk) superior to sterilized cow's milk, or even the humanized milk. * * * In most cases increased experience with the powder has led to greater confidence in its employment."—(Robert J. Blackham, M.D., in May, 1921, The Practitioner, London, England.)

"Dried milk is not a panacea * * * (it) is just another step forward in infant feeding. Dried milk is even more digestible than boiled milk."—(Roger H. Dennet, M. D., in July, 1918, New York State Journal of Medicine.)

Pointed statements like the above are available at every hand, and in addition most of us know personally of maternity and infant hospitals and homes in which the entire infant population is being and has been fed for long periods of time on reconstituted powdered milk. Any food which is sufficiently pure and digestible, and which is useful in every respect to satisfy the exacting needs of infants, may be safely used as supplementary or adjunct nourishment with older children.

The danger is that children will not receive sufficient milk because health officers, milk inspectors included, will take the short view of the matter and discourage the use of reconstituted powdered milk by regularly established liquid milk dealers for the supplementing of their milk supply, even though they would be compelled to admit that from the standpoint of cleanliness, low bacteria count, and high food value such reconstituted powdered milk is equal or superior to the local, and especially the shipped-in liquid milk supply.

Milk inspectors and other health officers should assume the positive rather than merely the negative attitude with respect to the health and well being of their clients. And this means good food made more fully valuable just as keenly as it means the protection of the people from the invasion of pathogenic type of bacteria.

POWDERED MILK AND VITAMINES

From the nature of the popular and the scientific discussions of the last few months respecting the vitamine content of powdered milk, it would seem that many had concluded that vitamines constituted the entire food value, that ash, of base forming nature, was no longer of any consequence, that the proteins of the easily digested and assimilated kinds were no longer things to be regarded, and that even energy will hereafter not be needed if only vitamines be present. This radical swing of the pendulum may be needed to focus attention and cause close study, but it is not a healthy attitude, nor a true measure of the value of foods. It would be just as logical to say that sugar shall not be used because it contains no proteins; that fats of meats shall not be used because they contain neither ash, protein, nor much vitamine; that eggs should not be used because the part of them which we can eat contains practically no ash; that even winter butter would be taboo because not so rich in growth-stimulating fat-soluble A as that produced on green grass. Such conclusions are, of course, illogical and unwarranted, but truly not a whit more so than the attitude of some people respecting powdered milk.

Powdered milk of all makes contains ash in high measure of just the kind needed, protein in large amount and of nature best adapted to build growth, energy easily obtainable and readily used. In addition it contains fat soluble A in essentially as large quantitites as contained in initial milk in proportion to the amount of fat retained in the powder, and water soluble B likewise in positive quantity and unreduced by the process. But how about the anti-scorbutic factor?

"Water Soluble C is the anti-scorbutic factor. Here we come to the crux of the question. Experiments at Lister Institute appear to indicate that the anti-scorbutic quality, which is poor in fresh milk, is largely diminished in dried milk, whereas the results of American investigators (Hess, Fisk, Unger and many others) demonstrate that there is no diminution of this factor, and that they have actually cured cases of scurvy by the use of dried milk. * * * The evidence of the Infant Welfare Clinics is unanimous as to the absence of scurvy on a diet of dried milk. I have never seen a case of infantile scurvy in a child fed on dried milk at home or in the tropics."—(Robert J. Blackham, M.D., in May, 1921, "The Practitioner".)

But even if this or that process of rendering a good food more available did lessen the anti-scorbutic factor, it is no more nor less than we are continually doing in drying forage for cattle, in purifying grains for human consumption, in the drying of fruits that they may be shipped and stored; in fact in nearly every step of our food handling business, we are lessening the anti-scorbutic value of such dried foods. With fruits, tomatoes, rhubarb and the like, so rich in anti-scorbutic, and milk so uncertain, especially in the winter seasons, why cavil over this feature?

Unquestionably the wonderful improvement in the physical and mental vigor of growing children, when given an adequate supply of milk, is due to the amount and nature of the ash and the proteins nearly, if not quite as much as to the presence of vitamines, especially the two water solubles.

Powdered whole milk is now being made which may be reconstituted and blended with locally produced fresh milk in any proportion to supplement local shortage, and this with perfect success, for the cream rises naturally.

In conclusion, since dairying is primarily an industry of salvage, and is a benefit to the individual, the state and the nation engaging therein, and since people in our Northern cities and Southern regions find great difficulty in obtaining a sufficient quantity of milk food, should we not adopt the progressive attitude and favor the introduction and use of standard type and grade of powdered milk that it may supplement local production and thereby nourish all the people well all the time?

Anyone wishing to study further the question of dried milk will find, in addition to our several Government bulletins on the question, that the best of all is the so-called "Coutts Report," Food Report No. 24, New Series, No. 116, published by His Majesty's Stationery Office, Imperial House, King's Way, London W. C. 2, England.

"A city must preserve the health of its children, that its own health may be preserved in another generation."

BACTERIAL QUALITY OF MACHINE AND HAND DRAWN MILK

DR. G. C. SUPPLEE, *Director of Research Laboratory,* The Dry Milk Company, Adams, New York

The milking machine in its relation to the bacterial content of milk has been the object of much concern on the part of milk inspectors and others directly interested in milk and dairy sanitation. Observations of field inspectors and the results from control and research laboratories have all pointed to the milking machine as an important potential source of bacterial contamination, particularly in the hands of users who are unfamiliar with the basic principles of dairy sanitation. The extent to which the milking machine is a factor in determining bacterial quality of milk under practical routine conditions of production may be ascertained from the results from samples of milk taken regularly over a period of time from milking machine users and non-users delivering to factories in representative dairy sections.

These observations were made possible as the result of a comprehensive milk improvement system used by a manufacturing company whose desire has been to improve the quality of milk delivered to their factories. As adjuncts to this system, adequate laboratory facilities have been provided for the regular bacteriological examination of patrons' milk, and field men have been maintained, whose particular duty is the improvement of the quality of the milk by extension methods among the patrons. It should be remembered, therefore, that the relationships shown hereinafter are derived from the mass of data obtained in connection with a practical routine milk grading and improvement system, and as consequence of such, no claim is made for the scientific control of variable factors which may or may not have contributed to the general results. It is believed, however, that by a grouping of the large number of determinations obtained under all climatic conditions and from highly developed and undeveloped dairy sections, there will be a certain significance in the tendencies shown.

Before presenting the results obtained from these determinations, it will be desirable to briefly outline the system of bacteriological grading under which the data were collected. The program provides for a regular examination of each patron's milk between certain dates once every month. All determinations are made by the microscopic method (Breed Method) at the Central Laboratory or at branch factory laboratories as circumstances may dictate at the particular time. Both technique and results therefrom are subject to periodic supervision and check by the Central Laboratory. All data are forwarded at regular intervals to the Central Laboratory for review and correlation.

The samples are graded in three classes on the basis of the average result from examination of not less than five microscopic fields; the fields of the different microscopes having been adjusted to the same area. The three classes are designated as Grade I, which is considered satisfactory from the standpoint of bacterial numbers; Grade II, which is less satisfactory in this respect than Grade I; and Grade III, which is of unsatisfactory bacterial content. The plan provides for the further examination during the month of those patrons' milk whose sample was in the unsatisfactory Grade III class at the time of the regular monthly examination. This provision calls for as high as six examinations in any one month, depending upon the bacterial quality of the milk at the time of the preceding examination. This follow-up plan furnishes up-to-date information for the field inspector, thus enabling him to concentrate his efforts at those places where the bacteriological findings indicate milk to be of the poorest quality.

Incident to this system, over 10,000 samples are examined per year at the regular monthly grading. This figure does not include some 2,500 to 3,000 reexaminations made in connection with the follow-up plan. Of the 10,467 regular examinations made during the year under consideration, there were 1,617 or 14.5 per cent of the determinations made on milk drawn with the milking machine. Although there is nothing particularly imposing in these numbers they are presented in order that the following comparisons of the quality of milk delivered by milking machine users and non-users may be more comprehensively understood. The comparisons follow:

During the warm months from April to September inclusive it was found that 46.2% of the samples from milking machine patrons were in the satisfactory Grade I class, whereas of the samples from non-users there were 59.9% in this class. It was also found that 23.9% of the samples from milking machine users were in the unsatisfactory Grade III class, whereas of the samples from non-users there were only 13.7% in this class.

During the cold months from October to March inclusive it was found that 28.6% of the samples from milking machine users were in the Grade I class, whereas of the samples from non-users there were 53.2% of the samples in this class. During this period it was again found that there was a slightly higher percentage of milking machine users in the Grade III class; there being 18.9% of the samples from users in this grade, as against 15.3% of the samples from non-users.

From these figures, it would seem quite evident that milking machine users as a class deliver a somewhat poorer grade of milk than do the non-users during both winter and summer months. It is also believed that these figures allow a further, and equally significant interpretation relative to one of the fundamental factors which must be taken into consideration in this problem—that is, what might be termed the reaction of the individual user to the stimulus of necessity as determined by climatic conditions. For example, it is significant to find that during the warm months 42.6% of the samples from milking machine users are in the Grade I class, and that during the cold months there are only 28.6% of such samples in this grade. The samples from the non-users, likewise, show a lowering of quality during the winter, but not to the extent shown by those using machines. The comparative figures for this group are 59.9% Grade I samples during the summer and 53.2% in the same grade during the winter. The difference is, indeed, striking, and illustrates the results which are to be expected from varying degrees of diligence in the care of the machines, as it is believed that the poor quality during the winter months is a direct result of the lack of attention to the cleaning, which condition, in turn, has been fostered by the cold weather, due probably to the general knowledge which most milk producers now have, that natural low temperatures will preserve milk and thus tend to counteract the results naturally obtained from slackened diligence in the matter of frequent cleaning. It would seem that this theory might be further substantiated by the fact that in the Grade III class there is a slightly lower percentage of samples from milking machine users in the winter months than in the summer months; therefore, as a consequence of the low percentage in the Grade I and Grade III classes, the greater bulk of users deliver milk in the Grade II class during the winter months which, if the care of the machines had been equal to that given them in the summer, should have been in the Grade I class.

Further correlation of the data from the samples taken each month in addition to those involved in the regular monthly grading is of value in showing the relative susceptibility to improvement of the milk delivered by users and non-users. The period for which these comparisons are made is from May to September inclusive. From four factories in representative dairy sections it was found necessary to take one or more samples as provided for in the follow-up plan, from 20.3% of the deliveries made by machine users as against 14.2% of the deliveries made by non-users. By taking from one to five subsequent samples from each of these groups during the same month, it was found that the milk from 80.1% of the deliveries from non-users was sufficiently improved during that month to be changed in rating from the Grade III class to the Grade I or II class; whereas the milk from only 46.7% of the deliveries from machine users could be similarly changed in rating during any one month. This evidence indicates that the milking machine introduces a factor which at least tends to make the production of milk of low bacterial content more of a problem for the average producer; or, stated in different terms, it might be said that machine drawn milk under average conditions is not as readily susceptible to improvement by recognized corrective measures as is hand drawn milk.

Among the efforts which have been made to overcome this tendency for the production of a lower grade milk by machine users has been the distribution of a hypochlorite solution to those who have been desirous of availing themselves of the opportunity. This solution is prepared at the Central Laboratory and furnished to patrons at a small cost. In distributing the solution, directions have been given for its use, and emphasis placed upon the fact that frequent and thorough washing is also essential for the best results. These instructions recommended that about three gallons of water containing a small amount of the concentrated hypochlorite solution be drawn through the tubes of each unit prior to immersing in the solution used for holding the tubes between milkings. The strength of the concentrated hypochlorite is such, that by using practical means for measurement of the proportions of the solution and water, the chlorinated water drawn through the tubes will contain between 150 and 200 parts per million available chlorine. Directions are also given for the preparation of the solution for holding tubes between milkings. This solution is made to contain between 300 and 400 parts per million available chlorine. It is recommended that a new solution be prepared every three or four days. The cost of the hypochlorite to the farmer when used in this manner is slightly over one cent per day; thus the item of expense for hypochlorite is reduced to a very low figure.

During the same five months period to which reference has already been made 32.7% of the samples taken from the machine users for the regular monthly grading were from patrons using hypochlorite solution. The percentage of samples in bacteria grades I and III from the group of hypochlorite users and non-users follow: For those using hypochlorite solution there was 49.5% of the samples in Grade I and 21.1% in Grade III; for those not using hypochlorite solution there was 50.7% of the samples in Grade I and 23.8% in Grade III. These results certainly provide food for thought, as the figures seem to indicate that arguments for the use of hypochlorite are entirely discounted by the showing made by those patrons who do not use it. Probably these average results are significant in so far as averages indicate general tendencies, but a further average figure showing amount of concentrated hypochlorite used per month per patron will be of interest. In spite of the fact that recommendations for the use of the hypochlorite provided for a minimum of approximately 1¼ gallons per month, our records at the end of the five-month period show that there could not have been more than an average ot .6 gallons used per month per patron. The above averages, therefore, must be interpreted in the light of the small amount of hypochlorite used.

Of equal significance in its bearing on the matter of use of hypochlorite for milking machine treatment is the comparison of data showing what might be termed the rate of improvement in quality of milk delivered by hypochlorite users and non-users. The data for these comparisons are obtained from the results of our follow-up system in the same manner as those obtained for similar comparisons between machine users and non-users. From approximately the same percentage of hypochlorite users and non-users who delivered milk in the Grade III class at the time of the regular monthly examination, (21.1% and 23.8% respectively) and from which from one to five additional samples were taken during the same month, it was found that 60.5% of the deliveries from hypochlorite users improved during a single month to sufficient extent to be raised in rating from the Grade III class to the Grade I or II class during the remainder of that month. On the other hand, only 34.4% of the non-hypochlorite users improved to the same degree during the month in which they were first placed in the Grade III class. This would seem to indicate that the use of hypochlorite for the attainment of improvement in quality of machine drawn milk is distinctly a matter which is up to the individual patron. Our observations and study of individual records, as well as data obtained experimentally, seem to leave no doubt as to the accuracy of this conclusion.

In concluding, I would endeavor to place a broader interpretation on the results already given than has been possible during the presentation of figures.

Under the daily conditions of production as the milk buyer sees them, it seems apparent that milking machine users as a group are prone to produce a lower quality of milk, bacteriologically speaking, than are the non-users. On the other hand, it is quite apparent that the use of milking machines does not by any means exclude the possibility of the production of a good quality of milk from the standpoint of bacterial numbers.

There is a remarkable parallelism in the variations in quality of milk produced by users and non-users when both groups are operating subject to the same general conditions, such as those imposed by climate, by the presence or absence of an efficient field improvement system, by rigid or lax grading methods at the receiving platform, and by the degree of development of a particular dairy section. Under the last named condition it is implied that educational work for the improvement of quality has been more extensive and of longer duration in highly developed sections than in undeveloped sections. It would seem, therefore, that the significant element determining the production of a good or poor quality of milk with the milking machine is a combination of two conditions which must be recognized as actually operative in the every day production of milk under practical conditions. These two essentials are: first, the degree of intelligence and constancy of effort in the matter of cleansing; second, the fact that the physical make-up of the milking machine intrinsically embodies certain features which are prone to involve elements of negative sanitation. Even with these two vital factors involved in the production of milk of low bacterial content with the milking machine it is gratifying to believe that there are no insurmountable barriers to the production of a uniformly good quality of milk with this comparatively recent addition to dairy equipment. It seeems, however, that this attainment can only be reached by the utilization, directly or indirectly, of all available agencies for the promotion of those things which will furnish individual users with information as to correct practices, and to impress upon them the necessity of constant application of such practices; and also by bringing to the attention of the milking machine manufacturer those conditions in which he, too, may have a certain responsibility.

"Luck lies in bed and wishes the postman would bring him the news of a legacy. Labor turns out at six o'clock and with busy pen or ringing hammer lays the foundation of a competence."

THE VALUE OF MILK

RUSSELL S. SMITH, *Market Milk Specialist,* U. S. Department of Agriculture, Washington, D. C.

The value of milk may be decided upon from several different points of view, but for the purpose of discussion this paper will consider one viewpoint, namely, the commercial value of milk constituents.

As a secretion from the mammary glands of the cow milk has ever been a food for its own progeny, but no one seems to know just when or under what circumstances milk from the cow came to be used by the human family.

We know that as a result of selection and intensive breeding cows gradually gave more and more milk and that humans have used more as it became available.

The Bureau of Census figures show that the value of dairy products of farms in the United States in 1919 was $1,481,462,091 as compared with $596,413,463, in 1909, representing an increase of $885,048,628 or 148.4 per cent.

In 1919 dairy products constituted 55.5 per cent of the total value of live stock products, as compared with 50.6 per cent in 1909. Dairy products comprise milk, cream, and butterfat sold, and butter and cheese made on farms. It does not include the value of livestock sold or slaughtered.

That the dairy business is on the increase must be granted, and when we realize that the fountain head of all dairy products is the milk itself we also must realize that upon its value depends the entire industry.

Beginning at the point of production, we know that the milk producers are not in the business for their health alone. They are out to make a living the same as other tillers of the soil and they have selected the dairy cow as a quick way of marketing the product of their fields. These same men also have an eye into the future if they are real dairymen.

They get back a certain per cent of the feed in the form of manure for fertilizing and humus and they select the best animals for breeding. About the only complaint which a dairyman has is that he is confined to his farm to milk his cows two or more times each day, that his product is highly perishable, and it becomes a total loss if he cannot get it to market in good condition. He has to be bothered by city pure food regulations and farm inspectors. He has to put up a supply of ice in the winter time. He may be troubled with sick cows or have his entire herd condemned because of disease. His chances of success are rather low in comparison with some other methods of farming not requiring confinement the year around.

It is little wonder that the milk producers are continually demanding their due share of the prices received for their product when it is sold to the public. Let us look for a moment at the various systems of payment of milk and study the basic principle of the entire system for determining value if any such basis exists.

SYSTEMS OF PAYMENT FOR MILK

The price paid for milk by the dealer to the producers and by the public to the dealer has always been a debating point and the cause of many strikes, disagreements, ill feeling and dissatisfaction in the dairy industry. Fair price commissions have been appointed to decide the question and some of these are still functioning, perhaps as harmony producing bodies more than anything else. While statistics on the cost of city handling of milk may be relatively easy to secure from the books of the milk distributing companies, it becomes a difficult problem to set the proper price that should be paid by the milk companies to the producer.

Milk has been purchased in various ways, a few of which are cited* to show the variety and the need for a workable system which can be applied everywhere.

*Milk Market Review, U. S. Bureau of Markets.

a. "Average 10 times the average of the quotations for cheese (style, "Twins," "Daisies," and "Young Americas") for the preceding month; with 5.2 times the average of the New York quotations for 92 score butter for the preceding month; plus an arbitrary differential which will vary each month."

b. "Price determined at the end of the month and will be dependent on the previous month's sales."

c. "Price based on Chicago butter quotations for "Extras." The price will be 80c per cwt. plus 6c above the current month's average. Chicago 92 score butter quotations for each pound of fat contained in 100 pounds of milk."

d. "Semi-monthly changes in prices are dependent upon the prevailing prices paid for butterfat in the territory during the current month, the changing market prices for shorts, and an agreed upon schedule of allowances for seasonal changes in market supply and costs of production. The average of butterfat prices paid by creameries for the preceding 15 days multiplied by the average butterfat test of milk plus the price of 30 pounds shorts (on a ton basis) to cover value of skim milk for feeding purposes, plus premium of 40 cents per cwt. of whole milk for extra costs of producing good quality of market milk, plus or minus the seasonal allowances to encourage more uniform production. Surplus over 20% of contract will be paid for on butterfat basis only. Failing by 20% to deliver quantity called for by contract calls for 5 cents reduction per pound of butterfat."

e. "Price bases on milk testing 4% butterfat. In case of milk testing less than 4% butterfat, the quantity of excess skim milk is determined by calculating the quantity of skim milk necessary to be extracted to raise (such) milk to 4% test. The weight of skim milk (or the non-fat content of whole milk) above the amount necessary for 4% milk, is determined by multiplying the deficient fat test by 25, the result being the weight of 4% milk (standardized). The price to be paid per pound of butterfat not in excess of 4%, and the allowance per cent of excess skim are agreed upon in advance of delivery of milk by the association. Excess fat (above 4%) is paid for at fourteen cents above the current month's San Francisco butter market quotations."

A study of these various systems of payment clearly shows the need of some fundamental system which can be used universally and which is not beset with the complications of present systems.

Fertilizers which are fed to crops are bought and paid for on a basis of their chemical analysis. Stock food is also bought and paid for on a basis of its chemical composition. Since fertilizers are used for producing stock food and the food is fed to cows in order to secure their milk it is logical to sell this product on a chemical basis. Other factors, such as its perishable nature, its digestibility, its growth producing elements and its healthfulness must be considered when comparisons with other food are made. The fundamental basis of payment to the producer of milk should be essentially the same.

The Babcock Test for butterfat caused the adoption of a system whereby an accurate fat content became the basis of payment. As a result of this system many have come to believe that there is nothing in milk of value after the fat is removed. Needless to say that the skim milk which has been allowed to go to waste in so many instances has been to the discredit of the dairy industry, especially as we learn of the starving people of foreign lands and of our efforts to assist them.

Surplus milk, or rather surplus skim milk, seems to be a common problem in many milk plants during certain seasons of the year and it is a common occurrence to see the skim milk going to waste. This should not be.

STANDARDIZING

Since standardization of milk has become a necessity in so many cities because of the varying composition of milk received from producers it seems only good logic to handle the problem of surplus by standardizing, and a study of all of the factors involved leads to the conclusion that a radical change in the present wasteful system of marketing milk and payment for the same is inevitable.

Standardization seems to be a necessity because of the protection it gives the dealer and the assurance it gives the consumer that he is receiving milk equal to the standard required by law. There may be logical arguments against standardization, but the fact will remain that milk dealers are required by law to sell milk having a certain minimum composition. If they fail to do this they break the law and their business will suffer. It may be that some city dealers receive milk from producers which does not vary in composition from time to time and which can be sold to the public without any change. It may also be true that some dealers can so regulate their supply as to avoid a surplus without shutting off milk from some of their producers, but these are exceptions to the general prevailing conditions.

Attempts have been made and are still being made to get milk producers to breed their animals so they will freshen during a season when milk is scarce, but this is a slow process and its effect on surplus has been difficult to record. The season of surplus always means less money for the producer because of the fact that the milk dealers are unable to utilize the extra milk, cream or skim milk in such a way as to bring prices equal to milk prices.

Milk dealers have certain limitations depending on seasonal demands, and these limitations also reflect back to the producer. At nearly every milk plant where standardization is practiced the requirement of milk constituents is known from day to day. Just so much cream of a certain percentage fat and just so much skim milk is required to maintain a standard product for the trade and for such by-products as can be made and marketed with profit.

Since only certain quantities of milk constituents are wanted and since all constituents over the quantity that can be used to advantage constitute a surplus it would seem logical to keep the surplus on the farm, at the point of production and utilize it there where returns would be greatest. Aside from gaining the full value of the constituents where they will do the most good, the cost of containers, cost of labor in handling, cost of shipping, and the cost of returning empty containers is avoided.

Standardization of milk on the farm previous to shipping it to the city seems to be the logical solution of the ever increasing and perplexing problem of surplus and the consequent low price the producer receives as a result of surplus. About the only extra equipment necessary on the farm for this purpose would be a cream separator.

Milk dealers, knowing the quantity of milk constituents desired, can readily figure the composition of milk, in regard to fat and solids, that could be sent by their milk producers in order that surplus in the city plants could be kept at a minimum and the price to the producer kept at the maximum point. Why should milk producers send skim milk into the city when the city dealer has no use for it and when the price for the whole milk becomes reduced because of it?

By sending in milk with a fat content of 5, 6, 8, or 10 per cent as desired by monthly contract with the city dealer, he could save the surplus skim milk on the farm and receive a maximum price for that which he ships. Some of the milk would be separated when it arrived at the city plants as it is now separated in order to furnish the necessary component parts for standardizing or adjusting the milk to the proper percentage of fat.

In the process of separating the milk at the point of production the milk would of course be clarified. After it is standardized it would have to be cooled and otherwise handled the same as if it were whole milk; the only difference would be in its composition—some of the skim milk being kept on the farm for calf or hog feeding rather than being sent to a market which does not want it.

Standardization on the farm would insure definite and maximum prices for the product.

Standardization would not mean that the city consumer would receive less food value in the milk delivered to him. In some instances he would actually receive more food value than that which would exist in normal whole milk. *It has been shown that if milk from the cows whose butterfat percentage was over 3.8 per cent were modified by the extraction of butterfat to a percentage of 3.8 per cent, the purchaser would receive a higher percentage of solids-not-fat in the milk than if the milk were of 3.8 per cent to start with.

When we consider that in the "solids other than fat" are contained all the high-priced, hard-to-secure elements, the protein, and that the fat is comparatively cheaply and easily produced it seems that the buying of milk on its butterfat test alone would not be fair.

The usual method of determining the money value of skim milk is to compare its feeding value with corn when the skim milk is fed to fattening pigs, but it is recognized that for bone and muscle building, especially for young pigs and brood sows, its value is much higher than is stated.

The rules usually followed for finding the money value of skim milk are as follows:

†a. To find the value of 100 lbs. of skim milk when fed

*Maine Station Bulletin 299.
†Feeds and Feeding—Henry and Morrison.

alone, multiply the market price of live hogs in cents per pound by 5; if fed in combination with corn and barley, multiply by 6.

*b. The value of 100 lbs. of skim milk when fed along with corn to fattening hogs is half the market price of corn per bushel.

It will be noted that the value is determined by feeding the skim milk to fattening pigs. When we realize that skim milk has a very narrow nutritive ratio, perhaps of 1 to 1.5, we become convinced that as a fattening ration it would hardly be desirable when fed alone.

Unfortunately there seems to be no direct way of measuring the bone and muscle building value in the skim milk, but it cannot be doubted that such a value exists.

In absence of a definite system for determining values of the constituents present in milk the following plan has been outlined and it is submitted with some degree of apprehension because of the possible criticism which it may bring. However, if we are to progress some must venture in order that others may discuss and perfect that which is worthy of perfection.

EQUITABLE VALUE OF MILK CONSTITUENTS

In determining equitable values for milk of different tests of fat and total solids, the highest market value of each of the constituents should be allowed. Cost of manufacturing should not enter into the determination of value because of the fact that such cost might be in excess of the value of the raw material.

Butterfat.

The butterfat in milk can be sold in the form of sweet cream, and as is usually the case, the price received for the butterfat in the sweet cream and in the cream on the milk is about the same. For example, if 20 per cent cream sells for 70 cents a quart, the butterfat, 20 pounds in 100 pounds of cream, would be worth about $1.75 per pound.

*Feeds and Feeding—Henry and Morrison.

In one quart of 3 per cent milk there would be .06 pounds of butterfat and at $1.75 per pound for the fat the milk would be worth 10½ cents per quart when the butterfat alone is considered.

In 100 pounds of 3 per cent milk there would be 3 pounds of butterfat. At $1.75 per pound for the fat the value of the milk would be $5.25 per hundred weight when butterfat alone is considered. At a wholesale price for sweet cream of 40 cents per quart, the butterfat (20 pounds) in 100 pounds of 20 per cent cream would be worth about $1.00 per pound. At this price for butterfat, milk containing 3 per cent fat would have a value of 6 cents a quart when the fat alone was considered.

No matter what value is placed on the butterfat in the sweet cream, a corresponding value for the butterfat in the whole milk can be determined. This value would be logical because of the fact that the butterfat in the whole milk is in a sweet condition the same as the sweet cream. If the milk was sour then, sweet cream value should not be considered but rather a value corresponding to butterfat in butter could well be considered as equitable.

Protein.

Skim milk contains all the albumin, sugar, salts, and other valuable parts of milk except the butterfat.

The principal way of marketing the protein in cow's milk other than in the fluid skim milk or cultured milk is in the form of casein, albumin, skim milk cheese or cottage cheese. The quickest and least expensive of these methods seems to be in making cottage cheese.

When cottage cheese sells for 5 cents a pound at wholesale, the value of the protein contained in 100 pounds of cottage cheese would be $.23 per pound.

Applying this value to the protein in 100 pounds of skim milk (3.4 pounds of protein at 23 cents per pound), we have 78 cents as the value of protein.

This value seems to disagree with the value secured when the rules are followed for determining the money value of skim milk, when it is fed for fattening pigs. According to rule "a," when live hogs are worth 5 cents per pound each 100 pounds of skim milk is worth 25 cents when fed alone and 30 cents when fed with corn or barley meal. The value of the protein in the 100 pounds of skim milk would be 7 cents, as compared with 23 cents a pound if computed on the cottage cheese wholesale price basis.

No one will deny that some value higher than the feeding value to fattening hogs should be placed on the protein contained in skim milk. While the cottage cheese value may be high it more nearly represents the value of protein than does the feeding method.

Milk Sugar.

The cost of extracting milk sugar from milk may influence its value. The uses which can be made of milk sugar are limited and therefore there is no definite constant market for this product which is found only in milk.

Without discussing the uses of milk sugar and the value of it when so used, it seems logical and fair to place a value on it equal at least to a low wholesale price received for cane sugar. When consumed as a constituent of fluid milk the body derives a benefit similar to the benefit gained by consuming cane sugar.

In 100 pounds of skim milk there would be approximately 5.1 pounds of carbohydrate in the form of milk sugar. At 4 cents a pound, which would no doubt be equivalent to a low wholesale price for cane sugar, the value of the milk sugar in 100 pounds of skim milk would be 20.4 cents.

Ash.

The ash or the mineral part of milk exists to the amount of about 0.75 per cent and consists largely of the chlorids and phosphates of sodium, potassium, magnesium and calcium. These constituents may not be present in sufficient quantity to allow a comparative value to be given to each but there is no doubt that these elements in milk are valuable for their growth and bone building properties.

Considering the values of the principal constituents of milk together we may arrive at some basis for value of the fluid milk. Surely fluid milk should not be considered of less value than the sum of the equitable values of its constituents and especially as other favorable factors can well be emphasized when considering the true value of milk.

The following table shows a suggested system of determining the value of milk when a value has been given to the milk constituents in milk containing 3 per cent fat.

Allowance.	*Quotation*	*Value per Pound.*	*Number Pounds in 100 lbs. Milk.*	*Total Value in 100 lbs. Milk.*
Allowance for Butter Fat..	Wholesale market quotation for sweet cream	$1.00	3	$3.00
	40 cents a quart for 20% cream			
Allowance for Protein.....	Wholesale market quotation for cottage cheese. . . .		3.1	.71
	5 cents a pound	.23		
Allowance for Sugar......	Wholesale market quotation for cane sugar		4.25	.17
	4 cents a pound	.04		
				$3.88

NOTE.—Quotations in spaces represent low wholesale current market prices. These can be changed to conform with current prices as the market changes.

The question may arise as to how it may be possible for a layman to determine the percentage of protein and sugar in milk for the purpose of determining the equitable values in the preceding suggestion. The butterfat would, of course, be determined by the Babcock or other tests and the solids not fat could be calculated by formula after the specific gravity of the milk was determined by the lactometer.

A previous paper* showed a simple method of determining the full value of milk of varying compositions when the analysis is limited to tests for butterfat and for total solids as determined in routine practice. In this paper it was concluded that 27 per cent of the total solids in milk would represent the protein content and that 37 per cent of the total solids would represent the sugar content. These percentages would cover the seasonal and lactational variations.

By applying the suggested system to a series of milk tests when the milk is of known composition the value of the milk can be noted.

The table on page 107 shows the value of 100 pounds of milk of known composition when an equitable value has been given to each of the major constituents, viz., fat, protein, and sugar.

The steps for finding the equitable value of constituents in 100 pounds of milk may be summarized as follows:

1. Butterfat Content. (Babcock Test.)
2. Total Solids. (Lactometer, thermometer and Formula $\frac{1}{4}L+1.2$ B. F.=Total Solids.)
3. Protein Content. (27 per cent of Total Solids.)
4. Sugar Content. (37 per cent of Total Solids.)
5. Multiply number pounds of each respective constituent in 100 pounds milk by the current wholesale market quotation per pound for:

   Fat in sweet cream, Protein in cottage cheese, Sugar as cane sugar.
6. Add the resulting figures to find the total equitable value of the milk constituents.

CONCLUSION

The present systems of paying for milk have little or no consideration for the chemical constituents of which the milk

*"Calculation of the Nutritive Value of Milk from Routine Tests." By Russell S. Smith. Sixth Annual Report of International Association of Dairy and Milk Inspectors, 1917, pp. 185-189.

Fat.	*S.N.F.*	*Total Solids.*	*Pounds Fat in 100 lbs. Milk.*	*Value per Pound for Butter Fat.*	*Total Fat Value.*	*Pounds Protein in 100 lbs. Milk.*	*Value per Pound for Protein.*	*Total Protein Value.*	*Pounds Sugar in 100 lbs. Milk.*	*Value per Pound Sugar.*	*Total Sugar Value.*	*Total Value.*
3.0	8.50	11.50	3.0	*1.00	3.00	3.10	*$0.23	.71	4.25	*$0.04	.170	3.88
3.2	8.04	11.26	3.2	"	3.20	3.04	"	.70	4.17	"	.171	4.01
3.4	8.33	11.73	3.4	"	3.40	3.17	"	.73	4.34	"	.174	4.30
3.6	8.47	12.07	3.6	"	3.60	3.26	"	.75	4.47	"	.179	4.53
3.8	8.31	12.11	3.8	"	3.80	3.27	"	.75	4.48	"	.179	4.73
4.0	8.30	12.30	4.0	"	4.00	3.32	"	.76	4.55	"	.182	4.94
4.2	8.84	13.04	4.2	"	4.20	3.52	"	.81	4.82	"	.193	5.20
4.4	8.65	13.15	4.4	"	4.40	3.55	"	.82	4.87	"	.195	5.41
4.6	8.82	13.42	4.6	"	4.60	3.62	"	.83	4.96	"	.198	5.63
4.8	8.71	13.51	4.8	"	4.80	3.65	"	.84	5.00	"	.200	5.84
5.0	8.55	13.55	5.0	"	5.00	3.66	"	.84	5.01	"	.200	6.04
5.2	8.99	14.19	5.2	"	5.20	3.83	"	.88	5.25	"	.218	6.30
0.3**	...	....	..		...	3.40	"	.78	5.10	"	.204	.98

*NOTE.—A commercial value based on a low wholesale current market price for a commodity containing, as its principal ingredient, this constituent of milk. This value may be changed as the wholesale price of the commodity may change.

**Skim milk.

is composed and which make it of particular value as a food.

Fertilizers and stock foods are usually sold to the milk producer according to their chemical composition and these are used indirectly and directly for the production of milk.

The butterfat content of milk has become the popular common basis of payment for milk, thereby belittling the true value of other valuable constituents and of milk as a whole.

The money value of skim milk, which contains the valuable constituents, protein, milk sugar, and ash, with their growth giving properties, has usually been determined by feeding the skim milk to hogs for fattening purposes. Food rich in protein is not a fattening ration when fed alone, and for this reason the value of skim milk fed to fattening hogs should not be considered as its true value to the human.

Standardization of milk on the farm would result in greater shipping economy, in keeping the quantity of surplus milk at the city distributer's at a minimum, and in higher and more stable prices for the product shipped.

Standardization would result in the shipment to the city of definite quantities of milk constituents in fluid form according to the current demand. Seasonal fluctuations in prices to producers due to surplus skim milk would be a thing of the past. The practice of allowing the skim milk to go to waste, which has been a disgrace to the dairy industry for so long a time, would be stopped.

A system of payment for milk, having for its definite basis the quantity of milk constituents contained in the milk, is desirable.

The placing of an equitable value on the three principal milk constituents, fat, proteid and sugar, and the determination of the quantity of these constituents in milk of varying compositions leads to a system whereby the true value of milk can be more nearly computed than under any existing system.

While there may be arguments against such a system of value determination there are logical arguments in its favor, which might not have been considered heretofore. With this thought in mind the writer has presented the subject for consideration with the hope that constructive criticism will result.

Milk is the only universal human food without which mankind can not exist and its supply in adequate quantity affords one of the big economic problems of the day. Any effort which can assist in the slightest degree in solving the problem of surplus and of distribution and of placing an equitable value on this most important of foods, must be made if progress is to result.

"There is no substitute for any dairy product."

NEW YORK'S MILK SUPPLY AND ITS CONTROL

OLE SALTHE, *Director of the Bureau of Food and Drugs,*
Department of Health, New York City

In order that the volume of the milk flowing into New York City may be thoroughly appreciated, the following facts should be stated:

During the peak of the season, New York City received 2,646,550 quarts daily.

(These figures are not approximated, but are actual receipts as taken from the way-bills at the various railroad terminals, and were collected by Inspectors of the Bureau of Food & Drugs.)

Basing my opinion upon actual surveys made of the amount of milk received, I would state that the average daily receipt of fluid milk in New York City for 1921 was 2,300,000 quarts.

The population of New York City at present is 5,751,859, or a per capita consumption of a little less than one pint.

This milk comes from New York, New Jersey, Vermont, Pennsylvania, Massachusetts, Connecticut and Canada.

The milk is produced by 450,000 cows—approximately 45,000 dairies.

It is delivered by the producer to 709 creameries or gathering stations located in these various states, 408 of which are operated as pasteurizing plants.

The milk is transported by 11 different railroads requiring 32 trains consisting of 259 cars to bring it to the City Line. It is received at 11 terminals located in the City or immediately adjoining the City.

It is handled by 343 distributing depots, 39 of which are operated as pasteurizing plants.

It takes 5500 wagons to distribute this milk, and in addition, this milk is sold in 15,000 stores and 10,000 restaurants.

The shortest haul for our milk is 44 miles and the longest haul is 450 miles.

The volume of one of the larger pasteurizing plants in the City is 84,000 quarts daily.

There are approximately one-quarter of a million people employed in producing, handling and delivering milk to the consumers of this City and the daily milk bill of New York City is more than $250,000.

The problem before the health officials of this City is to see that this enormous volume of milk, handled by so many persons, reaches the consumer in a safe and wholesome condition and is available to the consumer at a reasonable price.

Because of its great volume and also because of the fact that there are three uses for milk:—(1) for infant feeding, (2) for adult feeding, and (3) for cooking and manufacturing purposes—the Board of Health has established the grading of its milk supply. In other words, it has classified the milk supply into three classes:—

Grade "A"—Milk safe for infant feeding;
Grade "B"—Milk safe for adult feeding;
Grade "C"—Milk to be used for cooking and manufacturing purposes.

There are approximately 255,000 quarts of Grade "A" Milk sold in the City daily—55,000 quarts of which is Certified or Grade "A" Raw, the balance of the supply being sold as Grade "B," there being little or no demand for Grade "C." The Health Department exercises control over this supply mainly through a permit system.

Before a person can sell milk in the City of New York, he must first obtain a permit from the Board of Health. In order to obtain this permit, he must inform the Board what the source of his supply is and where he will handle same. The Board regulations prescribe that no dealer selling milk in the City of New York can receive milk from other than those sources that have been approved by the Board. In order to obtain such approval, the person shipping milk to

New York City must submit to an inspection by representatives of the Department and it must be shown that his milk conforms to the regulations for the various grades of milk.

It may be interesting to note that the Board of Health has the power to adopt rules and regulations governing the conduct of the milk business in so far as they relate to the protection of life and health. Any such regulation adopted by the Board, after it is filed with the City Clerk, becomes a law; and violation of such a regulation is punishable as a misdemeanor with a penalty of $500 fine, a year in prison, or both.

The Board of Health has adopted 162 regulations governing the production, handling and sale of milk. Without going into details and taking up each regulation separately, the principal regulations will be pointed out:

As has previously been stated, practically all of the milk sold in the City—with the exception of about 55,000 quarts, a little less than one per cent of the total supply—is pasteurized. The Department's regulations require the pasteurization of all milk excepting Certified Milk and milk which is produced under conditions similar to those required for Certified Milk. The Board of Health requires the pasteurization of milk because it believes that this is the only method of safeguarding its milk supply. The reduction in milk-borne diseases since pasteurization was made compulsory justifies this attitude.

When the regulations requiring the pasteurization of milk were first adopted, the Board very carefully called attention to the fact that pasteurization was not to be a cloak for milk produced under unclean conditions, and in order to see that this was actually so, the Board prescribed definite standards and regulations before milk could be pasteurized. These regulations are enforced.

The regulations of the Department do not permit the pasteurization of unclean milk even though it is to be sold under the designation "Grade C," for cooking and manufacturing purposes.

The grading of milk is based upon the conditions under which the milk is produced and handled, more stringent regulations and standards being provided for "Grade A" than for "Grade B."

There are 2,545 dairies producing milk to be sold as Grade A Milk, 35 producing Grade "A" Certified, and 10 producing Grade "A" Raw. The other 2,500 dairies produce raw milk which is to be pasteurized and sold under the designation "Grade A Pasteurized."

These dairies are inspected by a representative of the Department once every three (3) months and careful attention is given to conditions under which the milk is produced and handled; the essentials which are stressed being the methods of milking, sterilization of containers, prompt cooling and prompt delivery to the creamery or gathering station.

The milk is further sampled for bacteriological examination, once every month, samples being taken of the mixed milk before pasteurization. Where this milk is pasteurized in the country, the bacterial standards are 100,000 bacteria per c. c. Where it is pasteurized in the City, the standard is 200,000. Practically all of this milk is pasteurized in the country.

Where it is found that the bacteria content is repeatedly above the standard, the milk is degraded and the producer is notified that his milk cannot be sold as "Grade A, Pasteurized."

Inspections are made of Grade "A" Plants at least once each month and the product shipped from these plants is sampled for bacteriological examination at least once every week.

Where the bacterial content is found to be repeatedly above the standard, the milk is degraded and the dealer is notified that his supply cannot be sold as "Grade A."

Because of the fact that this milk is guaranteed to the public as safe for infant feeding, the Department gives special attention to the enforcement of its regulations, and they are enforced to the letter.

As to Grade "B" Milk, not all produced is acceptable for pasteurization and sale as "Grade B."

The regulations of the Department prescribe that the dealer shipping Grade "B" Milk must make an inspection of the dairies producing this milk and there must be on file, at each creamery, a report of such inspection.

The Department has not the facilities to inspect all of these dairies; but at intervals it checks the reports of these inspections to see whether or not the dealer is making these inspections in good faith. Where our inspectors find conditions that are not reported by the dealer, the dealer is immediately warned that his inspection service is unsatisfactory and that, unless a satisfactory inspection is made, his product will be excluded from the City and possibly his permit revoked.

Bacteriological samples of milk to be pasteurized and sold as "Grade B" are also taken and where the milk is found to be above the standard, the milk is excluded.

Monthly inspections are made of all Grade "B" Pasteurizing Plants and samples of the finished product are taken at least once every two weeks.

Specific regulations governing the conduct and maintenance of creameries and pasteurizing plants have been adopted by the Board of Health and where any of such premises are found not to conform, the creamery or pasteurizing plant is excluded from shipment in New York City.

The Department's regulations require that milk must be heated to a temperature of 142° Fahrenheit and held thereat for thirty (30) minutes.

Another important regulation which is enforced by the Department of Health is that all persons employed in the production of raw milk, to be sold as such; all persons employed in the pasteurizing plants; and all persons engaged in the delivery of milk to the consumer must submit to a physical examination—and where it is found that any such person is suffering from communicable or infectious disease, he or she is immediately excluded from such employment.

Inasmuch as there is no practical method of determining, by analysis, whether or not milk has been properly pasteurized, the Department requires temperature recording devices to be placed on the pasteurizers and holders. While this should act as a safeguard to show that all milk has been properly pasteurized, unfortunately these charts can be faked and the Department has found them to be faked.

It therefore seems that, inasmuch as there is no food which is so essential and so vital to children and inasmuch as it has been definitely shown that the proper pasteurization of milk is one of the biggest factors in safeguarding the milk, some further precaution should be taken to see that all milk is properly pasteurized and that no unscrupulous dealer or employee of a dealer will take advantage of the absence of an inspector and hurry through the process of pasteurization.

In the larger meat establishments, the Government provides that the Inspector be on duty at all times. While there is no question as to the value and importance of this, it seems to me that the protection of the milk supply is equally as important and that some arrangements should be made in order that an official would be stationed at all times at each pasteurizing plant during its operation. In this way the Department could be assured that the milk sold in the City as pasteurized would actually have been heated to the proper temperature and held for the required length of time.

In conclusion, New York City owes the excellent quality of its milk supply to the policy of the Health Department in centering its activities on the following essentials:

(a) Healthy cows.

(b) Clean handling of milk during production, emphasizing the following:

1. Clean milking.
2. Sterilization.
3. Prompt cooling.
4. Prompt delivery.

(c) Pasteurization of clean milk.

(d) Physical examination of employees in pasteurizing plants, and all other employees who handle the milk after pasteurization.

(e) Rigid enforcement of all its regulations concerning the quality of the milk.

DISCUSSION

Question. ....

Mr. Salthe: Whatever milk is sold during the strike has been milk of good quality. Every available man was put to work. Dealers delivered to stores, people secured milk from stores. Storekeepers cooperated by going after milk. Larger wagons under police protection sold milk direct from the wagons. As the striking wagon drivers kept their books, the dealers were without records or customers' addresses.

Question. ....

Mr. Salthe: Permits for Grade A milk only are issued to Grade A milk plants.

Question: How is Grade A milk insured to the consumer?

Mr. Salthe: We stand behind the label. People can buy Grade B, but they do so on their own account.

"Luck is ever waiting for something to turn up. Labor, with keen eyes and strong purpose, will turn up something."

MILK AND ITS RELATION TO HUMAN WELFARE

PROF. H. E. VAN NORMAN, President, World's Dairy Congress, and President of the National Dairy Association, addressed the Association in part as follows:

The discovery of the vital part milk fats play in human health is a by-product of animal research. Dr. McCollum went to the University of Wisconsin to study a question which might be stated thus: Is a pound of protein from any common cattle food equal to a pound of protein from any other cattle food? Encouraged by the preliminary results, but appalled by the expense necessary to secure large quantities of purified foods for a considerable number of cattle and by the necessity of waiting four years from conception to maturity in each experiment with a cow, Dr. McCollum began groping for a smaller animal whose food requirements could be met with less expense and whose life cycle was much shorter. He chose the rat.

It soon developed that rats would not grow and reproduce themselves in a normal manner on a theoretically balanced ration. Briefly, years of research involving the study of thousands of animals revealed the fact that they must eat that unknown something which it has been proven is found primarily in the creative cells of the plant life and in the vital organs of animals. It was also found that nature has endowed those animals which suckle their young with the power to store up in the fat of their milk that vital something which they procure from the leafy part of their food. It was a long, slow process that required much confirmatory evidence before the plain, bald fact could be stated without modification that the butterfat in cow's milk contains what some scientists call "vitamine" and what Dr. McCollum calls "unknown A," or "fat soluble A."

In a certain city, the health officer showed Dr. McCollum the records of the deaths in children's hospitals, and pointing to the head of the list, asked:

"Why should these hospitals be able to show no deaths in from three to seven years, while this hospital (pointing to the bottom of the list) shows a loss of twenty-five per cent of all the babies entering there within a year?"

Dr. McCollum replied:

"I don't know."

Investigation of the conditions in many of these hospitals showed excellent sanitary arrangements and efficient nurses. In one hospital, the study of the diet revealed abundant use of potatoes, rice, cereal breakfast food and muscle meats.

When asked about the use of vegetables, the superintendent said:

"They are very scarce and high."

He admitted that they used little butter and that they used sixteen quarts of milk a day for 300 children and fifteen nurses. It was not reported what part of the milk the nurses got.

In another hospital, where the annual enrollment was somewhere near the same, but where there had occurred no death in seven years, the conspicuous difference in the diet was the abundant use of milk products and leafy vegetables.

Dr. McCollum, in reporting these facts to me, drew no conclusions. He left it up to me. He has, in his addresses and in his books, given us numerous examples of existing conditions which all point to the fundamental fact that the absence of milk products in the diet of those too young to meet their needs from leafy vegetables, or from the vital organs of animals—such as liver, sweet breads, etc.—must be met by milk products. An examination by measuring of 55,000 children in the schools of Los Angeles showed that those who did not drink regularly at least a glass of milk a day were underweight and below their fellows in stature. A further study of the data showed that the milk-drinking children were younger in every grade than were the non-milk-drinking children. While the difference was naturally smaller in the first grades, it was found that the eighth grade children who drank milk regularly finished that grade two years younger on the average than the non-milk-drinking children. It has been suggested that if Los Angeles would furnish at least a glass of milk a day to each of the children who do not get milk at home, it could enable them to complete their schooling at the same age as the milk-drinking children and save in the cost of school buildings much more than would pay for the milk required.

An interesting discovery is that mal-nutrition—revealing itself in rickets, bow-legs, pale faces, peculiar head shapes, etc.—is not confined to the slum districts, "back of the yards," or in other poor sections of our cities. The fashionable sections, like the "Gold Coast," have children who are walking advertisements of their insufficient use of milk products. No greater service can be rendered to parents, practically all of whom are eager to give their children what they need, than to furnish information to those who are mistakenly depriving their children of a needed, wholesome product—not because of its cost, but because of their own ignorance. No mother will knowingly deprive her children of twelve or fifteen cents' worth of milk a day, while giving them eighteen or twenty cents' worth of something else which will not supply the same needs.

DISCUSSION

Mr. Kilbourne: Experiments by Hess show vitamines destroyed by pasteurization if exposed to air, while in pasteurized milk not so exposed the vitamines were retained.

Mr. Munn: The vitamines in milk are not impaired when pasteurization is properly performed, so McCollum says. He has also found that most of the creamery butter contains the essential vitamines.

Dr. Price: I would be very slow to accept a report of recent results of injury to milk as a result of proper pasteurization.

"Every fact that is learned becomes a key to other facts."

FILLED MILK

M. D. MUNN, *President,* National Dairy Council,
Chicago, Ill.

Mr. Munn said in part:

Ninety-one million dollars is required to pay New York's milk bill each year, and three billions of dollars represents the price paid by consumers for the milk consumed in the United States. Investigations indicate that twenty cents out of every one dollar expended by the American family for food is spent for milk and dairy products.

The National Dairy Council has been at work for several years to increase the use of milk through educational methods. During the past year we have given out 240,000 pamphlets describing the great value of milk as a part of our diet. Ninety-five per cent of this printed material has gone directly into the hands of the consumers.

Forty-two thousand school teachers have cooperated in an effort to get better results in the class room through the increased efficiency resulting from better nutrition. Funds for supplying milk to the public schools have in some cases been supplied by those who are interested in human welfare, and the general public is becoming interested and educated in the important part which milk has in the development of the child and human welfare.

What is filled milk? Filled milk is milk after the natural fats have been removed and cocoanut oil substituted for the milk fat. There are valuable elements in skim milk, casein, proteids, etc., but with the removal of the milk fat there is also removed the most valuable and essential principles, called vitamines.

If filled milk could be bought and sold in all cases for what it actually is, and with the full knowledge that the milk has been deprived of its most valuable part, then less damage would result. When, however, filled milk is sold even under label, it is not recognized in many cases, as has been proven by investigations which we have carried on in several cities. In Milwaukee 74 stores were visited, 35 of which were handling the filled milk in condensed form, and when condensed milk was called for by a customer, 34 out of 35 of these stores handed out a can which was sold to the unsuspecting consumer as condensed milk and was represented to be just as good. In Philadelphia, out of 200 stores visited, 72 per cent of the storekeepers when questioned gave an answer that would convey the impression that filled milk was good condensed milk. In Chicago, a majority sold filled milk as a product equal if not better in quality than condensed milk.

In many if not in most cases the profits the dealers make in selling filled milk are larger than those made in selling condensed milk, and its sale is urged either through ignorance or in a deliberate attempt to increase profits.

It is a crime to sell an imitation product for the real product, notwithstanding the manufacturers say they can comply with the pure food law by labeling the product. Even if the storekeeper told the truth, a large percentage of the people buying erroneously believe that they are getting something just as good as whole milk. To meet this situation, several states have passed legislation to govern the manufacture or sale of filled milk. Two bills have been introduced into Congress. One is known as the Fordney bill, and the other as the Voight bill. The Voight bill prohibits the sale or shipment of filled milk in interstate commerce. The Fordney bill recognizes the right to manufacture and distribute filled milk, but places a tax on the product that will tend to regulate its manufacture and sale. There is no question about the constitutionality of the Fordney bill, as being a revenue measure it is subject to amendment and change. A license fee of $100 for a jobber and $25 for a dealer are suggested.

All places of business where such milk is sold or used should be required to display signs telling the public what they sell. Personally I believe we should have a law which will practically prohibit its use. Thirty years ago we had filled cheese. That nearly ruined the reputation of Wisconsin cheese. Wisconsin then prohibited its manufacture and sale within the state, and Congress passed a law taxing filled cheese ten cents per pound. Congress after much delay imposed a tax on oleomargarine, or imitation butter, but that has not stopped its manufacture and sale, and those products are regularly sold and advertised sometimes as butter substitutes, and churns, dairy maids, or other illustrations suggestive of the dairy industry are used. Billboards with deceptive advertising which can only be read in part by ordinary observers are also used in advertising oleomargarine. Its manufacturers use milk for flavoring and to destroy the effects of cocoanut oil.

To protect the public and promote child welfare it is necessary to have legislation of this kind. I hope it may become as impossible to sell filled milk as it is to sell poison. Pretty strong, but all depends upon the vitality of the people, and anything that injures that vitality strikes at the root of our national existence.

Much has been said about food value of milk and dairy products. McCollum has made it clear, and the results of his work show that a very large percentage of our children are suffering from lack of proper nutrition. Their bones and teeth are improperly developed, as the result of defective diet. In Edinburgh 78 per cent of the children are defective, due to improper diet or malnutrition. The most dangerous form is where it attacks the ribs and bones as a result of the lack of proper bone-building material in the food. The internal organs are also affected by such a deficiency.

Unless this country is brought to a realization of the deficiency of diet, we in a few more generations will be suffering material physical decay. In England a thorough investigation showed a condition like that in Edinburgh, due in a large measure to the fact that children are not getting the proper amount of milk and its products. We do not want that condition in this country. We have the cows, but we need the knowledge to use their products for the proper maintenance of the race. We have the means for developing physical and mental character necessary for leadership. Do not let ignorance regarding the proper nutrition of our children retard their proper development or threaten the safety of their country.

DISCUSSION

Mr. Kilbourne: Would the danger from feeding filled milk be lessened if the milk was labeled "Not fit for infant feeding?"

Mr. Munn: I think not. Many cannot read the label at all. Others would take the storekeeper's word for it. Selfishness and dishonesty cannot be overcome by legislation. The filled product is not the kind adults would use. If most of the fat soluble vitamine is destroyed, you are taking away a necessary food requirement.

Dr. Smith: How about the value of condensed skimmed milk?

Mr. Munn: I believe we should not permit the sale of condensed skim milk. In the South, as elsewhere, the people should get the same vital elements.

President Roadhouse: California requires artificial coloring. Storekeepers promote the sale of imitation milk because of larger profits.

"A milk that is both supervised and pasteurized is the only satisfactory solution of the milk problem."

COOPERATION IN DAIRY INSPECTION

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

The thought that was intended to be conveyed to you is fairly well explained in the title of this paper, but I just want to elaborate for a few moments on its possibilities.

The principle of cooperation is a very well established one at this day and age, and the fundamentals which govern any move of this kind are substantially a step in the right direction. We know that the hygienic qualities of milk depend very largely upon the conditions existing at the source of supply and an inspection at the dairy farm seems to be the most logical means of securing this information.

There is a valuable adjunct to this service, however, that should play a very important part in all dairy inspection; namely, the laboratory. This is really the eye of the dairy inspector watching the handling of the product when he is not present, and if used in the proper manner will give the inspector the information concerning the dairies at which his special attention should be directed. Many times we find a dairyman sincere in his efforts but overlooking some simple operation of sterilization or cooling, who may be put on the right path simply through the laboratory pointing out to him where the trouble lies. To accomplish this we are using very extensively the Breed or microscopic method of analyzing milk samples. This method you are all familiar with, but from our experience and after using this assistance over a period of years, we find that by its use we are materially assisting the dairyman as well as the inspector. Just as an example of this assistance, I would call your attention to a case where the product of one dairyman was very high in bacterial content. A very thorough inspection was made of the dairy premises, but nothing could be found to throw light on the subject. The microscope was brought into play and the utensils subjected to examination, which developed nothing; and finally the milk from each cow was analyzed, which revealed the fact that two cows were producing the objectionable product even though the udders were apparently normal. These cows were segregated and the trouble abruptly terminated.

Outside of the question of construction of dairy barns, and a suitable and abundant water supply for all dairy purposes, the essentials for a clean and wholesome supply of milk could be enumerated in a few words—a healthy, clean and comfortable cow, kept amid clean surroundings, milked in a cleanly manner into clean utensils and the milk at once cooled in a separate room away from contamination.

Probably one of the most important parts of dairy inspection is the health and condition of the dairy herd, mainly because milk is not only subject to contamination from outside sources, but may leave the udder in the condition of a dangerous product, the carrier of pathogenic or disease-producing bacteria. Taking tuberculosis as an example, it would be impractical from an economic standpoint to at once tuberculin test all of the cattle from which the product is sold in our cities. The loss would be too great and the shortage of milk too acute. Therefore, the physical examination by a competent and interested veterinarian seems to be the best substitute that we can find, and in the majority of cases tuberculosis of the udder (and this probably is the most important of the group) can be detected by a careful physical examination. But right here let me add, that no matter how thorough the inspection by the veterinarian, no matter how many drastic laws are passed by Federal, State and municipal health bodies, this disease or any other disease of the dairy cow cannot be eliminated except through a sincere desire by the dairyman to bring to light and rid his animals of those existing conditions.

Another of the more important diseases of cattle which make milk harmful to man is Mastitis, commonly called Garget, which from a differentiating standpoint can be divided into three heads; first, the catarrhal form, probably the most important because of the frequency with which it appears, and also because the milk may contain the causative bacteria some time before the disease is really noticed. Even the quality of the milk may not change to any appreciable extent, but small nodules may appear in the teat canal or cord-like growths extending the whole length of this canal, resulting in what is commonly known as "spider." Secondly, we have the parenchymatous type ushered in by the complete swelling with pain of one or more quarters. This can be detected after this disease is well set by the small flakes of casein ejected in the act of milking, and is also one of the most common forms. The milk usually contains a very excessive number of bacteria, many leucocytes and streptococci, even before the disease is manifest to the milker. In the making of low count milk this form of mastitis is very troublesome when we consider that even after the acute symptoms subside and the character of the milk apparently reaches normal, the milk may contain an unusually large number of bacteria and be the cause of throwing the whole mess in an inferior class. The third member of this group is called the interstitial variety and generally is caused by the entrance into the udders of bacteria through the agency of injuries, foreign bodies, etc. This form is more readily brought to our attention by reason of the cause. Practically all forms of mastitis generally run an acute course and the responsibility rests largely with the dairymen for its detection, except at times when the inspector or veterinarian is present, and in the larger herds, especially at certain seasons of the year, these cases are inevitable, as is also the inspector's absence. It is needless for us to say that a cow suffering from any form of mastitis should at once be segregated and treated and her milk should not become part of the daily mess.

There are many other diseases acute many times in their course, but the detection of which has to be left to the individual dairyman, and he must be taught to recognize the importance of any abnormal conditions so that at all times the milk for human consumption can be safeguarded.

In addition to the health of the cow, she must be kept clean, and as a chain is no stronger than its weakest link, it usually follows that unless we have an habitually clean dairyman we cannot have an habitually clean herd and stable.

It has been proven that clean cattle kept in a comfortable and clean stable will produce enough more milk to pay with interest the cost of the investment, and it is toward this end that we as dairy inspectors should direct our efforts.

A well whitewashed stable will generally be a clean stable because it forces a moral obligation on the dairyman, through example of what cleanliness stands for. Very few dairymen we find but what welcome a good job of whitewashing for not only does the lime whitewash make his stable clean, sweet-smelling and appear lighter, but the vermin, spiders, and different insects are eliminated to a large degree and by mixing a little disinfectant with the whitewash its value from this standpoint is increased. We have tried different methods of accomplishing a proper whitewashing job but after eliminating one after another feel that by furnishing a good whitewash pump and hiring someone in each locality to do the work, the most efficient work results. The cost is divided according to the length of time at each barn.

The utensils, too, must be scrupulously clean,—the construction of the pails, whether covered or uncovered, having very little bearing on the case. Again, it is the handling of the utensils rather than the construction that is one of the most important facts causing the difference between high and low count milk. The advantages of a covered pail from a bacteria standpoint may be somewhat neutralized by the lack of proper cleaning beneath the hood. On several occasions we have had cases of high counts in a raw product from a dairyman using hooded pails, only to find after a careful search that the attention to the under surface of the hood had not been properly carried out. This is no criticism of the hooded pail, but we must keep in mind the human element in connection with our inspection toward simplifying as far as possible the operations the dairymen must carry out.

A suitable room should be provided sufficiently distant from the stable to escape the odor, but not so far that the milk will not be strained in this room, having as its principal equipment a covered concrete or metal vat of sufficient depth so that the cold water may come to the neck of the can. The cover for the vat serves two purposes; it insures the milk against tampering and conserves the ice supply. This room should be properly lighted and ventilated and provided with racks on which the cans can be inverted to insure a dry interior. A tight, sound floor which can be properly cleaned and drained is also an essential.

During the Great War and due largely to the lack of man power both from an inspection as well as the dairy standpoint, dairy conditions were not maintained to the maximum of efficiency. The great slogan was production, and dairymen as well as all producers rallied to that cry, but even with the wonderful results attained in that period, the production attained in the past season was practically an increase of 44 pounds per dairy in August over the year previous. Now comes the reconstruction period, when every resource of the dairy inspector is brought in play. Inspection brings a representative of the health authorities into personal contact with the dairyman, a condition which should make for a better understanding and more sympathy on both sides.

Having in mind the constructive dairy inspection of a number of men, representing health bodies, how they through the medium of personal contact were instrumental in having milk and ice houses provided, light and ventilation installed, interiors bettered and by a man to man conversation arousing in the dairyman's mind a sympathy for the ultimate consumer's problems, I am wondering if we are not widening instead of narrowing the gulf of mutual understanding that is so necessary if we are to accomplish the ends expected of us; namely, a better and safer product. True, we have it in our power to disqualify a dairyman's shipment and when this is done we do not receive this milk, though this dairyman can generally get his premises again in condition to receive our approval, but for each day that we are present at his place there are hundreds of days that we are not there.

The average dairyman will do his best to make a good product, is very susceptible to encouragement but equally as easily discouraged. He has to be educated by patient endeavor and when properly approached will produce the desired results.

A teacher in an agricultural college was once asked how much money a man should make on a certain piece of land if worked under certain conditions and very promptly said, "Show me the man," and this very aptly applies to dairy inspection. To succeed as inspectors we must grow a real desire in the mind of the dairyman to produce the very best article and to my mind in order to do this he must know the fundamentals governing the growth of bacteria and its influence on the quality of milk. Let us not only point out to him where he is wrong but how to make the wrong right. The human element is present in dairy inspection probably to a larger extent than in most fields, and it rests largely with the dairy inspector whether there is real progress made which will be reflected in an every-day effort or whether the conditions at the dairy are gained by sporadic efforts to meet an inspection at a certain time. This is the field for real cooperation, because when all is said and done it rests wholly with the individual dairyman and his attitude toward dairy inspection whether we are to achieve success or not.

"Men who lie down on the job will soon be lying about the job."

MILK DISTRIBUTION BY PRODUCERS' COOPERATIVE ASSOCIATIONS

C. E. CLEMENT, *Market Milk Specialist*, U. S. Department of Agriculture, Washington, D. C.

In general, milk producers' associations may be classified into two main groups.

1. Associations which function as agents for the producers in bargaining with the dealers, and in collecting from dealers and remitting to the producers for milk shipped. In some cases country plants are owned and operated by these associations and they often take care of the surplus.

2. Associations which function as distributing agencies for the local milk producers. These associations have central distributing plants and dispose of the milk either direct to the consumer or to dealers. It is this second group of milk producers' associations that are considered in this paper. A questionnaire was sent from the Dairy Division, U. S. Department of Agriculture, to all the leading milk producers' associations in the United States, and this paper is based on the information received from those associations that operate distributing plants.

REASONS FOR ORGANIZING AND ESTABLISHING A CENTRAL DISTRIBUTING PLANT

There have been various reasons for producers organizing and establishing distributing plants. As a general rule the local economic situation made it imperative that some change be made. The following reasons for organizing and establishing plants were given in replies from 28 milk producers' cooperative associations who operate central plants.

To establish a permanent all-the-year market for the milk of the producers, 9. To get better prices for the milk, 9. To make it possible to comply with city pasteurization ordinances, 3. To eliminate duplication, 3. To effect more economical distribution, 3. To establish a market for the local producers, 2. To be able to give better service to the city, 2. To handle the surplus, 2. To give the producers more time for their farm work, 1.

Some of the associations gave two or more reasons, but the most common reasons given were to establish a permanent all-the-year market and to get better prices for their milk. These prevailing reasons were really the result of necessity in many cases; i. e., the producers were driven to do something on account of the uncertain market and the low prices received. Other important reasons are to eliminate duplication and to handle the surplus milk. Many of the associations consist in part of producers who have been retailing their milk, and in those cases the organization of the association and the establishment of a plant of course eliminated considerable duplication and permitted the producers to spend their entire time with milk production. In one city the establishment of such a plant reduced the number of delivery outfits required to supply a certain number of people from fifteen to five.

MEMBERSHIP

Of a total of 23 associations the number of members varied from 14 to 650, with an average of 139, and the membership consisted of producers, producer-dealers and others, usually business people, in the town where the milk was to be distributed. Thirteen associations had some members who were not producers, and of the total 3,206 members in 23 associations, 623 were not producers. In four of the associations 50 per cent or more were former retailers, and the membership of 14 of the 23 associations consisted, in part, of former retailers. Of the 2,583 producers in 23 associations, 453 were former retailers. One association had a considerable number of consumers in its membership, while another association consisted of 20 producers and 10 employees of the plant.

The intention of all associations is to have the membership consist primarily of milk producers and almost invariably the control of the business is wholly in the hands of the producers. Where both preferred and common stock are issued the preferred stock is usually sold to men who are not milk producers and gives the holder no voting privilege. This preferred stock is often retired after a certain period of years so that in time all the stock is held by milk producers. Similarly where certificates of indebtedness are originally issued to men who are not producers, they give the holder no voting privilege and a certain number are usually retired each year and new certificates issued to milk producers only, so that they are eventually all in the hands of milk producers.

METHODS OF FINANCING

Various methods are used to raise the capital necessary to finance the organizations and establish and equip the plants. Formerly the most common method was to issue capital stock. The common stock with the voting privilege is issued to milk producers and where additional capital is desired preferred stock with no voting privilege is usually sold to business men. The preferred stock usually has a definite dividend allowance, while the common stock is usually limited to a certain maximum percentage for dividend payments. The organization with no capital stock has been more common in recent years. Usually a membership fee is charged and certificates of indebtedness are issued. These certificates carry a definite percentage of interest and are often sold to outsiders as well as to producers. All memberships are of course held by milk producers and each member has one vote. The plan is usually to retire a certain number of the certificates each year and to gradually get them all in the hands of the producers in proportion to the quantity of milk they are shipping to the association. While it is desirable for the entire membership to be of milk producers, it is sometimes necessary to raise more money than the producers can put up, and, therefore, outside capital must be obtained and this is one of the ways used to get it.

Of a total of 28 associations, 19 issued capital stock and six issued certificates of indebtedness only, while four associations issued both capital stock and certificates of indebtedness. The average authorized capitalization of 21 associations was \$65,857.14, varying from \$5,000 to \$225,000.

BASIS OF SUBSCRIPTION

Various bases of subscription to capital stock and certificates of indebtedness were used, and the following are among those reported:

\$5.00 per quart of milk shipped. \$50.00 per 50 lbs. of milk shipped. \$4.00 per gallon of milk shipped. \$50.00 per cwt. of milk shipped. \$5.00 per cow owned. \$10.00 per cow owned. Not less than \$250.00.

The limit in the amount of investment one member could hold in the association varied in 15 associations from \$100 to \$10,000. In 11 of the associations there was no limit to the amount one member could hold.

METHODS OF VOTING AT STOCKHOLDERS' MEETINGS

At the stockholders' or members' meetings one man is allowed only one vote with no proxies at 23 of the associations, while at five of the associations the stockholders vote according to the shares of stock held.

OPERATING METHODS

In Table I are shown the number of plant employees, delivery routes, office clerks, etc., at cooperative milk plants of various sizes. In this respect cooperative plants do not differ from ordinary privately owned plants. While most of the plants operate routes of their own, the two largest do not. One of these sells bulk milk to dealers who come to the plant for it each day. At the other large plant the dealers come to the plant with their own delivery outfits and are furnished with bottled milk at so much per quart, the dealer to stand for all losses of bottles. This method of doing business has proved very satisfactory at these two plants, and both the producers' association and the dealers seem to

TABLE I.—NUMBER OF ROUTES AND NUMBER OF EMPLOYEES IN 25 PRODUCERS' COOPERATIVE MILK PLANTS.

Size of Plant. (number of gallons handled daily.)	No. of plants.	Ave. No. gallons handled per plant.	Number of Routes. —Wholesale— Ave. per plant.	Wholesale Per 100 gallons handled.	—Retail— Ave. per plant.	Retail Per 100 gallons handled.	Number men inside —plant— Ave. per plant.	Per 100 gals.	Ave. number route foremen per plant.	Average number office clerks per plant.
500 gallons or less..........	9	380.5	0.5	0.12	3.5	0.88	3.0	0.76	0	1.0
501 to 1,000 gallons..........	7	793	1.1	0.14	4.0	0.50	5.6	0.70	0.5	2.1
1,001 to 2,000 gallons........	5	1,760	2.8	0.21	2.6	0.20	10.4	0.60	0.5	3.4
2,001 to 4,000 gallons........	4	3,300	1.8	0.05	12.0	0.36	20.5	0.62	1.8	5.2

Two plants handling over 4,000 gallons daily had 0.31 men in the plant per 100 gallons handled. These associations sold milk to dealers and had no distributing outfits of their own, and at one of them no milk was bottled. At 157 privately owned city milk plants, ranging in size from less than 100 gallons daily to over 10,000 gallons daily, the average number of employees inside the plant was 0.50 per 100 gallons handled daily, and varied from 0.4 to 1.7.*

*U. S. D. A. Bulletin No. 849.

TABLE II.—INVESTMENTS IN PLANT AND EQUIPMENT AT 27 PRODUCERS' COOPERATIVE MILK PLANTS ARRANGED ACCORDING TO QUANTITY HANDLED.

Size of plant (Number of gallons handled daily.)	Number of plants.	Ave. number gals. handled daily.	Investment in plant Ave. per plant	Investment in plant Per 100 gals.	Investment in plant —equipment— Ave. per plant.	Investment in plant —equipment— Per 100 gals.	Investment in delivery —Equipment— Ave. per plant.	Investment in delivery —Equipment— Per 100 gals.	Total Investment Ave. per plant.	Total Investment Per 100 gals.
500 gals or less	9	413.9	[1] $10,000.00	[1] $2,597.40	$11,811.21	$2,873.00	$2,893.75	[2] $666.19	[1] [2] $21,433.44	[1] [2] $5,170.85
501 to 1,000 gals.	7	793.	[3] 18,977.87	[3] 2,277.34	25,208.68	3,179.48	11,185.79	1,407.21	[3] 49,985.43	[3] 6,304.47
1,001 to 2,000 gals.	5	1760.	[3] 22,515.76	[3] 1,169.65	[4] 20,933.77	[4] 1,189.42	7,146.06	[4] 433.09	[3] [4] 49,482.13	[3] [4] 2,811.48
2,001 to 8,000 gals.	6	4199.66	94,570.25	1,914.38	60,960.15	1,234.01	19,475.25	521.19	[5] 155,136.34	[5] 3,697.72
	27	1602.7	$36,339.02	$1,945.79	$26,624.28	$1,697.77	$8,556.39	$702.29	$63,749.18	$3,954.47

(1) Only 5 plants in this group had buildings of their own.
(2) One plant in this group had no delivery system.
(3) One plant in this group rented a building.
(4) One plant in this group handled mostly all wholesale.
(5) Two plants in this group had no delivery systems.

be performing important and necessary functions. Where the business is carried on in this way the dealer receives whatever quantity he desires at a definite price and the producers handle the surplus. It is thus necessary that the producers' plant have facilities for manufacturing the surplus into by-products, such as butter, cheese, etc. One producers' plant was established primarily to handle the surplus. The milk received at this plant, which is the quantity over and above what the dealers require, is disposed of in various ways, depending on market conditions and prices. Considerable cream is sold to ice cream dealers and the skim milk sold to the farmers. Milk received in poor condition is manufactured into butter.

INVESTMENTS IN PLANT AND EQUIPMENT

As is the case with privately owned plants, there is a great variation in investments at producers' milk plants. In Table II are shown the investments at various plants arranged according to quantity of milk handled daily.

METHODS OF HANDLING SURPLUS

All the plants have a surplus of milk to handle at certain seasons of the year. This is also true in the case of practically all milk dealers except in cases where arrangements are made for the producers to handle it. The following is a tabulation of the replies from 28 associations as to how they disposed of the surplus:

Commodity Sold	*Number of Associations*
Butter and cottage cheese	23
Sweet cream	9
Buttermilk	5
Ice cream	3
Condensed skim	2
Skim milk to producers	2
Milk powder	1
Ice cream mix	1

The most economical method of disposing of the surplus, of course, depends on market conditions and prices and the cost of manufacture. The market for cottage cheese is limited and irregular in most places, but where there is a good market for it the manufacture of butter and cottage cheese is a very profitable method of handling the surplus.

The sale of sweet cream is very profitable where there is a good market for it and the price is favorable.

SYSTEMS OF PAYING FOR MILK

Ten associations paid a flat price for milk based on market conditions, while at fifteen of the associations the price paid was based entirely on the profits made by the association; i. e., the price was dependent upon the operating costs for the current month. At one association a flat price based on the market was paid for milk received from non-members, while the members of the association received for their milk a price based on operating costs. This price was usually considerably more than the price paid to non-members.

The logical method of payment for a cooperative association is to have the price based on the operating costs for the current month. With this method, the producer gets what it left after expenses and reserves are deducted and he more readily realizes that he is a member of the association and is to reap all the benefits. Some cooperative associations have encountered considerable difficulties the first few months because the plant was started with the idea of paying flat price for milk and under conditions where there was considerable competition in buying milk. Usually, cooperative associations find the first few months operation very trying and costly and until the plant is running smoothly the producers should be willing to stand a little loss if necessary, and they cannot expect to receive a high price for their milk from the beginning. Often a large quantity of milk will be received the first few weeks of operation, which cannot be sold as market milk, but must be manufactured into by-products and disposed of at a less price. If the producers are paid market milk prices for their milk under these conditions, the plant will be operating at a loss, and the proposition will be very discouraging. The organization also loses its cooperative features to a large extent where milk is paid for on a flat rate basis. As a general rule, a cooperative plant will "get on its feet" after the first two or three months and the producers will feel repaid for having stood a small loss at the beginning.

BASIS OF PAYMENT

Twenty-one of the associations reported that the milk was paid for by weight, while at six of the plants the measure or gallon was used as the basis of payment. Butterfat content was taken into consideration at 19 of the plants. It is gratifying to note the large proportion of the associations which paid on the weight and butterfat basis. This is fast becoming recognized as the most accurate and equitable method of basing milk prices yet in use.

SINKING OR RESERVE FUND

Nearly all the associations have some method of setting aside a sum each month to take care of depreciation, etc., only four out of 28 associations reporting that no such fund was set aside. Figures from 16 associations showed that they were putting aside on the average $622.20 per annum for each 100 gallons of milk handled daily. The various associations varied from $365 to $1,032.12 per annum per 100 gallons handled daily. While the most common system was to set aside a definite flat sum each month, some of the associations based the amount set aside on various factors, among which are the following:

1. Depreciation.

   3% on plant investment
   20% on plant equipment investment
   33% on delivery equipment investment

10% on plant equipment
25% on automobiles
10% on horse, wagons and harness

2. Milk handled or business done.
   ½ cent per gallon handled
   1 cent per gallon handled
   1 cent per cwt. handled
   6 per cent of gross sales
   ¼ cent for each quart of retail sales

Too much emphasis cannot be put on the importance of setting aside a sum each month to take care of depreciation, buying new equipment, etc. Some associations have encountered great difficulties because they had no fund to fall back on, and cases have been known where all the available funds have been paid out for new equipment, etc., so that the producers had to wait a month or more for their milk checks. If such associations had paid a little less to the producers each month and at the same time set aside a definite sum into a reserve fund each month, there would not have been this shortage of funds and there would have been better satisfaction all around.

OTHER ACTIVITIES CARRIED ON BY MILK PRODUCERS' ASSOCIATIONS

Eleven out of 28 of the associations carried on activities besides the handling of milk. The following is a tabulation of these activities:

Buy feed cooperatively, 5. Buy fertilizer cooperatively, 4. Buy coal cooperatively, 1. Buy grass seed cooperatively, 1. Buy twine cooperatively, 1. Buy groceries and meat, 1. Buy dairy supplies, 1. Handle eggs, 1.

"The education of children in schools to use milk is reflected in the more intelligent use of milk in the home."

REPORT OF COMMITTEE ON CITY MILK CONTESTS

RUSSELL S. SMITH, *Chairman.*

Since the inauguration of milk and cream scoring contests in 1906, when there were but two kinds of contests held, there have developed other contests which have proved to be interesting.

The object of all contests is to arouse competition in producing a higher grade of milk, because a milk producer who knows how to secure a high quality milk is a credit to the industry. The personal satisfaction gained in learning that the milk has been produced and handled in such a manner as to bring special merit for it in a contest is worth more to the conscientious milk producer than any prize or token. He feels that he has reached as near perfection as it is possible for anyone to reach along that particular line of endeavor.

While the contests in which dairymen prepare their own samples of milk and cream are still being held, the fact that larger cities are gradually losing the retail raw milk producer results in fewer samples being entered in this class. The difficulty which wholesale producers of raw milk have in securing empty bottles for their entry also tends to reduce the number of entries in the producer's raw milk contest.

It has been stated that in allowing a producer to take extra precautions in preparing an entry of milk or cream in a contest, the entry would not be a representative sample of what the milk would be from day to day. While a producer might receive the highest prize for his milk in a contest, the average daily condition of his milk might not warrant a prize.

No doubt the so-called "surprise contest" more nearly shows the condition of the quality of milk from certain producers, especially when such a surprise contest extends over a period of a year. In such a contest samples are taken from city distributers once a month but on some date unknown to the distributer. At the end of the month ratings are published, which are based on the three previous months' ratings. At the end of the year the leader is awarded a suitable prize by the health department or other interested parties. This form of city contest is in the nature of an inspection and grading system, which can be carried out by any city having a regular routine milk examination. Usually at the last sampling an outside judge is called upon to determine the ratings in the final tests in order that no question of favoritism can be claimed. In the improvement of city supplies in general, the yearly contests have their merits.

Another kind of contest which has come into vogue in some sections is the city milk inspectors' contest, which may be held once or several times a year. In such a contest city inspectors in a certain State compete with each other by sending ten samples of milk, five raw and five pasteurized, from their leading distributers after they have notified the distributers that during a certain week samples will be taken, but the exact day is not given. The samples, properly packed, are then sent to some central point, such as the State Dairy Show, and the milk is tested and the winning inspector awarded. Such a contest arouses interest in the comparative quality of milk in different cities in the same State, and it tends to spur the inspector to greater effort in instructing the producers or distributers in the proper methods. The contest then becomes of personal interest to the inspector who wants to make a good showing and who rejoices in having his instructions bear out in the final results.

Such contests are valuable in that they can be carried on by city or town inspectors who have not the proper laboratory facilities present for their own examinations, but who have been working with their producers and distributers for better quality. Another advantage in such contests is that the number of entries, which is the same for all cities, allows for a comparison of the leading sources of supply in the cities of a State. Such a comparison could not be secured in any other way. Time of taking samples is arranged so that all samples arrive at the testing point at about the same time, thus insuring the same age for all samples when they are tested.

Another kind of contest similar to the one just mentioned has been successfully tried, and it has aroused considerable interest. Heretofore, when State-wide contests have been announced, the interest shown by producers may have waned by the time the actual contest is to be held. A producer may intend to enter the contest, but somehow he forgets the date or it comes and goes before he realizes it. In such instances a constant reminder is the best remedy, and to this end the county agent has been enlisted. Previous to the contest application blanks are sent to the milk producers and distributers throughout the State. Those who desire to enter the one-week surprise contest sign up and return their blank to the State College. The number of entries is then known in advance and laboratory preparations can be made accordingly. Usually a class for raw milk and for pasteurized milk is included. The State College then sends out small shipping boxes containing four empty sterile pint bottles, with sterile caps in an envelope, to designated agents who are to secure the samples during contest week. The exact day of sampling is never known to the producer, and for a period of a week, at least, he is very apt to put forth his best efforts. On the designated day samples are taken in the sterile bottles. They are then properly packed and shipped to the central point, where an outside judge supervises the examination and prepares the ratings.

There seems to be no doubt of the value to the industry that milk and cream scoring contests have become. There seems to be a tendency to supplant the prepared sample contests by contests which more nearly represent the every day condition of the milk. The surprise contests, in which the exact time of taking the sample is unknown to the contestant and in which the sampling period extends over a period of time, seems to be conducive of good results. Whether this period is a year, month or week depends somewhat on the arrangements present for continuous periodical sampling, but the fact that the producer or distributer knows that his milk is to be sampled some time and that he is in competition with his fellow workers in the industry and that his showing depends on his ability to take proper action, all are bound to produce results. If he should fall below in his tests he is then in a position to improve with positive information from which he may be advised as to proper changes.

While the committee has been unable to learn the exact number of milk scoring contests which have been held, from the data available it is known that there were held during the past year over 31 contests in 23 cities, located in 11 States.

It is interesting to note that California leads with 21 contests in 12 cities, and when we know that milk and cream from that State made the best score at the last contest held by the National Dairy Show, we may attribute it somewhat to the practice the producers have had in their local contests.

It may be interesting to this Association to know that at a certified milk scoring contest held in Boston last June, two samples of milk from California took first and third prizes. The shipping cases in which these samples of milk were sent were so constructed as to keep the milk at a low temperature. One had two small pieces of ice in it which had not melted during the trip because it was well insulated with lith. The other case was re-iced en route and the milk arrived in good condition.

The bacteria counts of the milk were made by the Boston Health Department laboratory, and they were unable to find more than 1,066 bacteria per c.c. in the sample which won first prize.

This, then, shows the possibilities of producing and shipping milk under ideal conditions.

The value of milk scoring contests properly carried on cannot be questioned. They act as an object lesson for the milk producer and as a check on the work of an inspector, especially in the State contests when different inspectors submit samples from their producers with whom they have been working. Milk contests form a stimulant and an element of friendly competition which cannot be secured in any other way and as an incentive towards producing milk of highest quality the contests should receive the attention that is justly due them.

"Success is not achieved by chance or good luck."

REPORT OF COMMITTEE ON REMADE MILK

O. L. EVENSON, *Chairman*

Since the last report of the Committee on Remade Milk, no further developments on the commercial aspect, methods of inspection or control and infant feeding, have come to the attention of or been considered by your Committee.

The results of experiments so far made on the use of dried milk in infant feeding are substantially as reported at the two previous meetings of this Association by Dr. W. H. Price and Prof. James O. Jordan.

The work on methods of detecting natural and remade milk and cream has been continued in the Bureau of Chemistry and some general statements regarding this work are given here.

Experiments for developing methods of detecting remade milk have been in progress in the Bureau of Chemistry for several years. The experiments are not yet completed but interesting and important results have been obtained. A large number of samples have been made, using various combinations of raw material. These were combined by well known emulsifying and homogenizing machines, and in the case of whole milk powder samples were sometimes made up by hand in a mixing tank. A progress report of this work was given in the last report of this Association.

A statement might be made here regarding some observations made on the effect of the machines used in making the milk on the fat. In these samples of remade milk and cream except when homogenized, fat had a tendency to rise, more or less in the form of butter, especially when butter was used as one of the raw products. In eleven samples of remade milk emulsified by two different machines, an attempt was made to measure the amount of fat separating in the form of butter. For this purpose a definite volume of each sample of milk was centrifuged for 10 minutes at a definite speed and the butter that separated was weighed and the per cent of fat determined. In this way it was found that, roughly, 35 per cent of the fat in the milk separated in the form of butter. In the case of whole milk powder in which the fat has not been broken up in the process of manufacture of the powder, experiments so far made indicate that, although the fat rises in a form simulating that of natural milk, close examination reveals the absence of that smooth consistency of natural cream. The fat tends more easily to separate as clear fat particles, especially when warmed. The emulsifying machines also tend to break up a small portion of the fat to such an extent that the fat cannot be removed with the cream separator to the same extent as that in natural pasteurized milk. This is being further investigated in this Laboratory.

Since the publication of the last report on remade milk, a simple and practical method has been developed for detecting remade milk when mixed with natural milk. As little as 10 per cent of remade milk made from milk powder, this varying somewhat with the kind of powder used, can be detected by this means. If condensed milk has been used in making the remade milk, the amount that can be detected will depend upon the degree of heat to which the condensed milk has been exposed in the process of manufacture. The manscript covering this method is now in the process of publication and should be in print before this report is published. (Journal of Dairy Science) The method used for milk was as follows:

"To 25 c. c. of milk in a 250 c. c. beaker was added an equal volume of distilled water and after warming to 25 or 30° C. the curd was precipitated with 3.5 or 4 c. c. of 10 per cent acetic acid. Distilled water to the amount of 200 c. c. was then added and after standing for some time to settle, as much as possible of the supernatant liquid was decanted through a 166 mesh silk bolting cloth. The curd left on the cloth was washed back into the beaker. The beaker was again filled with water and the curd allowed to settle and decantation made as before. This was repeated three or four times.

The curd was then transferred to a 15 cm. rapid double filter and washed at least three times, filling the funnel nearly full each time. The curd was broken up with a glass rod to facilitate washing. The filter was then removed from the funnel and after squeezing out the excess of water with the hand, the curd was placed in vials of clear glass 17 by 100 mm. and 10 c.c. of 5 per cent sodium hydroxide added, the curd being broken up and mixed with the liquid with the aid of a glass rod. The yellow color began to develop in about two hours; the vials, however, were left over night and the observation made the next day.

"The control or standard for comparison was a sample of natural milk pasteurized at the temperature of 63-65° C. for 30 minutes. Several 25 c. c. portions of this control were treated at the same time in exactly the same manner as the unknown and placed in vials of the same diameter."

For cream the procedure was as follows:

"To 15 c. c. of cream was added an equal volume of water and after warming to 30-35° C. the curd was precipitated with about 2 c. c. of 10 per cent acetic acid and filtered and washed. The greater part of the fat was then removed by washing first with 25 to 40 c. c. of 95 per cent alcohol, then with 50 to 75 c. c. of pure acetone, using small quantities at a time, the curd particles being broken up with a glass rod after each addition of the solvent. The curd was then washed thoroughly with water to remove the acetone and after draining was placed in glass vials of the same size as those used for milk, and 10 c. c. of 5 per cent sodium hydroxide was added.

"The standard used for comparison was a sample of natural pasteurized cream of about the same fat content. No attempt was made to detect mixtures of natural cream and remade cream."

This test, which can be carried out with the aid of the apparatus and chemicals of the ordinary routine laboratory, perhaps by the inspector himself, will enable the food control official easily and quickly to make a survey of the city milk supply.

An investigation has also been made of the viscosity of natural and remade milk. It was found that many of the samples of remade milk examined had a higher viscosity that natural milk. The manuscript covering this work is

With the permission of Mr. T. O. Kellems, it is desired to mention here an investigation made by Mr. Kellems in the Laboratory of Physical Chemistry on the electrolysis of natural and remade milk. Although the results of this investigation were mostly of a negative character, a brief statement in regard to this work is made here for the use of other investigators. It was thought possible that in the heat treatment to which milk powder or condensed milk has been exposed in the process of manufacture, the protein molecule had undergone a change which, under the influence of the electric current, would cause a difference in the quantity of protein transferred to the anode, when natural and remade milk were compared in this manner. Platinum electrodes were immersed in the milk in U-tubes connected in parallel. These tubes, together with a voltmeter, an ammeter and a resistance, were connected to a set of storage batteries and the current was passed through the system. Later a coulombmeter was placed in series with each tube to determine the total quantity of current. The investigation, as carried out, showed that the electrochemical differences between remade and natural milk brought out by electrolysis are not great enough to be of value in distinguishing the two kinds of milk.

"The efficiency of the Health Department is proportionate to your own feeling of responsibility for its success."

REPORT OF COMMITTEE ON PASTEURIZATION OF MILK AND CREAM

CHAS. H. KILBOURNE, *Chairman.*

The Committee on the Pasteurization of Milk and Cream, after considerable thought, has decided that we would not take up as a matter of research and report any of the many problems connected with the treatment of milk and cream. Instead we decided to prepare and present to the Association a manual to be used by inspectors as a guide in overseeing the operation of pasteurizing plants.

Doubtless conditions and requirements vary with differing sections of the country, and many cities already are successfully following their own routine in controlling the pasteurization of milk. It seemed to your committee, however, that if a composite of the experience of all its members could be embodied into a general guide to inspection, such a manual might serve a useful purpose.

In preparing such a manual, the question of its scope required consideration. If we attempted to cover all the problems which confront the milk dealer in installing and operating a pasteurizing plant we would burden ourselves with problems requiring extensive research, difficult for a scattered committee to make, and the final result would have been too voluminous.

This Association being made up very largely of men engaged in the official control of milk supplies it has seemed wise to us to confine our efforts to aiding these men in the efficient supervision of pasteurization, instead of attempting to cover the wide and intricate details of mechanical installation and commercial operation.

In doing this we have to remember that the function of dairy and milk inspection is, primarily, the preservation of the health and physical well being of the community through preventing the sale or distribution of milk and milk products which appear to work physical detriment. To a certain extent also, our public departments should guard the people against fraud. This, however, is a secondary consideration.

Holding these views as to the function of public departments, we must remember that all regulations for the pasteurization of milk and cream have primarily this one object in view, namely, that milk and cream shall be so treated by means of heat that all bacteria which are considered to be pathogenic, or which appear to disturb the comfort and well being of the human organism, shall be destroyed.

In preparing the manual which we now present, we have kept this in view, namely, that in the proper control of pasteurizing plants, there were three fundamental items to be considered.

1. The construction and equipment of the building and the apparatus used.
2. The mechanical control of the apparatus.
3. The personal control of the operation of the plant.

Under the first of these, the building and the apparatus should be such that they are *capable* of safely and efficiently treating milk and cream, so that all dangerous bacteria shall be destroyed without impairing its chemical or nutritive properties, and without needlessly decreasing the cream layer.

Under *mechanical control,* we have to see that so far as possible, the operation of the apparatus is so automatically controlled that the results of which the apparatus is *capable* shall be secured with the least chance of failure.

Under *personal control* we must carry on careful routine inspection in order that we may be sure that the men who are in personal control of the operation of the plant are efficient. This in order that the *mechanical possibilities,* and the *automatic controls* shall be *efficiently directed.*

In order to aid us in arriving at these results, we have prepared and herewith present an information form or blank which may be used when making the primary inspection of pasteurization plants.

The considerable detail used in this blank covers some points which are applicable to all milk handling plants, whether or not pasteurization is carried on.

It will be noted that the various items are numbered. Following this numbered blank we have enlarged upon the various important points, and in doing so, have made use of the same numbers which appear upon the blank form.

This inspection blank, while it is perhaps too extensive for use except for making the primary inspection of a plant, may still be used as a tickler to remind the inspector of the points needing attention.

In all pasteurizing plants it is important that there be abundant boiler capacity. Plants are frequently deficient in this respect through a mistaken desire for economy. Water lines should be large enough to fully meet all water needs at the time of maximum demands.

Following is a more detailed consideration of the items bearing numbers upon the blank form:

CONSTRUCTION

1. Is building of wood, brick or concrete? Either is satisfactory. If of wood, the walls for a distance of two or three feet from the floor should be of concrete.

2. Is lighting evenly distributed? Are parts where milk is handled abundantly lighted? Is there enough artificial light for night work? Is there enough ventilation to carry off all excess steam and heat?

The condensation of steam in cold weather sometimes produces a heavy fog in the plant. This is more effectively prevented by providing additional heat for the building than by increasing the ventilating area.

3. Are floors of wood, concrete or iron? Wood is not satisfactory. Concrete floors where there is heavy wear

should be reinforced by iron plates or iron grates imbedded in the concrete.

Floors should be graded toward discharge drains which should be well trapped.

4. Walls and ceiling should be of smooth boards or concrete. It is well to cover all walls and ceilings with an enamel waterproof paint.

5. All windows and doors should be screened against flies during the summer.

Doors which are frequently opened, as for the receipt of cans from farmers or from trucks; for the return of washed cans to farmers; or for the loading of filled cans and bottles onto cars or trucks, should be provided with screens for the upper part of the opening, leaving only sufficient open space beneath them to allow cans and filled cans to pass, in or out beneath the screen.

6. Water closets should not connect directly with rooms in which milk or milk utensils are handled.

7. Earth closets should be at a distance of 50 or 100 feet from the building.

9. Separate rooms for each of the various processes are unnecessary, especially if the milk itself is protected, and is not exposed. The receiving room and the rooms for the washing of containers should be separated from the milk handling rooms.

EQUIPMENT

14. Are wire strainers in good repair with seams soldered flush? Are strainer cloths sterilized after washing and frequently changed?

At what point or points is straining done?

Straining of hot milk may be done as it enters the holder. A much heavier straining medium may be used with hot than with cold milk.

16. Can pumps be easily taken apart for cleaning? Pumps fastened together with bolts, requiring the use of a wrench, are more likely to be neglected than those which

fasten with thumb screws. Some rotary pumps are not easily washed.

17. Copper pipes, tin-lined, are usually used. Some success has been attained in the use of enamel-lined iron pipes.

18. Is the heater of the batch or tank type, or is it of the continuous flow type?

In the former, the heating is accomplished either by forcing hot water through a coil of pipe which is immersed in the milk; or the hot water is forced against the outer side of the tank containing the milk; or a hot water jacket surrounds the milk container. In either of these forms, the holding of the milk is completed in the same tanks in which it is heated.

See how much hotter the heating medium is than the final temperatures to which the milk is to be heated.

If in an effort to more rapidly heat the milk, the temperature of the water is very high, the milk may be scorched and the cream layer may be reduced. A reduction of the heating time may be secured by increasing the speed of flow of the water through the apparatus. Larger pumps or increasing their speed will secure this result.

The return water should be reheated in a separate tank before it is re-pumped through the apparatus.

See that all gaskets and stuffing boxes are tight and are kept clean.

In the continuous flow type, the milk flows through pipes or over surfaces which are kept hot by means of hot water. The same attention should be given to the heating medium as in the tank heater.

In order that a uniform milk temperature may be secured, three things are desirable.

1. A uniform speed of flow of the milk through the heater.

2. A uniform temperature of the raw milk.

3. A uniform steam pressure in the pipe supplying the heat for the water.

With these three items taken care of, it is not necessary that an automatic heat regulator be installed, although it is even then desirable. The uniform temperature of the raw milk is not always possible when the milk is pasteurized as fast as received from the farmers.

When milk flows by gravity to the heater, the speed may be regulated by the size of the pipe feeding the heater, or by a float valve.

If milk is pumped to heater, the speed of the pump should be controlled. If the boiler pressure is sufficiently high, this control is aided by installing a steam pressure reducer in the pipe supplying the pump with steam. If steam from this same pipe is supplied to the water which heats the milk, the regulation of the milk temperature becomes more easy of control.

19. Is the holder of the batch or of the continuous type?

If the former, care must be taken to see that the outlet valve is not opened until all of the milk in the tank has been held for the full required time at the maximum required temperature. Also that no milk is admitted through the inlet pipes after the holding period has commenced.

In the continuous type it is always true that there is some mixing of the milk during the holding period, the amount of mixing depending largely on the speed of flow of the milk. An allowance must be made for this, and the time for filling the holder should be from 25 to 50 per cent greater than the theoretical holding time. If foam gathers on the surface of the milk in either type of holder, this has a lower temperature than that in the body of the milk. This may affect the the destruction of bacteria.

20. Is the cooler so arranged that no contaminated air can reach the milk? In the open type the surface should be covered with a metal cover or the cooler should be enclosed in a separate room. It is probable there is less danger from air contamination than has been thought.

The cooler should be large enough to cool the milk as fast as it can be delivered from the holder and taken care of. The more rapidly the cold water flows through the cooler, the more efficient a cooler of any given size becomes.

If the return water from the cooler is warmer than the water supply of the creamery, this return water should be discharged to the sewer or into a storage tank. In this case the ice water pool should be replenished from the creamery supply.

See that there is no leakage of water into the milk, and if the cooler is of the regenerative type, see that there is no mixing of the raw with the pasteurized milk through leaky joints or pipes.

21. Where and how is the temperature recorder attached to the holder? It is desirable that a recorder be also attached to the heater and to the cooler.

If the holder is a batch pasteurizer, the recorder should be inserted into the milk through the end of the tank.

In this type of holder, remember that the recorder shows not only the actual holding time, but also includes in its record the time required to heat the milk and also a part, at least, of the time required to empty the tank. Where the hot milk is released without partial cooling in the tank itself, we must make an allowance for the time of emptying in determining the actual holding time when observing the record line of highest temperature.

Recorders should be frequently tested for accuracy. The pen arm may become unintentionally moved. Weather conditions also affect the accuracy of the record.

In the continuous type, the recorder should be attached at the highest point of the discharge pipe and should be so inserted that if for any reason the milk flow stops, the thermometer will still be immersed in the milk.

22. An automatic controller for the temperature is desirable, although under the conditions described under 18 it is not absolutely necessary. In heating milk in the continuous method, there is always required a certain amount of steam

for heating the water. The temperature control is affected, whether by hand or machine, by moving the valve to admit more or less steam. A by-pass for the steam, so arranged that only a part of the steam supply will be affected when this valve is moved, will aid in the easy control of the temperature.

23. A storage vat between the cooler and the filler will act as a reservoir for the cooled milk, and obviate the necessity of stopping the pasteurizer if for any reason the filling of the cans or bottles is interrupted.

25. The bottling machine should be easily cleaned, and if it is an automatic machine the speed should not be too great to allow of proper inspection of the bottles both before and after they are filled.

26. All bottles should be capped either with a hand or a power capper, which can be easily cleaned.

27. With a proper can filler, foam is avoided on the can, any great amount of which renders it necessary to do considerable dipping from can to can, which may be a source of contamination.

28. Bottle washers should wash both the inside and the outside of the bottles.

29. Bottles may be heated either by jets of hot water or steam. They may be placed in tanks or in insulated rooms where they are subjected to steam heat. They should be well cooled before being filled, or the temperature of the milk may be raised to the danger point.

30. Cans and covers should be rinsed with clean water after washing, should be thoroughly heated, and should then be dried over jets of heated air.

31. If the cans and covers are dried, the covers may be with safety placed on the cans during storage. Otherwise the covers should be left off and the cans inverted on suitable racks.

METHODS

32. No dirty material from which dust or dirt can be blown into the milk handling rooms should be allowed about

the creamery. Also there should be no offensive odors which can readily enter the building.

34. All rubbish and unused material should be absent from the milk handling rooms. Clothing should be kept in a separate dressing room.

35. Provision should be made for the employees to wash hands after visiting the toilet. Soap and towels should be available, and should be so placed that it will be necessary to pass the washing facilities before leaving the toilet.

36. No smoking, spitting or tobacco chewing should be allowed while milk is being handled.

The employees filling cans or bottles should wear clean white outer garments and all employees should wear easily washable garments.

38. Examine all apparatus before milk is admitted to it. Take apart all pipes; open all pipe caps; take pumps apart; look at all corners and spots which are difficult to clean. In open coolers look at the ends of the pipes, and especially examine between the sections. Look at rubbers on bottle filler.

Be particular to examine the bottler.

39. Unused bottle caps should be stored in a separate room and should be protected from dust, dirt and offensive odors.

MILK HANDLING

40. The purchase of milk by weight and by butterfat test is the most desirable method. The purchase by measure without regard to butterfat content invites dishonesty on the part of the farmer and loss on the part of the dealer.

41. Observe and describe the route taken by the milk from its receipt to its final disposition.

42. No slop milk or the leakage from pipes, etc., should be put out for consumption unless it is re-pasteurized. Its use for by-products only is desirable.

It is often found that the first milk of the cooler contains more bacteria than that delivered later, indicating either too low heating of first milk or inefficient cleaning.*

PASTEURIZING PROCESS

43. Milk should be heated a few degrees hotter than the temperature at which it is intended that it shall leave the holder. This allows for possible cooling during holding time, The time required for the milk to reach the maximum temperature after heating is commenced is of little moment, provided the process is not so slow as to allow of the incubation of the bacteria during the process.

44. Be sure that the full holding time is employed. Note remarks under 19.

45. Note the temperature of the first milk out of holder, and observe the length of time required before the maximum temperature is reached.

46. Cooling should be to 40 to 45 deg. The length of time allowed for the cooling is of less moment than formerly considered, as far as the effect on bacteria is concerned. It is desirable, however, that not more than 30 minutes elapse between the beginning and the completion of the process, since slow cooling appears to affect the cream layer.

48. Temperature charts should be made daily, correctly dated, and kept on file for a month. This enables the inspector to check up the operation of the plant, and also to check up the efficiency in case any contagious disease seems to be traceable to the milk sent from the plant. Watch the charts carefully, and determine that there is no counterfeiting of the record.

WASHING APPARATUS

50. See that all apparatus is washed immediately after its use for the day is completed. All milk which has been cooked on to the pipes or other parts must be removed, and care taken that all soluble milk be removed by rinsing before great heat is applied. All parts should be fully rinsed after

washing and should be heated first with boiling water and then with steam. It is well to insist that all piping and pumps be left disconnected after washing until they are put together for use on the following day. Thus there is opportunity for easy inspection before pasteurization is commenced.

51. The cooler, the bottler and all pipes leading from the cooler should be thoroughly heated with hot water and steam for 15 minutes or longer before milk is admitted to them each day. Thus any bacteria which may have developed over night in the moist apparatus will be destroyed.

52-53. Note remarks under 31.

54. Filled cans and bottles must be kept cold till delivered to consumers. If loaded directly onto railroad cars, ice must be placed on them. If held at plant till a later time for loading or if put out on the delivery wagons, they must be kept in refrigerator, or well covered with ice.

In order to assist in securing an efficient pasteurization, samples should be taken at frequent intervals for bacterial examination. If the finished product is found to be high in bacterial content, a series of samples should be taken to determine at what point the trouble is located which interferes with the proper treatment of the milk.

Samples should be taken of the raw milk at the mixing tank; at the outlet of the heater; at the outlet of the holder; at the cooler; and from the final container; these to be taken in the proper sequence as to location and time so that as nearly as possible relatively the same milk is sampled at the various points along its route through the apparatus.

Several series should be taken in this way, the first series from the first milk passing through the apparatus, and the other series at various times during the process. From the results, it is usually possible to determine the danger point, and to work out a remedy.

REPORT ON PRIMARY INSPECTION OF PASTEURIZING PLANTS

Inspection No.................. Date............... Time............
Location of Plant..

County........................ On............................R. R.
Name of Operator...............Party Interviewed.................
Address ....
Qts. received daily........Qts. pasteurized......Qts. cream past.......
Qts. Milk sold in cans..............Qts. sold in bottles..............
Qts. Cream sold in cans...........Qts. sold in bottles................
Milk received from...
....
Is delivered or sold to...

CONSTRUCTION

1. Building is constructed of.............is.............stories high.
2. Is...........properly lighted. Is...........properly ventilated.
3. Floors are constructed of..........Are........water tight and are ....properly drained except................................ ....
4. Walls and ceilings are......smooth, and are......painted with a light colored paint except..
5. Doors and windows are......properly screened except............
6. Toilet, earth closet, water closet is.....................provided.
7. Is located ....
8. Is........properly ventilated. Is........provided with self closing covers. Flies have........access to vault.
9. There are..........rooms provided as follows:.................. ....
10. Water supply is from................Is apparently free from contamination except ....

EQUIPMENT

11. *Apparatus.* Weigh cans are constructed of......have......suitable covers.
12. Mixing tanks are constructed of.........and have........suitable metal covers.
13. A....................centrifugal clarifier is.............provided.
14. A....................strainer filter is used at....................
15. Milk pumps constructed of........are........provided at........ for raw milk, for pasteurized milk.
16. Pumps are..............................of sanitary construction.
17. Pipes and fittings are......of sanitary construction except......... ....
18. A.........heater of........capacity is provided for milk—cream.
19. A......holder is provided. Has......been tested for holding time.
20. A........cooler is provided which is......protected by..........

21. An automatic temperature recorder is........attached at outlet of heater, holder, cooler. Is..........accurate.
22. An automatic temperature controller is.......provided. Is....... accurate.
23. A suitable tank is......provided for the storage of pasteurized milk.
24. Is........protected by covers constructed of...................
25. A..............bottling machine is................provided.
26. A..............bottle capping machine is............provided.
27. A can filling apparatus is..............provided.
28. A bottle washing machine is.........provided—is.........efficient.
29. A bottle heater is..........provided............................
30. There are......steam jets for heating cans. Cans are.......... dried by hot air blast.
31. Racks constructed of........are........provided for the storage of washed cans.

METHODS

32. Surroundings of buildings are........clean except................
....
33. Floors are.......clean. Walls and ceilings are.......clean except
....
34. Rooms where milk is handled are......free from rubbish and useless material except..
....
35. *Toilet* is........in clean condition.
36. Employees are........cleanly in their habits and appearance except
....
Clean washable clothing is......worn. Are medical certificates on file?............
37. Smoking and spitting is.............prohibited.
38. Apparatus is........in a clean condition except..................
....
39. Bottle caps are........protected from dust and dirt during storage.

MILK HANDLING

40. Milk is received by weight. By measure.
41. Milk is handled at plants as follows:............................
....
....
42. Overflow and waste milk is used for............................

PASTEURIZING PROCESS

43. Milk is heated to........F°. Time required for reaching maximum temp..............
44. Is held at temp. of........for............min.
45. Leaves holder at temp. of.........except........................
Requires..........min. for holder to empty.
46. Is cooled to.........F° within......min. after holding is completed.

47. Cream is heated to........F° and held for..........min.
48. Leaves holder at........F° Cooled to........F° within.......min.
49. Temperature record charts are..........made daily. Are........ correctly dated. Are..........kept on file for............

WASHING OF APPARATUS

50. All apparatus is........rinsed, and is washed with.............. immediately after use except.................................... Is........then rinsed with clean water. Is......heated with.......
51. All apparatus is heated by..........for..........min. immediately before use daily except...
52. Washed and heated containers are........cooled and are.......... protected from contamination until filled.
53. Cans and covers are........washed by hand, by machine. Are ....rinsed with clean water. Are heated by....... Are...... dried with hot air.
54. Filled cans and bottles are........loaded direct onto cars. Are......stored in proper refrigerators. Are......properly iced

UNUSUAL OBJECTIONABLE FEATURES.

RECOMMENDATIONS.

Inspector.

"Consider the postage stamp. Its usefulness consists in sticking to one thing until it gets there."

REPORT OF COMMITTEE ON FOOD VALUE OF MILK AND MILK PRODUCTS

GEO. B. TAYLOR, *Chairman*

The report of this committee for 1919 was made at a time when the propaganda for the increased use of milk was just beginning to be felt. Based upon the work of Director McCollum and other scientists who showed beyond a doubt the necessity of the use of milk and its products to promote growth, the United States Department of Agriculture and the National Dairy Council began their systematic work to inaugurate campaigns whose object should be the increased use of milk and its products in the home. The committee report gave a summary of views and work of the best informed persons along dairy lines—the heads of dairy departments in the agricultural colleges.

The report for 1920 was in a way a continuation of that of the preceding years. Health officers gave their opinions almost unanimously in favor of the campaigns for promoting the use of milk and its products.

The report of the committee concluded as follows:

"Your committee is of the opinion that the International Association of Dairy and Milk Inspectors should go on record as favoring campaigns to promote the more general use of milk in districts where there is available a supply which is reasonably safe, pure and clean."

During the last year the results of the campaign of the U. S. Department of Agriculture, the National Dairy Council, and various state agricultural colleges to promote the more general use of milk and its products have been very apparent. The Dairy Division of the U. S. Department of Agriculture reports that the whole country is awakening to the fact that milk is the most important of foods and that its use has increased very perceptibly.

Your committee is of the opinion that this association can do no more important work at this time than to emphasize the importance of safe, clean, and pure milk, and that its members should urge upon the departments they represent the necessity of concentrating efforts to bring about these results.

The producers of milk as well as other milk dealers have benefited greatly by the campaign conducted to increase the use of milk. No more important work can be done than that dealers and producers should increase their efforts to better the milk supply.

Your committee therefore recommends specifically that increased efforts be made to bring about two developments:

1. The production of milk from healthy cows by healthy milkers and handled by healthy persons in a cleanly way.

2. The proper pasteurization and subsequent handling of milk. By proper pasteurization is meant the heating of the product to 145 degrees Fahrenheit and holding it at that temperature for 30 minutes.

The above recommendations to this body may seem trite, but at this time their importance is so great that your committee believes that they again should be emphasized.

"After all is said and done, there seems to be something about the fat of cow's milk for which there is no substitute."

A SUGGESTED MODIFICATION IN THE PUBLIC CONTROL OF MILK SUPPLIES

CHAS. H. KILBOURNE, New York City

I am going to begin my talk with a story. The facts are exactly as I will tell you except for the names. Last year I was making an inspection of a creamery and after this I went to the dairies which brought milk to the plant. The manager of the plant, whom I will call Mr. Brooks, went with me.

We went to the farm of an Irishman whom I will call Flanagan. In looking over the place, I asked Mr. Flanagan where he cooled his milk. "I cool it in the well," he said. I asked, "How cold is the water?" "I don't know," he said, "I'll go down and find out." So he took a thermometer and started to climb down the stones of the well, which was not very deep. "Look out," I said, "or you will fall in." "You can't sink me," he said, "I'm a Cork man." This seemed like a good Irish joke. Now the next day, Mr. Brooks said to me, "You remember that place where we went yesterday where the man had the milk in a well?" I said that I did. "He was Irish, wasn't he?" "He surely was," I said. Then Mr. Brooks said, "I guess he must have meant that he came from Cork."

The story does not apply except to illustrate the fact that many of us are slow to see the obvious.

Those of you who attended the meeting of this Association last year at Chicago may have been unfortunate enough to listen to the paper which I read at that time on "The Value of the Bacterial Count in Raw and Pasteurized Milk and Milk Products." Those who were not at the meeting may possibly have read the paper in the Annual Report of the Association, or in some of the journals which have reprinted it.

If either experience has been yours, and if in addition you chance to remember the facts which I tried to emphasize, you will recollect that I attempted to partially show how many factors enter into the taking and the examination of milk samples and that these may affect the accuracy of the results. I showed that these factors vary so much from time to time that we have no warrant for expecting that we will secure results which are uniform and dependable when our bacterial counts are made.

I then described in some detail a series of tests which were made. In these tests, several laboratories, using standard methods of technique, made examinations of duplicate samples of milk. Later these same laboratory workers met in one of the laboratories and made tests on identical samples. I showed that the reports of all these tests indicating the number of bacteria found gave results which were, numerically, so far apart that the differences were measured by hundreds and thousands of percentages. From these results I drew the conclusion, which I thought was correct and logical, that the bacterial count alone, when this count was made by a single laboratory, could not with justice be depended upon as a basis for official action by Boards of Health. If Boards of Health either degrade or exclude milk from sale under these conditions, needless injury may, and often does, follow.

Of course we would expect some variation in bacterial counts, for no group of men can be sure to get exactly the same results any more than several watches can be expected to keep exactly the same time. To illustrate: By my watch the time is 2.26 o'clock, and I presume if you will kindly look at your watches you will find that they are from one to ten minutes either faster or slower than mine. But if we found that these watches were several hours apart, we would lose confidence in them and would hesitate about pinning our faith on any one watch unless it was adjusted with some known standard. In the absence of such a standard, the safest plan would be to make an average of all.

Now I fancy that the paper which I presented last year was not at that time received with any great enthusiasm by at least two classes of people. First, the official laboratories of cities or states may have felt that an attack was being made upon them with the object of discrediting their work. At the same time the executives whose duty it is to guard the public against food which is thought to be injurious may have considered that an attempt was being made to hamper their work.

Second, the commercial laboratories may have felt that in emphasizing the scientific discrepancies, and thus awakening distrust among their clients, the business of the laboratories would be injured. Now if either of these possible results have followed, let me say, they have been incidental, and not intentional results of this paper.

I have had enough experience in official life to know it to be necessary that respect for all proper public authority be maintained. As for the possible loss of business by commercial laboratories, I can only say that if any such loss has occurred it has been proportionally felt by me, since I am engaged in this sort of work.

I did feel, however, that some important facts were in my possession and that the spreading of the knowledge of *facts* could never result in any permanent injury. If it is true that standard laboratories which are carefully conducted and which are using standard methods of technique are not able in ordinary routine work to secure results which are reasonably comparable, then this fact ought to be known and some remedy worked out.

In the annual meeting of the American Chemical Society recently held in this city, I was impressed by the emphasis which nearly all of the speakers placed upon the necessity of guarding with the greatest care all the factors which might affect the results, when research work or when accurate routine work was done. The conclusions which one worker reached were often entirely negatived by the conclusions reached by another worker. In a paper presented by Dr. Barnard, formerly Food Commissioner of the State of Indiana, he pleaded for greater accuracy of data when investigations were made in order that results reported might be of real practical value. He stated that in the Government investigations which were made concerning bread, the records of the factors surrounding the making of the tests were so meagre that the conclusions drawn were absolutely of no value to bakers who wanted to make use of them.

All these facts seem to uphold us in demanding that conservative judgment be used when we are working in any official capacity.

Now in guarding against possible injuries from bad food supplies, it is of course necessary that some rapid method be used to indicate to the public official that dangerous conditions exist, since it is obviously impossible to make personal inspections of all places where foods are handled with sufficient frequency to discover all undesirable conditions. As I have said, some index is necessary, and it is undoubtedly true that the bacteriological examination of milk is one of the most satisfactory indices which can be regarded as danger signals. Let us be careful, however, that in using it we do not place unwarranted reliance upon it, lest by doing so we needlessly injure the business and financial interests. A danger signal means, "Watch out." It does not necessarily mean, "Stop!"

Having all these factors in mind, an attempt has been made to work out in theory a plan of action which will protect the public against foods which are believed to be injurious, will preserve confidence in official authority and prestige, and at the same time prevent undue injury and injustice to the producer and dealer in dairy products. The latter point has been, and I think still is, the weak link in the chain. Under present methods of procedure, the results of the official laboratories are considered to be final, without regard to the results which may have been obtained by other laboratories. It is the official policy to maintain against all comers that the official results are right, always right. This attitude is possibly the legitimate inheritance of the hypothetical assumption that "the king can do no wrong." This was, perhaps, a necessary fiction at one time. It was necessary that the authority of the state should be maintained, in order that a proper regard for public authority might be preserved. There should be no question as to the correctness of the decisions and commands of the public authorities. The question now arises, "Have we not somewhat outgrown this necessity? It is not now possible to encourage a spirit of cooperation between the public authorities and those over whom they exercise their authority?" I am convinced that it is now possible.

As a result of this conviction, there is now offered the following plan of action. You may think it a meagre plan to follow so long a preamble, and no doubt there will be objections to the plan. I think, however, the objections can be met.

To me the plan seems so obvious that I wonder it has not been brought out before. But you remember that we are oblivious to the obvious. Now a few minutes ago some of you looked at your watches. I think I will be safe in saying that not one out of ten of you can now tell what time it was when you looked. And I would be willing to wager that not one out of fifty of you can without looking at your watch tell what sort of a figure six is on your watch. Is it a Roman numeral or an Arabic numeral? I wish all those who think they can tell without looking would raise their hands. Now look and see. You see you are oblivious to the obvious.

Now it took Mr. Brooks twenty-four hours to see the obvious fact as to Mr. Flanagan's native town, and it has taken me a year to bring forward what now seems to me to be the most obvious plan to meet the weakness of the bacterial standard in milk and cream, etc. When I have presented it to you, you may not think it is obvious, and it may take you a year to see it.

At any rate, here is the plan.

We will assume that the official laboratory has reported that in a certain milk there has been found an amount of bacteria greater in number than is legally allowable. It is the present practice to either exclude this milk from sale; degrade it to a lower classification; or else make the results public in some way with the expectation that the consumers will avoid buying and using this milk.

In place of that procedure, I would suggest this: Let the public authorities offer the dealer the opportunity of actively sharing in the further testing of the milk, and also in the final action taken. Thus, when the official inspector again takes samples of the milk in question, allow the dealer also to take samples in duplicate or triplicate or as many sets as he pleases. Let these various sets be submitted to different laboratories. Then after the official results are known, and the various outside laboratories have also made their reports, let an average of all the counts be made, and then let this average be the determining factor as to the final action which is to be taken. If this average count is above that which is legally allowable, then let the milk be degraded, or excluded. If the average count is lower than the greatest number which the law allows, then there shall be no action taken.

This, gentlemen, is the whole plan. Perhaps it appears too simple.

There will be objections offered to this mode of procedure. I have tried to discover as many objections as I could and to get some suggestions from other men as to the difficulties in the way. The first objection is that such a plan of action would take the authority away from the official laboratories and place it in the hands of the outside laboratories, and that these laboratories might be dominated by the dealers whose milk was in question.

We will say that the official count is 2,000,000 per c. c., and that the other laboratories show, we will say, 1,000,000 and 700,000 per c. c. respectively. This would make the average of the three counts, 1,233,000. This would be below the legal limit if such limit were 1,500,000, and the milk would not be excluded or degraded. This would seem to discredit the official count and take from the authorities the power which belongs to them.

In order to meet this reasonable objection, and in order to preserve the proper dignity and prestige of the public authorities, I would provide that the counts of the official laboratories be given the greater weight in the final averages, by counting them more times than all others combined.

Thus, we will say, where the dealer has two counts made, we will make our averages as follows:

Official count	2,000,000	6,000,000
" "	2,000,000	
" "	2,000,000	
Laboratory 1		1,000,000
" 2		700,000
		7,700,000

The average of these five counts will be 1,540,000. This is above the legal limit of 1,500,000, and thus the authority of the official laboratories would be maintained over the lower counts of the outside workers. At the same time, however, it does give the dealer a chance to be a determining factor in the final results.

In making all such averages, I would provide that the official count should be used at least once more than the number of all the other counts combined.

There is, however, a certain possibility which must be guarded against. It is this. It may occur that some one laboratory will secure results which are so radically different from the others as to make its accuracy questionable. As for instance in the tests which I reported, the average of the tests made by four laboratories on duplicate samples of milk were:

	No. 1	*No. 2*	*No. 3*
	153,000	357,000	27,000,000
and again:			
	7,125	13,400	384,270

To guard against such a contingency and against unjust action which might follow if the low ones were allowed to cut down the final average, I would provide that in case one laboratory reported results which were, we will say, 300 per cent above or 300 per cent below the results found by any other laboratory, this count should either be discarded in making the final average, or else I would consider the entire series of tests void and call for another series of examinations.

In case this plan were adopted, it should be understood that the laboratory workers should not be informed that checking was being done, but they should proceed with their work as though it were the regular routine.

To meet the objection that the adoption of such a plan would needlessly delay decisive action, and that the public health might suffer in consequence, I would say that it seems to me that the delay need not be any greater than at present. At the present time it is frequently the practice to defer any drastic action against a dealer until several sets of samples have all shown high counts. Under the proposed method, it would be possible to have a series of samples taken by the various laboratories immediately after the official laboratory had found the first high count. There would then be no greater delay than at present and very possibly there might be less.

To the objection that the dealers cannot be trusted to make honest and fair tests, it may be answered that we all are obliged to have a certain amount of faith in the other man, and that the dealers are now called upon to trust absolutely the results obtained from the public authorities. If there were the inclination, there certainly is the opportunity for dishonest work. At any rate, under the proposed plan, if we discard all tests which are 300 per cent below other tests we can secure against the temptation to dishonestly report abnormally low counts. I am unable to think of any further objections, and it seems to me that the advantages far outweigh the difficulties.

I feel convinced that such a plan would secure the following advantages:

First: It will preserve the respect of the public for the dignity and authority of the Government.

Second: It will promote the spirit of cooperation between the public authorities and those whom it is their duty to serve and protect.

Third: It will tend to check any inaccuracy and carelessness on the part of laboratory workers, whether they are in public work or commercial work.

Fourth: I am convinced that it is fundamentally just and right.

"Success does not consist in never making blunders, but in never making the same one twice"

WHY THE MILK INSPECTOR SHOULD BE A SHOWMAN.

A. W. LOMBARD, Department of Agriculture, Commonwealth of Massachusetts, Boston, Mass.

We have developed in the United States and Canada during the past few years some of the greatest agricultural shows in the world. The National Dairy Show, International Live Stock Show, Eastern States Exposition and Toronto Fair will serve to illustrate this point.

The National Dairy Show has for many years been considered of enough importance for the United States Department of Agriculture to put on an educational exhibit of enormous proportions.

The Eastern States Exposition held in Springfield, Mass., has had the support of the State of Massachusetts to the extent that a State building has been erected at a cost of $50,000 to house the states exhibit at this show; and the same thing has been done in other parts of the country and on other fair grounds.

These fairs and expositions are wonderful educational shows, with just enough entertainment features to attract and hold the attention of visitors.

Millions of people visit these fairs during the late summer and fall months, and it is perfectly safe to say that 50,000,000 people attend agricultural fairs annually in the United States and Canada.

This opportunity to place before the milk producing, handling and consuming public the milk inspector's side of the milk problem is too good to be missed, hence the title of this paper, "Why the Milk Inspector Should Be A Showman."

"Let your light so shine before men," etc., is as true today as it was in the beginning.

Milk inspectors have been so busy attending to the numberless details attached to their jobs that they have apparently not been able to find the time to make exhibits and display their wares to the public. The opportunity offered is tremendous, and we as milk inspectors should avail ourselves of every chance to tell our story in an appealing and instructive way. We have perhaps more available material from which to draw than most any other branch of control work. Our exhibits, besides being educational, may be made most attractive, and even create a certain amount of wonderment in the minds of the uninformed. Do not fail to unite with every civic organization, health movement, or association wishing to hold a show and put up the best exhibit you know how to produce.

You may with perfect propriety include in your display features of interest connected with the business of producing, distributing and handling milk which naturally have a bearing on control work.

Always have an attendant in charge of the exhibit and one competent to explain the detail and workings of each feature.

Have as much life as possible, as motion attracts the eye and holds the attention of visitors.

In closing let me say the opportunity has been presented to us. The field is a big one, the good we can accomplish is very great, and the character of our work lends itself admirably to the show business. Are we going to lose this wonderful chance either by reason of inertia or lack of interest, and let slip through our fingers the best means available to create an active interest and spirit of cooperation on the part of the milk consuming public? My hope is that we will not neglect this wonderfully favorable setting, and so miss the chance of driving home the importance and necessity for every community to have an efficient and complete milk inspection service.

"The man who does nothing does somebody."

DETECTING SOURCES OF MILK CONTAMINATION BY MEANS OF THE DIRECT MICROSCOPIC METHOD

PROF. T. J. MCINERNEY, Ithaca, N. Y.

In the past few years many cities, and in some cases the entire state, have established sanitary codes and ordinances in regard to the grading of the milk supply. These codes or ordinances usually specify the different grades of milk that may be sold and also state how these different grades may be determined. One of the important factors in determining these grades is the bacteria count, and in some cities this is the only factor in determining the different grades of milk.

The number of bacteria in milk is ordinarily obtained by counting the colonies which develop from a definite portion of a cubic centimeter of milk on nutrient agar or gelatin petri plates and multiplying according to the dilution used. Two of the main disadvantages of this method are: (a) Long period of time before the count may be known; (b) It does not show the presence of streptococci and other important things necessary in estimating the sanitary quality of milk. In order to overcome these difficulties, a method known as the direct microscopic method was developed.

Briefly, the microscopic method consists in smearing a certain volume of milk over a unit area on a glass slide, drying the smear, removing the fat by means of xylol, and fixing the smear by the use of alcohol. The smear is then stained by methylene blue, after which the bacteria are counted directly by the microscope and from these data is calculated the total number of bacteria per cubic centimeter. This method also has its disadvantages, but it also has two great advantages. These advantages are: 1. The results on a given sample can be reported within a few minutes. 2.

It shows the cell content, the presence or absence of streptococci and other important things necessary in estimating the sanitary quality of milk.

With the increased use of the microscopic method for the grading of milk a more general knowledge concerning the numbers and types of bacteria commonly introduced into milk by the different sources of contamination should be known. That is, if by examining a sample of milk under the microscope, a large number of bacteria are found, the bacteriologist should be able to tell in a general way the type and significance of the organisms present. He should also know the relation of these types to the source of contamination. Harding states that 75 per cent of the bacteria normally occurring in milk drawn from the udder under strictly sanitary conditions are micrococci. Ruehle, Prucha, Winter and others have shown that dust and barn conditions influence the bacterial content of milk to a very slight degree. Under diseased conditions of the udder streptococci are found in varying numbers.

Breed, Harding, Stocking and Hastings in regard to milk quality make the following statement: "The confusion regarding bacteria in milk is being cleared up by studies which show that the real source of contamination of milk is either an unusual population of bacteria in the udder or more frequently the presence of a surprisingly large amount of germ life upon the utensils in which the milk is handled. Germ life is present in large numbers upon dairy utensils which have been rendered clean in the ordinary sense of the word, but which have not been so handled as to obliterate germ life."

If the micrococci in general come from the cow's udder, streptococci from diseased conditions of the udder, and the stable air influences the bacterial content to a very slight degree, the question naturally arises, from where does the contamination come? By the process of elimination we might answer by saying that it must come from the dairy utensil. To prove this, work was done at Geneva, N. Y., and Ithaca, N. Y., in connection with the regular milk inspection as carried out in both cities. The investigation determined: first, the average size of groups of bacteria found in market milk; second, the average size of the groups of bacteria found in the condensation water taken from milk cans washed and steamed; third, a study of the milk from these cans when delivered to the milk station.

In order to get data on the kinds of organisms found in milk, as shown by the microscopic method, and how these organisms exist in milk as to groups, sizes of groups, etc., a study was first made of the Geneva milk supply and further work was done on the Ithaca supply. In the following table is summarized the average size of clumps of bacteria. This includes the types of organisms as found in the different grades of milk.

TYPES OF ORGANISMS AND SIZE OF GROUPS FOUND IN MARKET MILK.
TABLE I.

Grade of Milk.	*Type of Organism.*	*No. of Clumps Seen.*	*Total No. Bacteria Seen.*	*Av. Size of Clump.*
A	Streptococci	347	11,654	33.5
B	"	822	18,804	22.8
C	"	596	14,448	23.9
All grades	"	1,765	44,906	26.8
A	B. L. A.*	34	104	3.0
B	"	123	387	3.1
C	"	400	978	2.4
All grades	"	557	1,468	2.8
A	Micrococci	1,184	14,811	12.5
B	"	1,308	14,613	11.1
C	"	971	13,100	13.4
All grades	"	3,463	42,524	12.3
A	Rods	1,433	8,140	5.6
B	"	1,345	8,732	6.4
C	"	1,633	9,097	5.5
All grades	"	4,411	25,969	5.9
A	Yeast	2	13	6.5
B	"	2	9	4.5
C	"	0	0	0.0
All grades	"	4	22	5.5
A	All types	3,000	34,722	11.2
B	"	3,600	42,545	11.8
C	"	3,600	37,623	10.4
All grades	"	10,200	114,890	11.1

*Determined by the microscope alone.

It will be noticed that the groups of the different types of organisms varied in size as follows, going from largest to smallest: streptococci, micrococci, rods, lactic acid type and yeasts.

It often happens that the ordinary milk can as returned to the producer from the milk plant contains milk and water of condensation of varying amounts. If these cans are allowed to stand, especially with the covers on tight, and left along the road or in any place exposed to a favorable temperature, bacterial growth will take place.

In a study of 180 cans, Whiting found the organisms existing in milk cans as shown in Table II.

From Table II, we see that there were two general types of organisms found in the moisture that remained in the milk cans. These were the micrococci and the rod-shaped organisms. A careful study of all the smears made from the moisture found in the cans failed to reveal any streptococci, and it was also impossible to recognize the Bacterium lactis acidi organisms among the great number present on each smear.

Tables I and II tend to show that there exist groups of bacteria in market milk and also groups of bacteria mostly rods in the water of condensation in the milk cans after the cans have been returned to the producer.

It was then decided to study samples of milk, especially night's milk, as the producer delivers it to the milk station. Over 100 samples of milk were taken at a milk plant, and of this number, fifteen were picked out as showing evidence of possible contamination from utensils because of the presence of groups of organisms. These fifteen patrons were interviewed and it was found that five of the fifteen producers used milking machines, while the other ten producers were allowing the covered milk cans to set on a milk stand during the day. These patrons were then asked to rinse and dry their milk cans before placing milk in them again. The milk was tested again on the following day

TYPES OF ORGANISMS AND SIZE OF GROUPS FOUND IN MILK CANS.
TABLE II.

Can Number.	*Type Organism.*	*No. of Clumps Seen.*	*Total No. Bacteria Seen.*	*Av. Size Clump.*
113	Rods	10	1,400	140
114	Rods	10	1,800	180
115	Rods	8	320	40
	Micrococci	2	44	22
116	Micrococci	10	750	75
117	Micrococci	10	400	40
118	Micrococci	2	200	100
	Rods	8	700	88
119	Micrococci	2	60	30
	Rods	8	1,000	125
120	Micrococci	6	300	50
	Rods	4	1,600	400
121	Micrococci	5	500	100
	Rods	5	125	25
122	Micrococci	5	400	80
	Rods	5	500	100
124	Micrococci	1	200	200
	Rods	9	22,000	2,444
125	Micrococci	1	100	100
	Rods	9	2,400	266
127	Micrococci	5	4,800	960
	Rods	5	9,000	1,800
128	Micrococci	3	300	100
	Rods	7	500	71
131	Micrococci	1	150	150
	Rods	9	2,500	277
133	Rods	10	26,000	2,600
136	Rods	10	1,200	120
137	Rods	10	800	80
138	Rods	10	650	65
144	Rods	10	1,500	150
145	Rods	10	1,100	110
146	Rods	10	3,000	300
147	Rods	10	5,000	500
150	Rods	10	2,300	230
153	Micrococci	5	1,000	200
	Rods	5	120	24
154	Micrococci	6	500	83
	Rods	4	850	212
157	Micrococci	1	150	150
	Rods	9	350	39
158	Rods	10	27,000	2,700
Summary:				
	Micrococci	65	9,854	151
	Rods	215	113,715	528
Total		280	123,569	441

and all ten producers brought in milk with a low bacteria count and which showed the absence of groups. Two of the five producers using milking machines brought in milk the following day which showed a low bacteria count and the absence of groups. The other three producers who used the milking machine brought in milk the following day showing as many large groups as were seen in the previous samples. This would indicate that these three producers did not take the proper care of their milk cans or milking machines. The absence of groups would indicate that all of the other producers took proper care of their milk cans after receiving them from the milk station.

These results would tend to show that one of the greatest sources of milk contamination is the dairy utensil and the direct microscopic method is valuable in determining this fact.

DISCUSSION

Mr. Kilbourne: I have found machine-drawn milk to be much higher in bacteria in nearly all cases. The percentage of destruction of bacteria of hand-drawn milk is far greater than with machine-drawn milk.

"Luck whines, Labor whistles."

CONTAGIOUS ABORTION

Dr. G. H. Grapp, *State Dairy Inspector,* Baltimore, Maryland

This disease, which was carefully investigated, first by Professor Nocard of Alfort, and afterwards by Professor Bang of Copenhagen, may be regarded as a specific uterine catarrh, determined by a definite species of bacterium.

Contagious abortion of cows, it was estimated a few years ago, caused an annual loss of $20,000,000, but since it has continued to spread rapidly and widely throughout the country.

In economic importance the disease is second only to tuberculosis and is fast approaching first place. Formerly confined almost entirely to dairy cows, it has now spread to the beef herds upon the range where the losses are proving especially severe. It is imperative that the stockmen as well as dairymen awake to the seriousness of the situation and combine for a systematic campaign against the disease.

It often affects large numbers of animals in one district or on one farm and causes very serious loss. It is conveyed from cow to cow, either by the bull or by litter or utensils which have been soiled by the uterine discharge of an infected cow. As in many other infectious disorders, one attack of this disease seems to confer a certain immunity, and although some cows become sterile after aborting two or three times, they acquire relative immunity so that they conceive and carry their calves the full time. This is probably why epizootic abortion usually ceases after some years in herds which are kept isolated and do not receive fresh recruits.

The germ of epizootic abortion is a very small bacterium, which strains well with Löffler's Methylene Blue. When massed together these bacteria resemble cocci, but isolated specimens are seen to be true bacteria containing one, two, or occasionally three roundish elongated deeply stained granules. They do not stain with *Gram* and are nonmotile.

These bacteria exhibit remarkable vitality. Bang relates cases which seem to prove that they may exist within the uterus for at least fourteen months, and in the uterine exudate outside the body for at least seven months, even at comparatively low temperatures.

SYMPTOMS

The signs of approaching abortion are usually those which precede normal calving, with the exception that they are premature. Two or three days before abortion there will be swelling of the udder ("making bag"), swelling of the external genitals, and the appearance of a mucoid or mucopurulent, odorless discharge from the vagina. These symptoms may not, however, always appear, and abortion may occur without warning. In young animals and in those aborting for the first time the abortion usually occurs at an early period, and the fetus, surrounded by the intact membranes, is expelled. This may occur in the third or fourth month of pregnancy and may pass unnoticed because of the smallness of the fetus and the absence of any disturbance in the health of the cow. It may then be thought that the cow had failed to conceive. On the other hand, where abortion takes place in the seventh or eighth month of pregnancy retained afterbirth is a common occurrence, and the act is accompanied by restlessness and pain. In some cases pregnancy may continue almost to full term and the calf may be born alive but weak and may soon die. In herds where the disease is known to be present these cases too should be considered as abortions.

Following abortion there is a characteristic dirty, yellowish-gray, flaky, and at times bloody discharge, which may persist for two weeks or more. If the membranes are retained their decomposition may cause blood poisoning and death, or if the cow is able to survive, permanent changes may result which render her permanently sterile. If proper treatment is given promptly, these changes frequently may be prevented and the breeding function preserved to the animal.

In practically all cases of abortion disease, if the affected animals were killed, a variable quantity of a yellowish to dark brown fluid, characteristic of this disease, would be found separating the fetal and maternal membranes. The lining membrance of the uterus is usually swollen, hemorrhagic and roughened, and in some cases may show areas of decomposition. The cotyledons or so-called "buttons" are most severely affected, frequently being pale, soft, decomposed, and surrounded by exudate. The membranes may be thickened and leathery in appearance. Somewhat rarely the fetus may be retained and dries up to form a mummy. If infection with pus-producing germs follows abortion and persists for a considerable time, the walls of the uterus may become thickened, and the ovaries diseased, and permanent sterility results.

If abortion is not complicated by retained afterbirth or sterility, it does not markedly affect the health of the individual animal. The act of abortion is not accompanied by any disturbance in condition other than is seen in normal calving. The cow continues to eat and act normally, the discharge soon ceases, and she may soon breed again and afterward produce a living calf. Consequently, the tendency among owners has been to assign other reason than infection for the first few abortions, either because of lack of knowledge of the disease or because they were loath to believe that it had gained entrance to the herd. As the disease develops slowly, not much attention usually is given to the first cases; the cows are neglected, the proper sanitary measures are not employed, and the infection is disseminated throughout the herd. This may continue until a perfect storm of abortion, with all of its attendant conditions of retained afterbirth, sterility, and weakling calves, compels attention. If the owner, knowing the danger, had taken proper precautions with the first cases, an outbreak might have been avoided. In view of the insidious nature of the disease and the difficulty of tracing its path of introduction, it is always advisable to regard an abortion as of the contagious variety and to take ample precautions.

On post-mortem examination one finds between the mucous membrane of the uterus and the fetal envelopes an abundant odorless exudate, dirty yellow in color, somewhat thin, pultaceous, slimy or lumpy in character. Under the chorion is found a thin, clear, gelatinous substance contained within the fine connective tissue lying between the chorion and allantois. The umbilical cord is often œdematous. All these exudates contain the specific minute bacterium.

The above exudate forms the peculiar dirty, reddish-yellow, slimy, flocculent, pus-like odorless fluid which escapes from the vagina during or immediately after the act of abortion. The results of infection of the uterus with Bang's bacterium may be delayed for a considerable time. In two cases when he injected pure cultures into the vagina of pregnant cows no apparent local results had been produced at the end of thirty-three and thirty-five days respectively, when the cows were slaughtered, but in the case of two other pregnant cows, inoculated three months after conception, signs of abortion became apparent, and one cow in fact aborted in about ten weeks. Post-mortem examination revealed the characteristic local change and microscopical and cultural preparations clearly established the presence of the specific organism. Although the sexual organs form the usual channel of infection, it seems possible that the organism may in some cases enter the body through the respiratory or digestive tract.

TREATMENT

This condition is chiefly of a prophylactic character. Bulls which have served cows belonging to herds known to be infected should not be allowed to cover healthy cows. They should undergo careful local disinfection and for a time be withdrawn from service. Cows which show signs of impending abortion should at once be removed to a separate shed.

The fetus and its envelopes should be buried or burnt and the person who attends the diseased cow should be prohibited from entering the common cow-shed. When space does not admit of this, the affected cows should be removed as far as possible from those still healthy and placed in a separate row. When they abort the afterbirth should be removed by hand and the uterus daily washed out with some non-irritant but effectual disinfectant. Even after apparent recovery a period of probation should elapse before the cow is again put to the bull. The genital organs and vagina of the still healthy animals may also be irrigated with a disinfectant solution in order, if possible, to ward off infection.

For disinfecting the channels and floors of the stable quicklime will be found clean, non-odorous, cheap and effective.

In dealing with this disease one must always bear in mind the great vitality of the bacterium, the relatively long time it may persist, either in the animal's body or in the infected sheds, and the considerable period which may elapse before its effect becomes evident. The same or a similar organism seems capable of producing abortion in sheep and mares.

HERD MANAGEMENT

Three principal lines of treatment are employed in combating abortion. First, herd management, including control of breeding, plays an important part. It has been the practice of some owners to sell aborting cows. This practice is not only economically wrong but it does not serve to eradicate the disease. It has been pointed out that there is a tendency toward immunity, and more than half of the affected cows do not abort a second time. It would seem the part of wisdom, then, to keep the aborting cow, provided she is otherwise profitable enough to warrant the added expense, and by proper treatment to restore her to usefulness. Such a cow, having acquired immunity, would be more valuable in an infected herd than a susceptible animal, which would in turn abort. Moreover, when a man sells a cow he is often under the necessity of replacing her, and if he purchases from a clean herd the new cow will be susceptible. He has not eliminated the infection from his herd or premises, and consequently the newcomer will contract the disease. It has been demonstrated that thus to introduce susceptible animals into an affected herd is one means of perpetuating the disease. If, on the other hand, he purchases animals of unknown origin, he may be buying some other man's aborters, or animals that for some reason are less valuable than his own, and he is no better off than before. It is becoming increasingly difficult to purchase good breeding animals, and in view of the foregoing facts an owner should hesitate to dispose of a valuable animal because she aborts. Unless the aborting cow is sent to slaughter she is purchased by some unsuspecting person and may be the means of introducing a contagious disease into one more herd. This may be considered smart practice by some, but it is, of course, dishonest. Already laws are contemplated for the suppression of this abuse, which is having a disastrous effect.

It is sometimes necessary to introduce new blood for the purpose of building up a herd, the owner of pure breds desiring new blood lines and the owner of grades wishing to grade up his herd by the use of registered sires. It is unsafe to purchase mature animals, unless the purchaser can be sure that they are free from disease. A better practice is to purchase the new animals as calves, whether male or female, and raise them in an environment where there is no possibility of contamination.

Great care should be used in purchasing cattle, and cows not known to be free from disease should be kept in separate quarters until this point is determined. If a herd bull is not kept, then great care should be exercised to know that the animal used to serve the cows is free from disease and to see that he is properly treated, as hereinafter recommended, both before and after service.

It is assumed that owners desire to improve their herds. That being the case, the calves are the most valuable product of the herd, as improvement comes only through selection of the offspring of the best individuals properly mated. There is another reason for retaining the calves. Recent observations seem to indicate that calves born in affected herds and raised in that environment have a tolerance for the disease and are less liable to abort than heifers from free herds. This has been shown in the case of one large herd which has been under observation by the Bureau of Animal Industry for more than nine years. During the years that the herd was being replenished by purchase abortions were frequent, but that practice was discontinued, and the heifer calves born in the herd have been raised. Since that time abortions have progressively decreased, until at present losses have practically been eliminated, although some of the cows continue to react to the tests. Thus a herd immunity seems to have developed as the result both of keeping the aborting cows and raising the calves. Therefore it seems safest for a herd owner to raise his own calves and avoid bringing in new infection.

The proper handling of cows in advanced pregnancy plays an important part in the production of healthy calves. The cow should be withdrawn from the herd about one month before calving, and placed in light, clean, comfortable quarters. Every well-equipped establishment should have a maternity stable built to suit the size of the herd. It should be constructed of material—preferably cement—that will permit of thorough disinfection, and should have the maximum of sunlight and adequate ventilation. Individual box stalls are desirable. The stalls should be thoroughly disinfected and whitewashed before use, and thereafter kept bedded with clean straw. Some authorities recommend that an antiseptic bath be given the cow before she is placed in the new quarters, and in addition they douche the vagina two or three times a week with mild, non-irritating antiseptics. This practice, if consistently followed, will tend to prevent the diseases of young calves, such as white scours and calf pneumonia, and will repay for the effort expended in valuable calves saved. The feeding of the pregnant animal is also important. Constipation at this time should be avoided, and laxative feeds, such as bran, oil meal, silage, roots, or other succulent feed should be given.

The isolation of aborting animals is a feature of herd management which is of the utmost importance. The aborting cow contaminates with her discharges the stable or the pasture, and the infection is then transmitted to the healthy cows in various ways. Removing the discharging cow minimizes the chances of infection for the susceptible animals. Isolation does not mean neglect. The isolated cow should receive prompt, thorough and intelligent treatment if she is to regain her usefulness. Experience has shown that sterility may often be prevented by this course.

Whenever it becomes necessary to separate diseased and healthy animals, it is important that precautions be taken to prevent carrying infection, on clothing or shoes, from the diseased to the healthy cows. If it is not practicable to provide a special attendant, then by putting on rubber boots and a linen duster, or suit of overalls which can be kept clean, and are removed as soon as the special work has been finished, it would be possible to avoid spreading the disease. The boots should be washed with strong antiseptic on leaving the inclosure. The isolated cows should be attended to only after the work with the healthy animals has been completed.

DISINFECTION OF PREMISES

A second line of prevention consists of the disinfection of premises. It is one of the best known of all facts connected with preventive medicine that dark, damp, poorly ventilated buildings in which filth, dust, and litter have been allowed to accumulate, harbor and transmit the germs of contagious diseases. On the other hand, stables so constructed that filth cannot accumulate, that are well drained, well ventilated, and flooded with sunlight, seldom act as breeding places for disease. Proper construction, then, is of considerable importance in maintaining a healthy herd.

Chemical disinfectants are also used to good advantage in controlling disease. The following directions for their use are given.

1. Sweep ceilings, side walls, stall partitions, floors, and other surfaces until they are free from cobwebs and dust.

2. Remove all accumulations of filth by scraping. If woodwork has become decayed, porous or absorbent it should be removed, burned and replaced with new material.

3. If the floor is of earth remove 4 inches from the surface, and in places where it shows staining with urine a sufficient depth should be removed to expose fresh earth. All earth removed should be replaced with earth from an uncontaminated source, or a new floor of concrete may be laid, which is very durable and easily cleaned.

4. The entire interior of the stable, especially the feeding troughs and drains, as well as milking stools and all other implements, should be saturated with a disinfectant, as liquor *cresolis compositus* (U. S. P.) or carbolic acid, 6 ounces to every gallon of water in each case. After this has dried, the stalls, walls, and ceilings may be covered with whitewash (lime wash), to each gallon of which should be added 4 ounces of chlorid of lime.

5. All refuse and material from the stable and the barnyard should be removed to a place not accessible to cattle or hogs. The manure should be spread on fields and turned

under. In addition the yards should be disinfected by sprinkling liberally with a solution of copper sulphate, 5 ounces to a gallon of water.

The best method of applying the disinfectant and the lime wash is by means of a strong spray pump, such as is used by orchardists. This method is efficient in disinfecting against most of the contagious and infectious diseases of animals, and should be applied immediately following any outbreak, and as a matter of precaution it may be used once or twice yearly.

6. It is important that arrangements be made to admit a plentiful supply of sunlight and fresh air by providing an ample number of windows, thereby eliminating dampness, stuffiness, bad odor, and other insanitary conditions. Good drainage is also very necessary.

Before closing my paper I wish to call your attention to the following abstracts from reports of Dr. E. C. Schroeder and W. E. Cotton:

"Several years ago, at the Experiment Station of the Bureau of Animal Industry at Bethesda, Md., we made a series of tests relative to the occurrence of virulent tubercle bacilli in ordinary city milk, with special reference to their intermittent occurrence in milk vended by dairies from which tuberculous samples had been obtained with previous tests. In the course of these investigations many guinea pigs were given inter-abdominal injections of milk and afterwards kept alive somewhat longer than is commonly believed to be necessary for well-marked lesions of tuberculosis to develop. When the guinea pigs were eventually killed some of them showed lesions on post-mortem examination that could easily be mistaken for tuberculosis, but which our experience with tuberculosis in guinea pigs helped us to distinguish as probably another disease, especially as careful microscopic examinations failed to reveal acid-fast bacilli, which are, as a rule, abundant and not difficult to find in the tuberculous lesions of guinea pigs.

"We soon discovered the disease to be transmissible through subcutaneous inoculations of affected tissue from guinea pig to guinea pig, but our efforts to cultivate a supposedly existing specific micro-organism and our attempt to find an organism in the lesions under the microscope were unsuccessful.

"After our interest in the subject had somewhat abated it was actively restimulated during a study concerning the influence of tuberculin injections on the elimination of tubercle bacilli, with milk and otherwise, from the bodies of tuberculous cattle, by discovering that the milk of a tuberculous cow at the Experiment Station caused the mysterious disease when it was injected into guinea pigs that were afterwards permitted to live six weeks longer. We collected milk from this cow repeatedly under the strictest conditions to exclude its infection from any source but the interior of her udder, and this milk proved to be fully as infectious as that collected earlier with less minutely elaborate precautions.

"We again tried to isolate a specific micro-organism, and as no growth appeared in the numerous tubes of culture media inoculated with small fragments of tissue from affected guinea pigs, we assumed that we were dealing with an organism that either could not be cultivated artificially or that would not grow in the culture media we had used; hence, as the disease was particularly severe in its action on the livers of guinea pigs, we concluded to try a culture medium to which bile had been added.

"Probably the most remarkable thing about the bacillus is its expulsion from the bodies of apparently healthy cows with their milk, and hence it is desirable to show that this is really a fact and not a supposition backed by doubtful evidence. First, the bacillus was repeatedly proved to occur in milk, collected with the utmost precautions against extraneous contamination, from a number of cows that had previously been found to be infected, and, second, its presence in the milk and in tissue from the udder and supramammary lymph gland of one cow was proved in the following manner:

"Station cow No. 220, which had been known for some time through the injection of her milk into guinea pigs to be infected, was killed. Immediately before her death her udder was carefully washed and disinfected and her teats closed with strong ligatures, and directly after her death her udder, including the supramammary lymph glands, was cut from her body. The skin was then dissected from the udder and the entire denuded surface thoroughly scorched with the flame of a large Bunsen burner; the flamed surface was next incised with a sterile knife and milk collected in sterile pipettes, through the incisions, separately from each quarter, at points well removed from the teats. With equal precaution fragments of tissue were taken from one front and one hind quarter of the udder, from the supramammary lymph gland, and from the liver and the spleen; and this material was inoculated subcutaneously into 15 guinea pigs as follows:

"One guinea pig, milk from right front quarter of udder; result positive.

"One guinea pig, milk from right hind quarter of udder; result negative.

"One guinea pig, milk from left front quarter of udder; result positive.

"Two guinea pigs, milk from left hind quarter of udder; result negative.

"Two guinea pigs, tissue from front quarter of udder; result positive.

"Two guinea pigs, tissue from hind quarter of udder; result negative.

"Two guinea pigs, tissue from supramammary lymph gland; result positive.

"Two guinea pigs, tissue from spleen; result negative.

"Two guinea pigs, tissue from liver; result negative.

"What the real significance or practical importance of this bacillus, the presence of which in milk appears to have escaped detection in the past very likely because of the difficulties associated with its artifical cultivation and the length of time it requires to cause well-marked lesions in guinea pigs, may ultimately prove to be we are unable to say. But no one can doubt that the common occurrence of a microorganism, pathogenic for any species of animal, in an article of food as widely and as extensively used as milk, deserves that we should study it with the greatest care, especially after it has been shown that it is an organism which has the udders of apparently healthy cows as its normal habitat, and which therefore can not be certainly excluded from milk, no matter how much cleanliness and care are used in its production. In this sense the germ forms another link in the long chain of facts that point unmistakably to the proper pasteurization of all milk before it is used as food as a measure essentially necessary for the protection of public health. .

"Dr. John R. Mohler and Dr. Jacob Traum state that probably the most important and comprehensive facts which have been demonstrated in connection with this disease are the discovery that the abortion bacillus is eliminated with the milk of infected cows, and, secondly, that this bacillus is found in the tonsils of children, presumably as the result of drinking such infected milk. The frequency of the presence of B. abortus in a food product like milk and the ability of the organisms to produce lesions in guinea pigs, pregnant cows, and other animals led at once to the thought that B. abortus might prove pathogenic for human beings. As a result our endeavors were directed along three lines: First, to obtain sera promiscuously from human beings, and in case of positive reactions to learn more about the person whose serum showed the reaction; second, to obtain samples of milk from women in order to examine it for the bacillus; and third, to obtain tonsils from milk-consuming children at the various children's hospitals and inoculate such material into guinea pigs. Material for these lines of work was not forthcoming as fast as desired. Out of 42 sera from human beings no positive results were obtained by either the complement-fixation or agglutination tests, although in similar tests made by Larson 3 out of 100 specimens of sera gave positive results. No samples of human milk have thus far been obtained. Out of 56 tonsils and adenoids inoculated into guinea pigs, tonsil No. 3 produced nodular areas in the liver, but cultures from this organ remain sterile. Tonsils from the case No. 8 inoculated into 2 guinea pigs showed in one of them after 3 months distinct lesions of infection in the liver, spleen, and testicles."

This further strengthens my belief that proper pasteurization of all milk before it is used as food is a measure essentially necessary for the protection of public health.

LITERATURE

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"Health lies in labor, and there is no royal road to it but through toil."

THE SUPERVISION OF MILK PASTEURIZATION IN MINNESOTA

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Minneapolis, Minn.

The State Board of Health, in 1917, authorized an investigation of conditions relating to pasteurized milk used for human consumption throughout the State. The Division of Sanitation was selected to undertake the major part of this investigation because it was equipped with the engineering and laboratory facilities necessary for carrying on such work. At that time there were about fifty pasteurization plants in operation in the State. Milk was labelled and sold as pasteurized milk in all but seven cities with a population of 5,000 or more, and in these cities it represented from 50 to 90 per cent of the entire supply. Investigations were made at thirty-two plants, and in practically every instance the pasteurization of milk as carried on at that time had little, if any value from a health point of view. Five plants were found labelling their product "pasteurized milk" when they did not own any pasteurizing apparatus.

The detail investigation at each pasteurization plant, conducted during this survey, included a study of the building in which the plant was housed; the plant equipment, involving a careful examination for mechanical defects; and the efficiency of the process in accomplishing satisfactory pasteurization of the milk as determined by analytical examinations of the milk before pasteurization and during the various steps in the process. A careful study was also made of the methods of operation in use at each plant. Information was also collected relative to the supervision exercised by local authorities in the various communities in which these plants were located.

The investigation of the buildings in which the various plants were housed revealed the fact that the buildings were improperly planned and constructed for housing pasteurizing apparatus and other milk plant equipment. Some of these buildings were improperly lighted and ventilated; had floors and walls constructed of material, or in such a manner, that they could not easily be cleaned; had unsafe or inadequate water supplies; had unsatisfactory sewerage and waste disposal facilities; lacked toilet and lavatory facilities, and were not effectively screened against flies.

The study of the pasteurizing apparatus in use at the various plants brought out the fact that much of the equipment was incorrectly designed and constructed for the purpose of pasteurizing milk for human consumption, and that it was oftentimes arranged in an insanitary and impractical way. Many mechanical defects were found in the apparatus which could be eliminated, thereby insuring a safer product from a health point of view. These defects included mechanical difficulties in heating the milk to a proper temperature, in holding it at the required temperature for a sufficient length of time, in preventing the contamination of the treated or partially treated product, at some step in the process, with raw milk, partially treated milk, or with other contamination introduced from some external source during the treatment or to the finished product.

In addition to the unsatisfactory conditions associated with the housing of these plants and their equipment, it was found that many operators did not understand the purpose of pasteurization, the principles involved in the process, or the methods of operating and caring for pasteurizing apparatus. The employees at the plants were not given a medical examination to determine whether they were chronic carriers of infectious diseases.

This investigation revealed the fact that the control of pasteurization and the subsequent handling of the finished product was almost negligible at that time; the State had no law or regulation governing pasteurization, and only a few municipalities had local ordinances which gave them authority over the distribution of this class of milk.

To summarize briefly the results of these investigations, it was found that the pasteurization of milk throughout the State as conducted at that time meant practically nothing from a health point of view. It was practiced largely to improve the keeping quality of the milk, and for advertising purposes. This condition should not be charged entirely against the milk dealers, for the State had not then laid down any requirements for the pasteurization of milk, and only a few municipalities had realized the importance of establishing local control. The continuation of this condition would eventually have resulted in the loss of public confidence in the process as a health measure in the State.

With this information available, the State Board of Health decided that if the process of pasteurization as applied to milk for human consumption was to have any value as a safeguard against disease, some method of control must be adopted, and as a result the following steps have been taken to improve the unsatisfactory conditions which were found to exist.

In order to establish a uniform requirement for the pasteurization of milk throughout the State, a regulation was passed by the State Board of Health defining pasteurization, and requiring the approval of plans and specifications on all new installations, or changes in existing installations, of pasteurizing apparatus. General requirements governing the construction and operation of pasteurization plants were outlined, which established a uniform basis for the enforcement of this regulation.

The fact that the plant owners and operators did not always understand the purpose of pasteurization as a protection against disease, the principles involved in the process, or the methods of operation and care of their pasteurizing apparatus, demonstrated the need for establishing some course of training for educating these people. Arrangements were made with the Division of Dairy Husbandry of the Department of Agriculture, University of Minnesota, to give a course for training plant operators, in cooperation with the State Board of Health.

To further the establishment of local control of pasteurized milk and its subsequent handling in municipalities in the State, a proposed milk ordinance was drafted and approved by all departments of the State Government interested in the local control of milk supplies. This ordinance is adaptable to cities in the state not in Class 1, which would include all cities except Minneapolis, St. Paul, and Duluth. The requirements of this ordinance governing pasteurization conform with the regulations of the State Board of Health.

As a result of these efforts to establish supervision of pasteurization in the State, pasteurization plants have been investigated and recommendations made for correcting defects in construction and operation in all plants where it was found to be necessary. These recommendations have been carried out in all plants under the jurisdiction of the State Board of Health, or the plants have been ordered to discontinue labelling their products "pasteurized milk." Follow-up investigations are being made at irregular intervals to determine whether the plants are being operated in a satisfactory manner, and to assist the authorities where local control has been established.

Plans of new pasteurization plants are being examined and approved in accordance with the detail procedure established for carrying out the regulations of the State Board of Health.

Provision has been made for the medical examination of employees who are engaged in the pasteurization or bottling of milk, or in the cleaning or sterilizing of milk apparatus and utensils at the plant, in an effort to locate chronic carriers of infectious diseases. This work is done under the direction of the Division of Preventable Diseases of the State Board of Health.

Short courses for pasteurization plant owners and operators have been given at the University of Minnesota for the past two years. These courses have consisted of lectures, demonstrations, and visits to pasteurization plants, including briefly the study of the process of pasteurization as a health measure, the important essentials in the construction and operation of pasteurizing apparatus, and general practical milk plant problems. These courses have been well attended and have resulted in an apparent improvement in the personnel of pasteurization plants throughout the State.

A campaign has been carried on to encourage municipalities to pass the proposed milk ordinance approved by the various state departments, which establishes local control of the milk supplies under state supervision. Talks and illustrated lectures before interested organizations, and city and village councils, have proved a very effective way of accomplishing results. The results of this work may be understood when it is appreciated that only two cities in the State, exclusive of cities in Class 1, had effective local supervision when this work began, while at the present time the proposed ordinance has been passed and is in force in 85 per cent of the cities in the state with a population of 5,000 or over.

The success which has been obtained in Minnesota in the improvement of the pasteurization of milk from a health point of view may be attributed to a number of reasons, the most important of which are: (1) the initial survey which provided information concerning the existing status of pasteurization in Minnesota, and formed an intelligent basis for action, (2) the carefully worked out plan for correcting the unsatisfactory conditions which were found, and (3) the cooperation which was received from all parties concerned, including municipal officials, local organizations interested in this problem, and the milk dealers.

"The man who is eternally watching the clock never becomes the man of the hour."

MILK REGULATION BY A MILK REGULATION BOARD.

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

Prior to the passage of the act creating the Milk Regulation Board by the General Assembly of 1917, Connecticut had to get along with such statutory provisions as had been adopted from time to time for the regulation of the production, care, and distribution of milk. These laws were often grudgingly passed on account of the large percentage of farmer members of the Assembly. It was extremely difficult to secure the passage of real constructive legislation for a better milk supply. These country members were all responsible to their constituents for their behavior while in Hartford at the sessions of the General Assembly.

The rulings and enforcements of these statutory provisions were left to the Dairy and Food Commissioner to work out and very often he was considered an autocrat when he honestly tried to accomplish results which would better the milk supply. Section 2485 of the General Statutes entitled "An Act concerning the Production and Marketing of Milk and Cream," creating the Milk Regulation Board, reads as follows:

Sec. 2485. Milk Regulations Board. The dairy and food commissioner, the attorney-general, the commissioner of health, the secretary of the State Board of Agriculture and the secretary of the Connecticut Dairymen's Association shall constitute a milk regulation board. Said board shall keep a record of its proceedings and may appoint officers and prescribe their duties. Said board shall have an office with the dairy and food commissioner."

Section 2486 defines the powers of the board as follows:

"Sec. 2486. Regulations. Said board, after public hearing, notice of which shall be given by publication in a newspaper published in each county at least two weeks before such hearing, may make, amend, repeal or suspend rules and regulations concerning the inspection of dairies, the production, care, handling, marketing or sale of milk or cream within the State, to protect the public from the use of milk or cream which is insanitary or detrimental to public health. Such rules and regulations shall take effect twenty days after such publication."

Section 2487 provides for appeals to the milk regulation board from orders issued by the city or local authorities. The method of appeal is set forth in the Bulletin No. 7.

Section 2488 provides for appeals from orders, rules or regulations of the milk regulation board to the Superior Court for the county wherein such person resides, and is fully set forth in the above mentioned bulletin.

Section 2489 provides that no person shall engage in the production, care, marketing or sale of milk or cream unless he shall have complied with the rules and regulations of said board and the provisions of sections 2485 to 2492 inclusive.

Section 2490 provides for prohibition as follows:

"Sec. 2490. Sale and Distribution Prohibited.—The dairy and food commissioner, or his deputy, shall prohibit the sale or distribution of any milk or other dairy product which is unsanitary or detrimental to health, and which has not been produced, cared for or handled in the manner prescribed by said sections and by the rules and regulations of said milk regulation board."

Section 2491 provides for local regulations as follows:

Sec. 2491. Local Regulations not affected.—No provisions of sections 2485 and 2492 inclusive shall affect the authority of any town, city or borough to enact ordinances or by-laws for the control, regulations, sale or distribution, within its limits, of milk which is detrimental to public health."

Sec. 2492 provides for penalties; for violation of any provisions of the foregoing sections or rules or regulations established by the Board or any order of the Dairy and Food Commissioner, the fine of not more than One Hundred Dollars or imprisonment not more than thirty days or both, shall be imposed.

The first rules and regulations were adopted by the board on Oct. 8, 1917, in accordance with the provisions of section 2486. The first rule provides for the registration of producers and it was thought that it might be at least five years before we could get a real registration. But we have been using every effort the last three months to get as near a complete list as possible and feel that we are going to succeed in four years instead of five. This registration must be made annually during the month of October and has just been completed, but not checked as yet.

During the latter part of 1919 the board took up seriously the preparation of rules and regulations for the pasteurization of milk and cream. There was no intention to compel pasteurization, and I feel very sure that if we had possessed the power and should have used it to compel pasteurization our milk regulation board would have been legislated out of existence by the next session of the General Assembly. A public hearing was called as prescribed in Section 2486 in Hartford, Feb. 18, 1920, and adjourned to the 20th at New Haven at the solicitation of those present to accommodate the people at the other end of the State. There was a large attendance at both places and considerable animated discussion. The board, on March 3, 1920, adopted the regulations found on pages 19-23 of our Bulletin No. 7. On March 10, 1921, the board, after two hearings held in accordance with Section 2486, adopted specifications for certified milk and cream as found on pages 24-27 of Bulletin No. 7; also specifications for Grade A milk or cream as found on pages 27-29; also specifications for Grade A pasteurized milk or cream as found on pages 30-31 of the same bulletin.

This completes the regulations to date, but undoubtedly more hearings will be held later as necessity arises. After an experience of four years I feel justified in saying that I am more than pleased with the results and it is a real pleasure to have such a set of rules with which to work, formulated after a hearing where producer, dealer and consumer had an opportunity to be heard.

The enforcement of these regulations required a larger force of inspectors, but after these were appointed I felt that the adoption of a score card was one of the first necessities. We formulated and adopted a score card, one for dairy farms and one for milk plants, and they have worked out very satisfactorily. Previous to the adoption of these regulations, inspectors in their dairy work would try to get compliance with the Commissioner's orders, which were often called arbitrary, and sometimes much stronger language was used. Now, the inspectors can refer to Bulletin No. 7 of our Department whenever an argument occurs, and this bulletin contains all the regulations, adopted after a public hearing and held to be fair and just. It is the duty of the Commissioner and his deputies to see that the rules and regulations are complied with.

"No laws, however stringent, can make the idle industrious, or the thriftless provident."

PROGRESS REPORT OF COMMITTEE ON SERVING MILK IN THE SCHOOLS

DR. H. A. HARDING, *Chairman*

During the past few years there has developed remarkable interest in the use of milk by children. The dairy inspector is interested in this movement; first, because he is expected to provide a milk supply which is fit to be served, and, second, because the movement has important health significance.

Your Committee has experienced difficulty in arriving at the facts regarding the origin and aims of the milk serving idea and has succeeded in accumulating only a limited amount of information regarding results from such feeding. The Committee is of the opinion that the milk inspectors should take an active part in this movement in their own localities and should see that the milk served is of the highest quality.

The beginnings of this movement appear to date back to the open air schools developed in connection with the fight against tuberculosis. The program of these schools included fresh air, special food and rest at the noon hour. From the first milk was an important part of the lunch, due in part to the ease with which it could be served. In practically every instance the open air school produced distinct improvement in the health and in the mentality of the pupil.

With the abrupt rise in living expenses accompanying the war the school lunch came to popular notice. While emphasis was placed upon a hot lunch this often included milk.

A little later the nation-wide movement toward weighing and measuring children brought out the startling information that at least one-third of the children are under weight for their height, and this fact suggested that they had not been properly fed.

This indication of a general deficiency in the American diet prepared the public mind for the findings of Mendel, McCollum and others that certain important items in the diet had been entirely overlooked. These food substances, called vitamines, are not uniformly distributed in the material ordinarily used as human food but may be most readily obtained in considerable quantities in milk.

There seems to have been this steady accumulation of influences leading in a common direction until finally the idea of furnishing the growing children with more milk took form and swept the country from Boston to the Golden Gate like an epidemic. Unlike most epidemics, no harmful effects have followed in its wake and much good has undoubtedly been done. Practically the only danger in connection with this movement is that latent in some of the over-enthusiastic and almost hysterical claims made by some of its supporters.

The immediate object of this increased feeding of milk to children was to bring the weight of the children up toward or to the standard amount. Accordingly the results of the effort have been expressed in pounds of weight added by the children, in the few instances in which the results have been reduced to statistical form. Compilation of such results was kindly furnished by Miss Jessie Hoover, of the Dairy Division, Federal Department of Agriculture.

It will be seen by an inspection of this data that the increase in the weight of the children was surprisingly large considering the additional amount of milk consumed. This is well illustrated by the report from Cumberland, Maryland, where the 42 children during nine weeks consumed a total of 330 pounds of solid food in the form of milk and showed a total gain in weight of 149 pounds, or roughly a gain of a pound of weight for each two pounds of food consumed. These results suggest that the stimulative action of the milk fed lies, not so much in the food value of the milk, though this is considerable, as in the fact that the milk supplies elements which are deficient in the ordinary diet. The furn-

RESULTS OBSERVED FROM FURNISHING MILK TO CHILDREN.

State.	*Place.*	*Time.*	*No. Children.*	*Amt. Milk Given.*	*Total Gain.*	*Average Gain per Child.*
Md.. . .	Cumberland	9 wks.	42	1 pt. daily	149-lbs.	3.5 lbs.
Mass. . .	Springfield	5 wks.	20	1 pt. daily	75¼ lbs.	3¾ lbs.
Mich. . .	Oakland Co.	4 wks.	8		49 lbs.	6⅛ lbs.
Mich. . .	Wayne Co.	2 wks.	37	1 pt. daily	153 lbs.	4.1 lbs.
Mo. . . .		6 wks.	15	1 pt. daily		½ to 5 lbs.
N. Car. . .	Winston-Salem W. End School	6 wks.	20	1 pt. daily	58 lbs.	2.9 lbs.
N. Car. . .	Winston-Salem W. End School	4 wks.	8		11.2 lbs.	1.4 lbs.
N. Car. . .	Granville School	6 wks.	24		72 lbs.	3 lbs.
Ohio . . .	Akron Mason School Nutrition School	2 mo.	1000		67% of children	
Ohio . .	Ottawa	6 wks.	80	1 pt. daily	85% of children	
W. Va. .	Wheeling	5 wks.	800	1½ pts. daily	2½%	
Ohio . .	Warren		25			
Ind.. . .	Evansville Clarmont School	2 mo.	20	1 pt. daily	75 lbs.	3¾ lbs.

ishing of these deficient elements appears to facilitate the utilization of the other portions of the diet with the result that the weight of the child approaches the normal amount and all of the physical and mental activities tend to become normal.

This simple and effective method of improving the body and mind of the coming generation should especially commend itself to the milk inspectors and should receive their hearty support.

"There is nothing in the universe that I fear except that I shall not know all my duty or shall fail to do it."

PRODUCTION AND CONSUMPTION OF MILK AND MILK PRODUCTS.

DR. CARL W. LARSON, *Chief,* Dairy Division, B. A. I., U. S. Department of Agriculture, Washington, D. C.

Milk and milk products form an important part in the diet of the American people. From the child that is entirely nourished by milk, on through our total population, milk and the many products of milk are estimated to form 15 to 20 per cent of our total food. Whether this estimate is exactly correct or not, the fact remains that milk is one of our most important foods from the standpoint of amount, as well as from the vital part it takes in the nourishment of our people. It will therefore be interesting to review the trend of both the production and consumption of milk and its products.

DAIRY COW POPULATION

As a nation we lead all countries in the number of cows and in the production of milk products, still we are not the largest consumers of dairy products per capita. This is because of our large population as compared with the countries that are large consumers of dairy products. It so happens that the countries of the largest population consume relatively small quantities of milk per capita. India, however, is an exception. The number of our cows is constantly increasing, but it has hardly kept pace with the increase in population. In 1840 there were 287 milk cows per thousand population while today there are only 218. During that period there has been some fluctuation from year to year but in general the population has increased more rapidly in proportion than our dairy cows. However, our cows have been improved somewhat in their production per head, and we are today utilizing a larger proportion of the milk produced than ever before, so it may be said that our consumption of milk products has about kept up with our increase in population. The following table shows the number of cows in the United States per thousand persons.

Number of Milk Cows in the United States per 1,000 persons

1840	287
1850	278
1860	276
1870	234
1880	251
1890	264
1900	237
1910	220
1920	223
1921	218

During the period of the world war and following, our cow population fluctuated considerably. In some sections there was considerable expansion due to the improved market for dairy products and to the advantages of producing milk in those sections. In parts, as the South, for instance, where the boll weevil has been so disastrous to the cotton crop, it has been necessary to diversify the farming and there has been considerable increase in dairy cows. In some other sections such as the Middle West and Far West, where other crops have been more attractive than those grown for feeding dairy cows, we find a failure of the normal increase in dairy cattle and in some cases there is a decrease.

The following table gives the geographical distribution of increase of milk cows on farms in January, 1921, as compared with 1915.

Geographical Distribution of Increase of Dairy Cows.
1915-1921

	Increase.	*Decrease.*
10 Middle Western and Rocky Mountain States	19.3%	
13 Southern States	16.8%	
6 New England States	2.5%	
6 Middle Atlantic States	No change	
8 North Central States	7.4%	
3 Pacific States		.1%

HOW MILK IS UTILIZED

It is estimated that there is produced in this country at the present time approximately 90 billion pounds of milk, half of which is manufactured into various products. Creamery butter requires 20 per cent of the milk produced, farm butter 15 per cent, and cheese, condensed and evaporated milk, and ice cream each about 4 per cent.

The following table shows the various forms in which our milk is used. It will be seen that we have more than 24 million dairy cows whose average production is 3600 pounds of milk per annum; and that with our present population there is available 846 pounds of milk for each person, either in its original form or in the form of some of its various products.

Production and Uses of Milk in the United States, 1920.

	Quantity of product. Pounds.	*Milk used per unit of product.* Pounds.	*Total whole milk used.* Pounds.	*Per cent of total milk.*
Creamery butter . .	863,577,000	21	18,135,117,000	20.226
Farm butter	675,000,000	21	14,175,000,000	15.810
Cheese (all kinds) .	362,431,000	10	3,624,310,000	4.042
Condensed milk. . . (including evaporated)	1,578,015,000	2.5	3,945,038,000	4.400
Powdered milk. . .	10,334,000	8	82,672,000	0.092
Powdered cream . .	309,000	19	5,871,000	0.007
Malted milk	19,715,000	2.2	43,373,000	0.048
Sterilized milk. . . (canned)	5,623,000	1	5,623,000	0.006
Oleomargarine . . . (all kinds)	370,162,925	0.065	24,256,000	0.027
Milk chocolate . . .	....	....	60,000,000	0.067
Ice cream (gals.) .	260,000,000	13.75	3,575,000,000	3.987
Total milk used in manufacturing. .	....	....	43,676,260,000	48.712
Household purposes: (43 gals. per capita for 105,708,770 people)	....	....	39,091,000,000	43.599
Fed to calves: (200 lbs. per capita for 21,012,000 calves)	....	....	4,202,000,000	4.687
Waste, loss, etc. . . .	....	....	2,689,000,000	3.000
Grand total. . .	....	....	89,658,000,000	100.000

Dairy cows (including town cows)............ 24,720,000
Yield per cow.................. .... 3,627 pounds
Population of United States, 1920............105,708,770
Milk production per capita................... 846.16 pounds

MILK CONSUMPTION

The factors of supply and demand that operate with many agricultural products do not operate in the same way with milk for direct consumption. A family will purchase a pint, a quart, or two quarts, as the case may be, daily, year after year regardless of the fluctuation in the price of milk. In some cases consumption may be stimulated by a decrease in price, or decreased by an increase in price, but this does not take place to the same degree as with other products, for instance butter. The buying ability of the consumer from year to year or month to month does have more influence upon the amount of consumption than the price. This is observed at the present time in some industrial centers where salaries have been reduced relatively more than the price of milk has decreased. In the case of butter, for instance, the demand fluctuates quickly with price. A reduction of 5 cents in the price of a pound of butter, or even 2 or 3 cents, adds a wide circle of purchasers that would not buy, or at least would buy only limited quantities, at the higher price. Likewise, with an increase of 2 or 5 cents in the price of butter, the circle of purchasers decreases in a remarkably regular fashion.

It is rather difficult to estimate the consumption of whole milk for the entire country, but it is believed to be approximately 43 gallons per capita at the present time. The quantity consumed varies with the section of the country. In general there is less consumed in the South than in the North. Estimates that have been made in the cities show the consumption to be less than a pint per person per day.

During the last three or four years a number of cities have conducted milk campaigns to encourage the consumption of milk, and these have been very effective. As a result of these campaigns, a number of cities have made increases as high as 15 to 20 per cent in the amount of milk consumed, and these increases have apparently been permanent. Increasing quantities of milk are being consumed for lunch by the men in factories and shops, and the amount of milk used at soda fountains for the various milk drinks is increasing rapidly. So it may be said that in our cities, at least, the consumption of milk is on the increase.

BUTTER

Next to milk used for direct consumption, butter is our most important product from the standpoint of the amount of milk required for its production. Thirty-five per cent of all the milk produced is used in the manufacture of farm and factory butter, and it is in the manufacture of this product that our greatest waste is found. Only a comparatively small part of the enormous quantity of skim milk that comes as the by-product from the manufacture of butter is utilized as food. This condition, however, is being improved.

The trend of production is from farm to factory butter. In 1880 almost all of the butter was made on farms, but since that time factory butter has rapidly increased and farm butter decreased until now farm butter amounts to only 685 million pounds while factory butter is 875 million pounds.

The foreign trade in butter has not been a material factor in the supply and consumption, although it has affected the

United States—Imports and Exports of Butter

Fiscal June 30 year.	*General imports. Pounds.*	*Domestic exports. Pounds.*
1851	479,180	3,994,542
1860	3,278,967	7,640,914
1870	4,089,038	2,019,288
1880	487,120	39,236,658
1890	75,521	29,748,042
1900	49,791	18,266,371
1910	1,360,245	3,140,545
1911	1,007,826	4,877,797
1912	1,025,668	6,092,235
1913	1,162,253	3,586,600
1914	7,842,022	3,673,597
1915	3,828,227	9,850,704
1916	712,998	13,487,481
1917	523,573	26,835,092
1918	1,805,925	17,735,966
1919	4,131,469	33,739,960
1920	20,770,959	27,155,834
1921	34,343,653	7,829,255

price somewhat during certain years. The importations during 1914, although small as compared with the total production in this country, nevertheless were sufficient to greatly depress the market. This was immediately following the reduction in tariff. The importations fell off because of the starting of the war in Europe, and by 1919 we had changed from a net import to a considerable net export. Consumption, however, has remained nearly constant for the last several years, at about 15 to 15½ pounds per capita.

CHEESE

The American people are not cheese eaters. We consume relatively small amounts of this dairy product, and most of that is consumed by our foreign population or by persons of immediate foreign descent. Our per capita consumption has fluctuated between 3 and 4 pounds per capita for the last several years.

Unlike butter, the foreign trade in cheese is a material factor in the quantity available for consumption. In the early eighties enormous quantities of cheese were exported, but by 1910 our exports had decreased and imports increased until we were buying 10 per cent of all cheese moving in international trade. Our importations continued to grow up to the time of the war when we again became an exporting nation, but already the former condition has returned and we are now consuming more cheese than we make in this country. Our exports consist almost entirely of American cheddar cheese, while our imports are of foreign varieties such as the Italian, Swiss, Roquefort, Camembert, Edam, Gouda and a few others.

Because of restrictions during the war in many of the countries where these products are made, exports to the United States were not possible. This condition stimulated interest in production here until now many of these cheeses are being manufactured in increasing quantities in this country.

It would seem that the manufacture of cheese offers a large opportunity for the development of the dairy industry in this country. A number of the countries of Europe now use two or three times as much cheese per person as is used in the United States.

United States Imports and Exports of Cheese

Fiscal June 30 year.	*Imports. Pounds.*	*Exports. Pounds.*
1851	603,398	10,361,189
1860	1,401,161	15,515,799
1870	2,289,257	57,296,327
1880	2,737,186	127,553,907
1881	2,655,370	147,995,614
1890	9,263,573	95,376,053
1900	13,455,990	48,419,353
1910	40,817,524	2,846,709
1911	45,568,797	10,366,605
1912	46,542,007	6,337,559
1913	49,387,994	2,599,058
1914	63,784,313	2,427,577
1915	50,138,520	55,362,917
1916	30,087,999	44,394,301
1917	14,481,514	66,050,013
1918	9,839,305	44,330,978
1919	2,442,306	18,794,853
1920	17,913,682	19,378,158
1921	16,584,678	10,825,503

CONDENSED MILK

The development of the canned milk industry in this country has been rapid, and within the last ten years this product has changed from a position of relative unimportance to one in which it takes up more milk than is required for the domestic cheese manufactured. The production of condensed and evaporated milk increased from one billion pounds in 1916 to more than two billion pounds in 1919, while 1920 shows a falling off in production of half a billion pounds.

Unlike the products butter and cheese, the production has been built up very largely on the basis of foreign trade, so that in 1919 more than one-third of all the condensed and evaporated milk produced in this country was exported. Our home consumption of this product has increased rapidly during the last few years until in 1919 a little more than 11 pounds per capita were consumed in this country. There was apparently a decrease to a little more than 10 pounds in 1920. The following table of imports and exports of condensed and evaporated milk shows the enormous trade developed during the war and the large reduction in our exports during the last fiscal year. It was the dropping from over 700 million pounds of export to 260 million that has so seriously upset the whole industry during the past year. Had the nations of Europe been able to finance purchases as it was possible to finance them in the years just preceding, our condenseries would no doubt have gone on manufacturing at the same rate, and probably there would not have been this situation in the dairy industry that we went through during the last year. The closing of a great many condensed milk plants left a large volume of milk for the use of other products, and as a result we had a depression not only in the market for condensed milk, but in the market for other products.

The following table shows the enormous development in the import trade in condensed milk, and it is also interesting to note that in spite of the shortage of space for shipping and the need of food in Europe, nevertheless in the neighborhood of 20 million pounds of evaporated milk came to this country each year during the war. Nearly all of it came from Canada and Europe.

United States Imports and Exports of Condensed and Evaporated Milk

Fiscal June 30 year.	*Imports. Pounds.*	*Exports. Pounds.*
1910	588,134	13,311,318
1911	630,308	12,180,445
1912	698,176	20,642,738
1913	1,778,043	16,525,918
1914	14,599,339	16,209,082
1915	33,624,189	37,235,627
1916	18,174,505	159,577,620
1917	18,375,698	259,102,213
1918	29,926,931	529,750,032
1919	20,183,723	728,740,509
1920	19,080,642	708,463,187
1921	19,272,528	262,668,206

ICE CREAM

Another dairy product to make enormous development in recent years is ice cream. In a few years the manufacture of ice cream has grown from a little industry to one that requires 3½ billion pounds of milk to supply the fat and other solids used in the manufacture of this product. It uses about the same amount of milk as cheese and condensed milk, but as an industry it ranks second to butter. The consumption of ice cream has increased at a rapid rate and it has been estimated that in some sections of the country, and even some whole States, the consumption has doubled during the last five years.

This is an American product and the factor of foreign trade does not enter into the supply or consumption, although practically all of the ships sailing between United States and Europe are supplied with ice cream for the voyage across and return. It is estimated that at least 2½ gallons of ice cream per capita are consumed in the United States each year.

MILK POWDER

The production of milk powder is increasing steadily, but stimulation during recent years has largely been brought about by a foreign demand. The use of the product in this country, however, is growing and it would seem that the dried product is destined to have a large place in the dairy market. It has been used largely by factories in the manufacture of reconstituted milk. Its use by direct consumption for infant feeding is growing, and in some sections there seems to be a tendency to increase the use of this product in the home. There were 20 million pounds of milk powder made in 1914, 18½ million pounds in 1916, and over 50 million pounds in 1920.

"The earnestness of life is the only passport to the satisfaction of life."

METHODS OF CARING FOR MILKING MACHINE TUBES*

ROBERT S. BREED, New York Agricultural Experiment Station, Geneva, N. Y.

At a Milker Conference held at the New York Station on May 27, 1921, one of the most important points discussed was the relative value of the hot water method of sterilizing the teat cups and tubes, and the chemical method of sterilization by means of harmless chemicals such as brine and hypochlorites. Because the Station has frequently been asked to discuss its experiences in this matter, the following statement has been prepared.

The most natural thought in connection with the cleaning of any dairy utensil is that of scrubbing it, following this procedure with scalding water or flowing steam, and completing the cleaning process by drying. It is, therefore, not surprising that practically all of the early investigators of sanitary methods of cleaning milking machines (Harrison, Stocking, Stocking and Mason, Edwards, Meek, Haecker and Little, Harding, Wilson and Smith, Hoffman-Bang, Williams, Golding and Mackintosh, Burri and Hohl and others) tried this method of caring for milker tubes. Where the heat used was less than the amount necessary to kill microorganisms present, or where other sources of contamination were left uncontrolled, the results were very unsatisfactory. The bacterial counts under these conditions were usually high. Where sufficient heat was used to sterilize or to practically sterilize the various parts of the machine, the results reported are better and in several cases excellent. Thus for example, Edwards reports counts as low as 1407 and 1776 per c. c. when the tubes were thoroughly cleaned, boiled and steamed.

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Practically all of the earlier investigators who have used heat-sterilization mention the fact that the rubber parts are so rapidly destroyed as to make this method of sterilizing milker teat cups and tubes by boiling water or by steam impracticable under ordinary conditions.

With the development of the rubber industry and the development of heat-resistant rubbers for use in surgical gloves, automobile tubes and other things, this situation has changed somewhat and there are today several rubber manufacturers ready to supply rubber parts for milkers that are designed to withstand boiling water or steam and that are at the same time sufficiently elastic to serve the purposes of mechanical milkers. This is particularly true of cloth-wrapped rubber tubing. Rubber parts such as are necessarily made in moulds can not yet be made of a truly heat-resistant rubber; so that those milkers using moulded rubber inflations, or moulded rubber mouth pieces, are placed at a disadvantage in the use of the heat-sterilization method. Yet it may justly be held that moulded rubber parts for teat cups should not be discriminated against as it is usually so difficult to remove the straight rubber tubing inflations from the teat cups that companies using this type of inflations do not ordinary advocate the removal of these inflations except for renewal, and provide for cleaning them without removal. Moreover, all persons familiar with the details of the matter seem to agree that even those machines which are normally equipped with heat-resistant rubber inflations and tubes occasionally receive a lot of rubber parts from the manufacturers of these goods that are of very poor quality. This condition of affairs is apparently due to the difficulty that manufacturers of rubber goods have in supplying material of an absolutely standard and unvarying quality.

In view of the fact that several of the standard makes of milking machines in general use on dairy farms are not equipped with heat-resistant rubber parts, it is unforunate that sweeping statements have recently been published as to the general applicability of the heat-sterilization method for caring for the teat cups and tubes of milking machines, some investigators even asserting that this method of sterilization is the *only* method that can be used with good results.

Because of the difficulty in getting rubber goods of the right quality for use where heat-sterilization was to be used, investigators have from the first tried to secure satisfactory methods of sterilizing the rubber parts by means of chemicals of various kinds. Thus among the early workers in this field, Erf tried boracic acid, a solution of lime, and formaldehyde. Stocking, and Stocking and Mason tried brine, borax, lime water, formaldehyde, and soap powders, while Harding, Wilson and Smith used brine. From this early work it became evident that brine was the most satisfactory solution that could be used for keeping the tubes sweet and clean, but its use was accompanied by the difficulty that some metals were corroded by it. Also, it is a preservative rather than a sterilizing agent. It was not until Ruehle, Breed and Smith showed that the brine organisms were not capable of growth in milk and that milk organisms were not capable of growth in brine, and Wing showed that brine could be readily and efficiently sterilized by the use of hypochlorites that the value of the brine-hypochlorite combination became really evident. Meanwhile an active advertising campaign was started by various firms selling hypochlorite solutions urging that milking machine tubes be disinfected by these solutions used alone. The net result of the latter campaign has been one of great disappointment. While milking machine tubes can be effectively sterilized by the use of hypochlorite solutions alone where these are used in sufficient strength and the strength is renewed with sufficient frequency (Ruehle, Breed and Smith), very few users of milking machines have appreciated the limitations of this type of sterilizing agent well enough to succeed continuously in producing a low count milk. In those cases where dairymen have neglected these solutions, it has not been uncommon, especially in hot weather, to find a man keeping his milker tubes in a stinking solution entirely free from any sterilizing agent and full of enormous numbers of organisms. Probably no one thing has so delayed the day when milking machine users will get satisfaction from their purchase and continuously produce a milk of good sanitary quality as has this campaign of commercial firms for the use of hypochlorite solutions. Hypochlorite solutions are highly effective for use with a preservation solution like brine; but when used alone, they require more attention than the average dairyman can or will give them.

However, the limitations of the brine-hypochlorite solution are such that no recommendation should be given for its universal use. The majority of the teat cups of milking machines are now made of metal parts that are not corroded by this combination; but in certain types of machines, because of mechanical limitations, this has not yet been accomplished with entire satisfaction.

A third method of caring for milker tubes has also been used quite commonly and with fair success in New York State where really cold springs are quite common. This method consists of allowing cold water to circulate through and over the milker tubes and cups between milkings. It depends for its success upon general cleanliness and the retardation of bacterial growth through the effect of cold is successful only when low temperatures (preferably less than 50°F.) are maintained. Because this method of caring for the teat cups and tubes can be used without injury to rubber parts or to the metals ordinarily used, it has been tried in some cases where conditions did not justify its use. It is not a positive method of sterilizing in that no bacteria are killed, and results can never be made as perfect as in those cases where proper heat methods or chemical methods are used. Nevertheless, there are some men who are getting good results with it in New York State under farm conditions.

With all of the procedures that have been suggested for caring for the tubes there has been a common tendency for dairymen to rely either on heat or cold or the action of the chemical solution to destroy the bacteria, to the neglect of actual cleanliness. Milk has been allowed to dry on the interior of the tubes, the teat cup claws have been allowed to become badly clogged with milky accumulations, check valves on the pail cover have been left uncleaned, tubes have been thrown carelessly into the solution so that entrapped air prevented the action of the sterilizing solution, and many other details have been neglected, with the thought that the heat, cold or chemicals took care of everything.

It was shown early in milking machine investigations that the tubes and cups could be kept in clean and sanitary condition without taking them apart daily if washed thoroughly by drawing an abundance of cold and hot water containing alkali cleaning powders through these parts *immediately* after each milking. (Harding, Wilson and Smith.) The publication of this statement has been used as an excuse by milker salesmen and by dairymen for saying that all the cleaning necessary was to draw a pail of cold water through the tubes whenever convenient after milking. In many cases this is all the cleaning milking machines have received for months at a time. This has been the case in spite of the fact that even where the tubes are cleaned thoroughly after each milking, there is always some blackening of metal parts where these are in contact with the rubber so that to keep them really clean and shining, they must be taken apart and each part individually polished at least as often as once a week. The failure of milker companies to teach the purchasers of their machines good cleaning methods and the failure of dairymen to realize the necessity for making satisfactory provision for proper conveniences for cleaning their machines had led to the production of large quantities of milk containing excessive numbers of bacteria. Largely for this reason, with the return of more abundant farm labor, the hand milker has again become a severe competitor of mechanical milkers. It is therefore not surprising to find the various milker companies cooperating in pushing a vigorous campaign for the better care of their machines by dairymen.

Recently some public health authorities, because of a very natural and well grounded prejudice against the use of chemical sterilization of dairy utensils, have threatened to forbid the use of chemical sterilization for milking machines. Fortunately, so far as known to the writer, this policy has never been put into force, and it is to be hoped that it will not be. Health authorities have every reason to be active in compelling dairymen to produce a clean milk containing few bacteria or discard their machines, but any attempt to enforce such a regulation as indicated would take us back to the days when dairymen were instructed by control officials that clean and sanitary milk could only be secured in whitewashed barns, with a specified number of windows and so on. Under present conditions, when health authorities or investigators undertake to dictate what method of cleaning milkers shall be used, or state that only one method is successful, because of mechanical limitations in the construction of milking machines, it gives the support of public agencies to one group of milker manufacturers as opposed to a second group. If there were any danger involved which affected the public health such a course might well be justified, even though one group of commercial interests were favored; but there is no evidence at present available that indicates the presence of such a necessity.

Some investigators have not realized the fundamental difference between the use of the ordinary chlorine solutions and the use of the brine-hypochlorite solution, or have reported that the latter method was not successful because they knew of instances where dairymen had reported that they were using it, yet the results secured were unsatisfactory. In the latter cases (as in the instances reported by Bright), an investigation would undoubtedly show that while the dairyman may honestly think he is following the directions, he is failing to observe some essential step in the procedure.

Inasmuch as it has been amply shown that the chief source of the bacterial contamination of milk is from the dairy utensils with which it comes in immediate contact (Prucha, Weeter and Chambers), and as literally tens of thousands of dairymen in the United States are using milking machines, the matter of a campaign for better care of these machines is highly important to all of the interests concerned. The public is interested through its agents, the public health authorities and experiment stations and colleges. The dairymen themselves are interested because any tendency to lower the quality of dairy products injures their business. The milker companies likewise face the necessity of showing that milking machines are capable of giving satisfaction in the hands of all, or practically all purchasers of their machines, or their business will disappear. Now that proved and tried methods of cleaning milkers are known, it would appear that the time is ripe for more vigorous campaign measures by all of these forces to improve a situation that is not what it should be. The milker companies, as already indicated, are individually or collectively organizing campaigns along lines that should command the support of everyone. Some states, such as New York, are carrying information directly to dairymen through extension activities. Some city milk inspectors and inspectors of dairy companies are securing correct information regarding these things and carrying it to the dairymen with whom they come in contact, and some of the dairymen's organizations are taking a real interest in encouraging their members to produce better quality products. Proper coordination of these activities would hasten the day when the users of milkers will clean and sterilize them properly. In New York State gratifying results are already evident from coordinated efforts along these lines so that we already have milk plants where educational measures have so reduced the trouble from dirty milking machines that many users of machines are continuously securing premiums at Grade A milk stations for the production of milk with a bacterial count less than 10,000 per c. c.

DISCUSSION

Dr. Breed answered several questions in part as follows:

Experiments by which milking machine parts were kept in running water showed good results when the water was not warmer than 50°. Springs may be polluted. Some men think they have the cold water method via the horse trough.

Scrubbing does not remove all bacteria from rubber parts. Tubes not taken apart for a week were nearly sterile, while scrubbed tubes did not smell well, indicating bacteria in the porous parts of the rubber. We have observed samples of sterilized water directly from the milking machine tubes, as it leaves the tubes is higher on the day after scrubbing than after they have not been scrubbed for a week. Scrubbing tends to open the pores of the rubber. We have scrubbed tubes and hung them in a cold box, but the counts did not stay as low as was expected.

"From the errors of others a wise man corrects his own."

HEALTH DEPARTMENT SUPERVISION OF PASTEURIZATION PLANTS IN A SMALL CITY

IRA V. HISCOCK, M.A., C.P.H.
Department of Public Health, Yale University.

Early health workers rightly gave serious study to the production and handling of milk, for it was found to be an excellent medium for bacterial growth and often the source of communicable disease.

It is possible by inspection and education to bring a milk supply to a reasonable point of cleanliness, but the only *safe* procedure at present available is pasteurization by the holding process. A year ago there were reported* in the United States and the Dominion of Canada approximately 4200 pasteurization plants in operation, with only a limited number controlled by public health officials. The pasteurization process must be controlled by laboratory analyses and frequent plant inspections. These measures should be supplemented with visits to the producing farms and regular analyses of individual supplies; for pasteurization was never intended to cover up the trail of dirty milk.

The importance of health department supervision of this character was impressed upon the writer in a thirteen months' study of the milk supply of a southern city of 37,500 population.† Of the dairies supplying milk to the city, twelve were under observation from July 15, 1919 to July 3, 1920. Samples of the milk of the previous evening and of the morning's milk were collected nearly every week. The samples were plated on agar according to the

*Report of the Committee on Milk Supply, American Public Health Association, Boston, 1920.

†These results are described in detail in a paper on Studies in the Control of a Municipal Milk Supply, Hiscock, Ira V. 1921 (not published.)

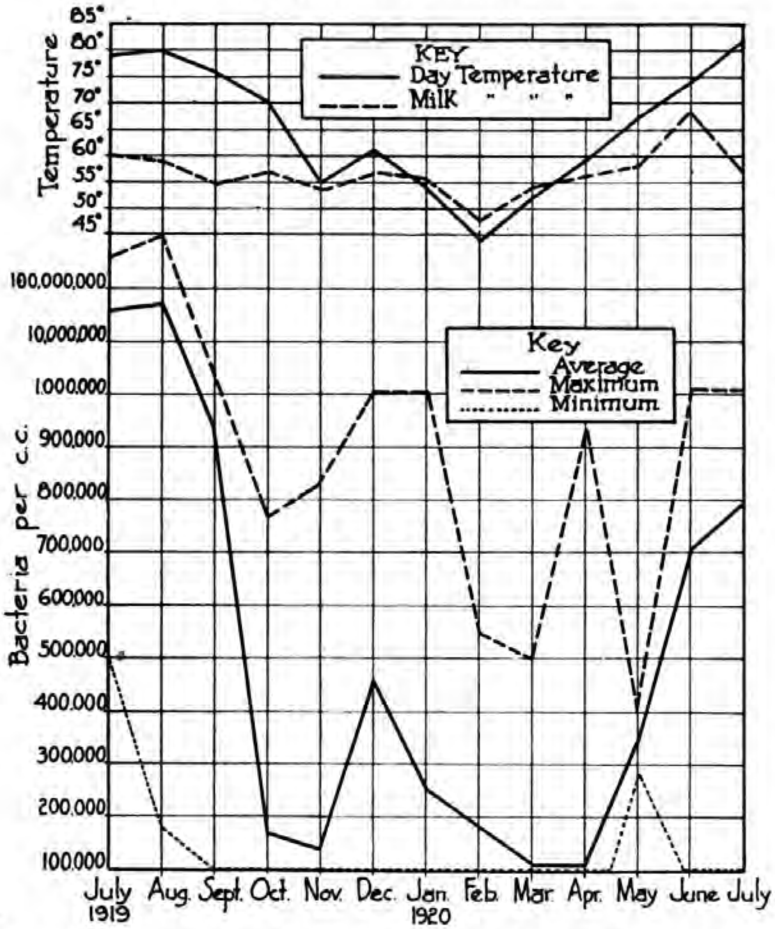
technique of "Standard Methods" of the American Public Health Association. Dairies were inspected by the city health officer, Dr. C. E. Smith, and the writer.

We seldom found a dairyman with dirty unsanitary surroundings who was not careless in his methods. On the other hand, dairymen with modern barns and equipment generally endeavored to produce clean milk of low bacterial content. However, this general condition does not always prevail in individual instances. For example, one of our lowest scoring dairies produced consistently low count milk simply because the owner supervised the work himself and was careful to exercise the important measures for clean production. Considerable variation in evening's and morning's milk was noted, both in bacteria count and in temperature upon delivery. Morning's milk was not infrequently higher in both temperature and bacterial count. Our most satisfactory counts were obtained from those dairies having coolers and insulated tanks which were kept well iced.

The seasonal variations in bacterial counts in milk have been frequently noted, and winter weather prevents any considerable increase in bacterial counts.

All of the bacteria counts become lower during the colder season, increasing again as the mean daily temperature approaches 70 degrees. Another important feature of these results is the appearance of enormously high counts during the first two months of this investigation. For July, 1920, the average counts do not even approach such high averages. The improvement in the appearance of the dairies themselves corresponds fairly closely in most instances with the drop in the bacterial content of the milk. As there was no supervision of these dairies for a few months prior to July, 1919, and as the counts show a decided drop and do not again return to such high proportions, it may be assumed that this improvement is due in a measure, at least, to supervision by laboratory analyses and dairy inspection. The ordinary dairyman, whether consciously or not, will

GRAPH SHOWING RELATION OF BACTERIAL COUNTS TO TEMPERATURE AND INSPECTION.



Monthly results: Temperature of milk and mean temperatures of sampling days, July 15, 1919, to July 31, 1920.

Bacteria per c.c., average, maximum and minimum, July 15, 1919, to July 31, 1920.

Month.	*No. Samples.*	*Average.*	*Bacteria per c.c.* *Maximum.*	*Minimum.*
July	38	55,464,000	160,222,000	500,000
August	54	69,356,000	197,600,000	184,000
September	48	937,000	4,690,000	11,300
October	49	162,000	772,000	11,300
November	55	140,000	832,000	3,200
December	21	458,000	1,227,000	22,000
January	50	258,000	1,611,000	3,200
February	62	180,000	552,000	3,100
March	45	111,000	502,700	2,400
April	47	109,000	934,000	36,000
May	14	340,000	403,750	278,000
June	43	704,000	1,748,000	39,000
July	38	799,000	2,160,000	43,000

strive harder to produce a milk of low bacterial content if he knows that his product is subject to laboratory examination.

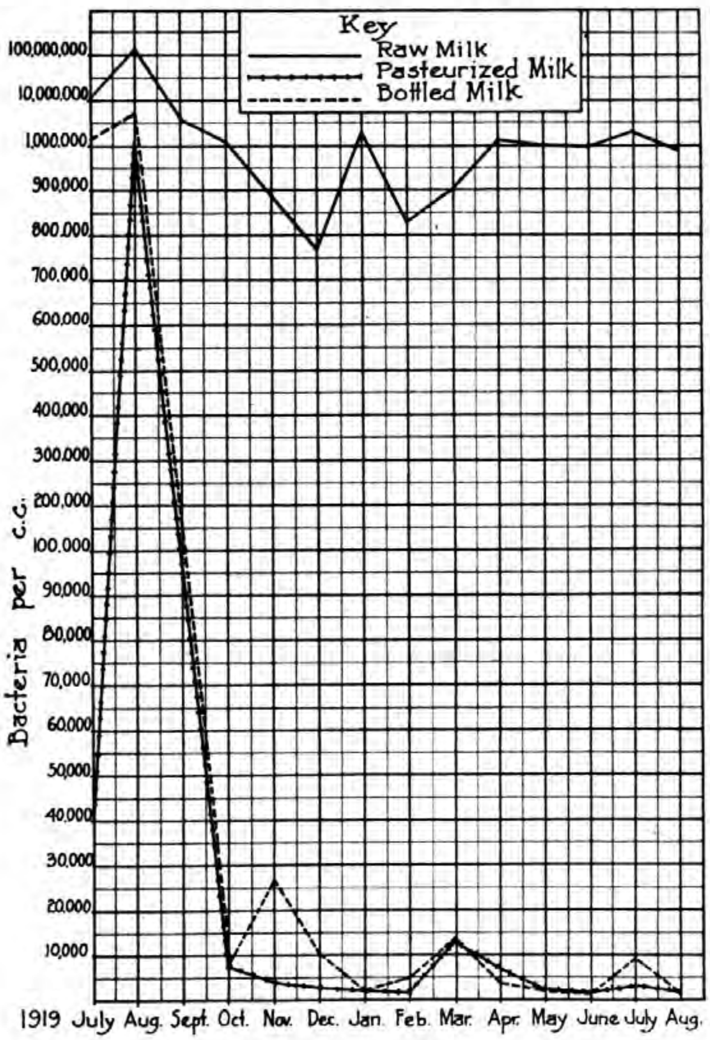
Inspection of the dairies will undoubtedly reduce the danger of disease germs getting into milk, but the sole practical method of assurance that it shall contain no disease germs is by adopting pasteurization.

Inspection, supervision, and education are essential for reliable results. The process of pasteurization is by no means "fool proof," but demands a knowledge on the part of the operator of the object and action of the process. A high reduction of bacteria is not a sufficient criterion of good results, for the original numbers, species, and prevention of recontamination are important. The mere presence of a pasteurization plant in a city is not sufficient proof of a good quality of milk, for improperly cleaned cans, bottles, or careless methods of pasteurization may produce bacterial increase. Our findings from two pasteurization plants in the city under study* further illustrate the importance of pasteurization plant inspection and supervision.

In the first place, we note that the bacterial counts for raw milk for both plants were higher in the early months of supervision. The milk pasteurized in plant No. 1 for the most part came from those dealers previously studied. The sampling in the plant was made from the raw-mixing tank and was a composite of all the milk. Special attention to the cleaning of this tank, together with prompt cooling of the milk, resulted in lower counts from the raw tank thereafter. As would be expected, the clarified milk gave a higher count, in practically every instance, than the raw milk before passage through this machine, due in large measure, undoubtedly, to the breaking up of "clumps," which would otherwise develop into single colonies. There

*Laboratory Supervision of Pasteurization Plants, Hiscock, Ira V., 1921 (not published).

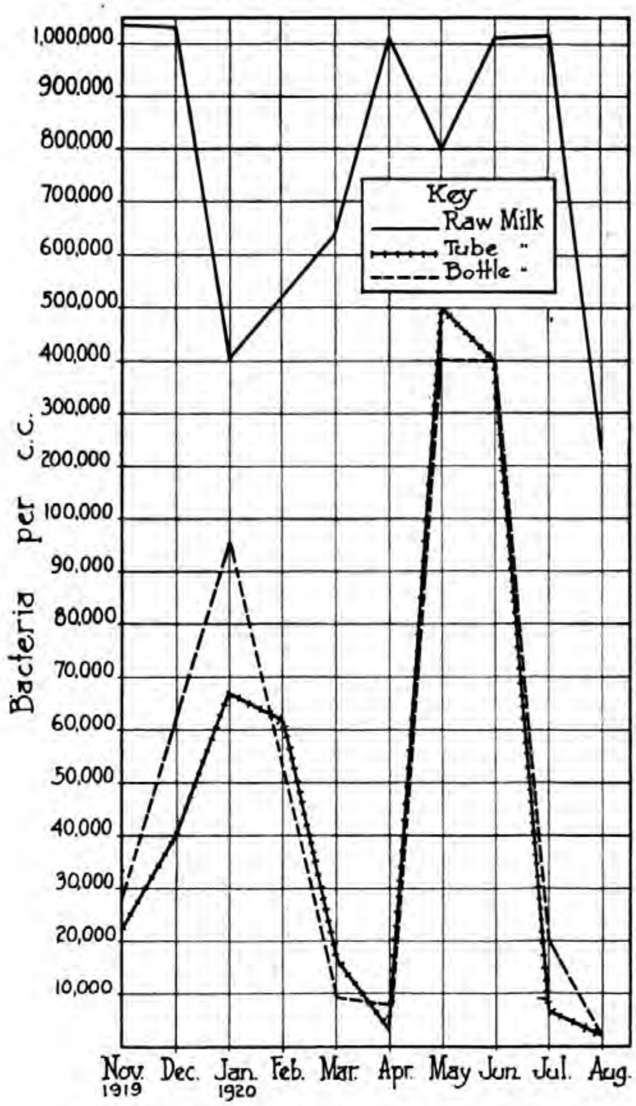
BACTERIAL COUNTS OF PASTEURIZATION PLANT No. 1 BY MONTHS, JULY, 1919—AUGUST, 1920.



No. of Thousand Bacteria per c.c.

Month.	*No. Samples.*	*Raw.*	*Tube.*	*Bottle.*
July	2	12,000	40	2,000
August	21	125,866	1,485	7,181
September	15	5,746	142	416
October	7	1,788	7	8
November	3	536	4	27
December	5	760	3	10
January	2	1,200	2	2
February	3	830	2	5
March	2	900	13	14
April	2	2,100	8	4
May	1	1,000	2	2
June	1	1,000	2	2
July	3	3,600	3	10
August	2	990	2	2

BACTERIAL COUNTS OF PASTEURIZATION PLANT NO. 2 BY MONTHS, NOVEMBER, 1919—AUGUST, 1920.



Number of Thousand Bacteria per c.c.

Month.	*No. Samples.*	*Raw.*	*Tube.*	*Bottle.*
November	2	3,400	22	27
December	4	3,025	39	65
January	3	402	66	94
February.	2	516	62	51
March	5	633	17	9
April.	2	1,100	2	8
May	1	800	500	400
June	3	1,900	400	400
July	3	2,200	8	20
August	2	230	2	2

is also the small possibility of inoculation from an improperly sterilized machine.

The pasteurization results showed the pasteurizers to be doing efficient service most of the time except in the case of plant No. 2, a cooperative creamery which had no recording thermometer. This fact, coupled with the use of old machinery by careless helpers, produced quite unsatisfactory results until July, 1920, when the plant was temporarily closed until a general clean-up and additional equipment should warrant reopening. A new manager was secured and the succeeding results were excellent.

Recontamination of the milk after pasteurization is believed to account for the frequent increase in bacterial counts after bottling, for neither of these plants pasteurized in the bottle. It is possible to obtain a noticeable difference in counts of the same lot of milk plated at the same time, as has been conclusively demonstrated in the extensive New York studies supervised by the late Professor Conn.* It is believed, however, that the high counts in the bottled milk of this study are the direct result of inoculation from the bottling machine, or the bottles or other sources operating after the milk left the heating tank. This idea was confirmed by special studies of equipment which indicated in plant No. 1, from studies made in July and August, 1919, a possible contamination of milk from the bottling machine of from 2,500 to 9,000 bacteria per c.c. if the machine were full. In nineteen series of tests of bottles ready for use a possible inoculation of 100 bacteria per c.c. or over was calculated in 58 per cent of the cases. Results from plant No. 2 were even higher from a study of several series of six tests for each series.

The process of can sterilization also revealed interesting results, for it was found that the usual time of exposure to live steam was about ten seconds, and the rinse water

*Conn, H. W. Standards for Determining the Purity of Milk, P. H. R. Vol. 30, No. 33, 1915.

tested from these cans showed a possible inoculation from both cans and covers of 1,000 bacteria per c.c. Ordinarily, these cans received no further treatment by the dairymen before the addition of new milk, making the need of proper sterilization at the plant doubly important.

No special study was made of bottle caps, but Smith* clearly demonstrated in his study of pasteurization and subsequent handling of milk that while the initial inoculation from milk bottle caps may be small, the importance of handling and of storage of the caps, especially in bulk lots, should not be overlooked.

Following our study of the mechanical features in plant No. 1, new apparatus for sterilization of equipment was installed, and a more systematic plan of supervision of the process by the owners was instituted. This resulted favorably for the concern in the production of a better quality of "pasteurized milk" which increased in popularity.

In conclusion it is believed that supervision of milk supplies is one of the most important and may be one of the most successful functions of a health department. Inspection of an educational character and laboratory analyses are both useful tools of the health officer in maintaining a safe milk supply.

Cooperation of the health department with owners of dairies and pasteurization plants is absolutely essential for effective results. Careful supervision should be exercised to prevent contamination of the milk after pasteurization. Medical inspection of the employees in a milk plant should be practiced and all those coming in contact with the milk after pasteurization, in the bottling and capping, should be given prophylactic inoculation where this is possible. Reinfection of milk injures the results of pasteurization and may be the source of spreading disease. Pasteurization

*Smith, Russell S. Observations on the Pasteurization and Subsequent Handling of Milk in City Milk Plants. Jour. of Dairy Science, Vol. 2, No. 6, Nov., 1919.

alone does not guarantee safety. Pasteurization, coupled with intelligent inspection at the source and competent supervision at the milk plant, *will* insure protection.

DISCUSSION

Dr. Schofield: Some dairymen say no matter how many bacteria before pasteurization, provided the count is low afterward. We know pasteurization efficiency varies according to original number of bacteria. The thermometers used in pasteurization should be checked frequently and only used when found accurate.

Prof. Stocking: The species of bacteria and temperature are the elements to be considered. The supervision of pasteurization plants is just as essential as the supervision of all other factors of production and handling.

Member: The efficiency of pasteurization will depend upon the species of bacteria present.

Mr. Smith: One of the principal troubles is due to recontamination after the milk is pasteurized.

Mr. S. H. Ayers: Not all the lactic acid bacteria are destroyed. Some are not resistful; other species of lactic acid organisms are not affected at a temperature of 150°. Milk containing 30,000 bacteria per cubic centimeter when raw has after pasteurization been found to contain 22,000 bacteria per c.c. The bacterial flora in pasteurized milk closely resembles that of clean raw milk.

Mr. Kilbourne: The object of pasteurization is to destroy possible pathogenic organisms.

Dr. Pease: One group of the B. Coli organisms is sometimes used as a test of the efficient pasteurization of milk, as it is slightly more resistant to heat. However, 145° for 30 minutes destroys this organism.

Mr. Ayers: We find quite a large percentage are not destroyed at a temperature of 145° for 30 minutes. However, if such a test as Dr. Pease refers to were made immediately after pasteurization, it would be a test of efficiency.

If milk is held for a considerable time, then the B. Coli test referred to is not altogether a check of efficiency of pasteurization, as the efficiency of storage also becomes a factor.

Mr. Jone: I have had to do with pasteurization in two ways, namely, as an official and in a private capacity representing milk dealers. My experience has shown frequently that the percentage of bacteria killed depends to a large extent on the nature of the bacteria. In summer the percentage of the surviving bacteria may easily be as low as one-tenth of one per cent, while in winter it may be as high as six per cent or seven per cent, even if care is taken to use exactly the same temperature for the same length of time in the pasteurization. The fact that nearly all the bacteria in the raw milk in summer are lactic acid bacteria explains why the efficiency of the pasteurizer is so high in summer. On the other hand, I found by experiment that in winter spore-bearing bacteria sometimes occur in the milk which survive a boiling of the milk for forty minutes. This kind of bacteria, however, is not numerous. I also found that quite a number of bacteria sometimes survive at temperatures lying between 145° F. and 212° F. It is plainly evident that these heat-resisting bacteria cannot be killed by pasteurization.

There is a strong tendency to lose sight of these facts when judging the efficiency of pasteurization. It is for this reason that I call attention to them. If, under these conditions, a pasteurizer fails to kill as much as six or seven per cent of the bacteria in the raw milk, it is neither the fault of the pasteurizing machines nor of the operator. We must resort to other means to get rid of the heat-resisting bacteria. Probably the best way to get rid of them is by keeping the cans strictly dry. In a moist can the heat-resisting bacteria which may survive the steaming of the can may multiply to such an extent that the raw milk which is subsequently put into this can may be seriously polluted with heat-resisting bacteria. The result will evidently be a poor numerical efficiency of pasteurization. In a dry can, on the other hand, the multiplication of these bacteria will evidently be prevented in such a way that only a few of them can reach the raw milk. This is my proposition for getting rid of the heat-resisting bacteria which pasteurization fails to kill.

"Whether or not the number of dairy cows is increased or diminished depends entirely upon the outlet and demand for milk. And this outlet is the city dealer, who, standing as a representative of both producers and consumers, buys as much or as little milk as the farmers produce, and sells the consumers as much or as little milk as they want."

RELATION BETWEEN MILK DEALERS AND MILK INSPECTORS

BENJAMIN VENER, Springfield, Mass.

During the last five years the milk business and all that it involves has passed through an avalanche of investigation, false impressions, unsound experimental changes in the methods of distribution, fixing of prices, marketing and processing. We all recognize that we are in a period of adjustment and re-establishment. So must the milk business strike a balance, forgetting the pre-prohibition jubilee, and swallow its share of bromide and work for retrenchment accompanied by sound and clear thinking. From now on there must be hearty cooperation between producer and dealer. The dealer, milk inspection department, and consumer must all work together so as to put the milk business, the backbone of sound agriculture, on a permanent basis so the consuming public shall get the best there is for as small a price as possible.

Can we say that a milk dealer is defined as an individual or an organization that handles and sells milk? The handling and distribution of milk is becoming a business, based on scientific research, real business acumen, utilizing engineering developments, including dairy machinery and artificial refrigeration. The progressive milk dealer of today is a master artisan in applying basic scientific facts in their relation to the proper handling of perishable foods, processing the same by expensive machinery and marketing these foods under as near aseptic conditions as it is humanly possible to do and keeping it so by the utilization of one of the greatest gifts to man—artificial refrigeration. This masterful thoroughness, seven days a week, three hundred and sixty-five days a year, service to your door—at your command—is the duty the modern milk dealer performs for me, for you, and for the community at large.

On the other hand, the complexities of the milk business require more expert knowledge from the milk inspector if he or his department is to function properly. We are rapidly drifting away from the accepted definition that the duties of a milk inspector lie in the collection and inspection of samples of milk for chemical and bacteriological analyses, and the casual blue print scoring of premises of production and handling. Milk inspection of today is becoming specialized. We now have inspectors for the country end, the farms and country stations, pasteurizing plant inspectors, analysts, and agents for the collection of market samples. You may say that it is so only in the large cities. But if it is necessary for the milk inspection department to divide these duties among men especially trained along these various lines, it is essential for the inspector of the smaller cities to recognize these different specializations in the handling of milk and become efficient along these lines. The inspector must be an industrial engineer, a technical adviser to the trade, supervising production, alive to the transportation essentials for high grade products, expert in the methods of pasteurization and efficient handling during the process; a marketing expert as well as an analyst who can interpret results and apply them to a logical conclusion.

The milk dealer welcomes the efficient milk inspector because he is the master link in the chain of quality milk production, distribution and marketing; the important connection between the producer and consumer. So the milk selling organization wishes the good will, the cooperation and the advice of the milk regulatory body. The milk dealer expects this and also recognizes that the inspector, in the performance of his logical duties, works as much for the benefit of the dealer as he does for the public. The milk dealer knows that many complaints, whether intentional or unintentional, can be ironed out smoothly. Milk inspection boards are daily receiving many complaints and detrimental remarks as to this or that product which if followed up could be perfectly adjusted for all concerned. For in most cases the dealers are not at fault and are usually left ignorant of these peculiar kicks. The milk dealer wishes to straighten them out satisfactorily, as it means keeping the good will and proper opinion that his business must thrive on for success. The milk dealer desires the milk inspector to view the milk business from a business standpoint, looking at it from the practical side as well as the theoretical extreme application of the law to the extent of the dotting of the "i's" and the crossing of the "t's."

The dealer expects from the inspection department, first, that the sources of his supply are as safe as inspection and personal supervision can make it. Secondly, that the milk is being produced under methods that are recognized as giving a wholesome, palatable and high quality product. Thirdly, that the cows which produce this milk are healthy, free from diseases that are liable to endanger the public. Fourthly, that the inspector recognize the fact that in the transportation of the supply that their duties are important in seeing that the milk is handled properly by the carriers. Attention be paid to the milk cars and that the milk is not subject to unnecessary delay, safeguarded against tampering in transit or come in contact with baggage which may in any way endanger the quality. In ice car shipments, that the carriers furnish the required refrigerant for the amount of milk carried and for the length of time it is in transit. And that at junctions or transfer points that the milk be handled with care and due attention for such perishable foodstuffs. Empty milk cans be handled carefully as food receptacles and not thrown to the seven winds, covers scattered and cans left uncovered. Now, fifthly, that legitimate owners of bottles and cans be protected against theft, penalizing the abuse of these receptacles for jelly jars, garbage containers, for other food products and the many other what-nots for which they are subjected. Sixthly, that the mushroom dealer does not by fraudulent advertisement or misrepresentation by means of caps, printed labels, etc., sell his milk as clarified, pasteurized, Jersey milk, baby milk, etc. Seventhly, desires the inspector to stimulate and set in motion such educational instruction that will be necessary for the public to use and utilize milk to the best advantage; give advice as to the keeping of milk sweet, the handling and return of the empty containers and education along the use of milk and its by-products.

Milk inspectors recognize that the milk dealer is dealing with a multitude of problems which seem to be ever occurring and ever changing. He rightfully expects the dealer to play fair, to give the best product possible, honestly handled and the best that he could place on the market. He desires the milk dealer to accept none but approved milk from licensed sources and handled and packaged under as sanitary conditions as when the inspector himself is present. The inspector desires the dealer live up to such regulations as are promulgated by the state or enacted by local ordinances. Desires the services of the dealer for cooperative working out of problems for the improvement of the supply so as his community shall have the highest quality and the best product that can be marketed.

During the last five years the trend of the milk business has been towards the larger dealers or cooperative organizations handling their milk for the farmers at central pasteurizing plants. Most cities show that in this period a large percentage decrease in the number of milk dealers and a large subsequent increase in the amount handled by the larger dealers. With this drift of business to the large plants and cooperative concerns has come a great percentage increase in the amount of milk that is pasteurized. There are many reasons for these changes in the last few years, which to my mind has been the transition period from the day when anyone who had a dozen cows and a rig that would hold three or four cans and as many dippers was labeled a milk dealer. Correctly applied then, for the stone age of the milk business, but no longer applicable, for the modern dealer is entering in the period of machinery and specialization where it becomes necessary for the milk to be handled under large expense, bound down by strict rules and regulations, supervised from the time the milk leaves the cows to the lips of the consumer. Most cities and towns do not require pasteurization excepting in some of the larger cities. The State of Massachusetts defines pasteurization in one of her statutes but does not require milk to be pasteurized, and similarly this inconsistency holds throughout the nation. You will find that the milk that undersells the prevalent price of safe or pasteurized milk is usually from raw milk dealers, dealers who buy the outlawed milk, milk that is passed up by the larger dealers as poor quality as to dirt, bacteria and low test. This poor milk is accepted and handled again, usually under intolerable conditions, and then passed on to the consumer as milk—two or three cents cheaper. This is the class of milk that keeps the inspector on his toes, prosecuting and following up the source of supply, constant inspection of premises, and the recurring analytical tests against adulteration. These dealers you will find are heavily indebted to the farmers. Most of the inspector's time is used for this class of milk and the larger dealers who put out the bulk of the supply do not get the attention that is due them.

Perhaps the future will bring better tidings to the large dealers, for then we may see the various commissions, boards of trade, women's clubs, and the other humane societies recognize the fact that it costs money to do things right and that they will then pay more attention to pointing out what the modern dealer has accomplished in benefiting the community, by safeguarding the health of the public, fostering efficient dairying and making the dairy industry with its multiplicities the envy of the world. Perhaps instead of their ill advised statements and meaningless figures if they would only plead for greater utilization of milk and its products, it would make for greater decrease in costs of doing business than any other factor.

The period of adjustment, for retrenchment, where it is necessary to cut costs of doing business may make for a poorer and unsafe supply. In that it may allow bulk milk to be sold, with the letting up of restrictions for the making of quality milk, deferring pasteurization ordinances thus allowing raw milk of doubtful quality to compete on equal footing as safe pasteurized milk with its natural increased costs of proper handling. It is a fact that with the modern refrigeration development in the shipment of high quality milk and the subsequent application of refrigeration at the larger plants it is no longer a real economic necessity to pasteurize the bulk of the milk, at great expense, to be able to market this supply for immediate consumption. We have passed the period of "sales on the jump" and are now face to face to a "jump for sales" condition. The question of cutting expense, meeting competition, begins to assume threatening proportions, and the large concern is beginning to ponder whether he should go to heavy expense of pasteurization in a free lance district where the raw milk undersells and is placed on the same health standard as that of pasteurized milk. Thus the milk inspector may see the large dealers enter the field of raw milk to compete with the underselling milk and flood the community with raw milk unprotected by pasteurization.

The dealer has thousands of dollars tied up in machinery and good will. Mischievous propaganda or false impressions and ill advised statements in the newspapers must be corrected by the help of the inspector for the good of the industry. The dealer expects and offers the fullest cooperation with the inspector and his parent board, and all allied organizations along milk control work, for the creation of a better demand and a safer supply, at lower costs which will make for a more appreciative public opinion. Let us look upon the modern dealer in the correct light, as a real necessity; a public service organization serving the vital needs of the health and the welfare of his community.

"Justice is truth in action."

THE EFFECT OF PASTEURIZATION ON CREAM LAYER.

DR. H. A. HARDING, Urbana, Ill.

It is the inspiration and the despair of the inspector that each year brings new ideas regarding the proper handling of milk. It is a credit to his openmindedness that these new ideas are given a hearing and frequently accepted as marking a real advance. At the same time the inspector realizes that just because a suggestion is new it is not necessarily an improvement. Many suggestions must be examined from various angles before their value can be determined.

Just at the opening of this century the work of Theobald Smith and Farrington and Russell brought out a new idea regarding pasteurization when they suggested that heating milk for thirty minutes at 140° F. would destroy the disease germs which might be present.

A little later it was suggested that if the temperature of pasteurization were put at 142-145° F. there would be a larger margin of safety. There is now a growing feeling that if this temperature of pasteurization were increased so as to fix 145° F. as the lower limit of the pasteurization process the margin of safety would be made still wider. This is undoubtedly true, and the margin of safety would be wider still if the milk were boiled, as is the domestic custom over a considerable portion of Europe.

Undoubtedly the reason why the boiling of milk has not been seriously advocated is the well known fact that the flavor of boiled milk is not acceptable to the American public.

The rapid spread of pasteurization during the last decade may have led some to think that pasteurization was a recent process. While not dating back into antiquity, it had no commercial following until after 1900 because the use of the temperatures recommended before that date resulted in a milk which had an evident cooked taste and one which was lacking a cream layer.

Modern pasteurization dates practically from the work of Farrington and Russell, which showed that milk pasteurized at 140° F. developed a normal cream layer.

As rapidly as the city milk interests became convinced that this method of pasteurization made possible a safe milk which was acceptable to the public they adopted it. The growth of pasteurization has been so rapid that many of us hope to see the time when the spread of tuberculosis through the use of raw milk will be entirely cut off.

However, the growing demand for a higher temperature of pasteurization for the sake of a wider margin of safety gives basis for the fear that the required temperature may be again shifted back into the place it occupied before 1900 when the pasteurized product was not acceptable to the public. If this happens it is easy to foresee that the spread of pasteurization will be checked and some of the present gains be lost.

It is a fairly well established fact that a cooked flavor begins to be observable in milk after a thirty-minute heating at 145° F.

It should also be remembered that with the means of temperature control at present available it is not practicable to pasteurize milk at - given degree of temperature, but that during the day's run of the pasteurizing machine the temperature at the end of the thirty minutes will vary through three or more degrees. Accordingly the proposition to fix 145° F. as the minimum temperature of pasteurization is practically equivalent to decreeing pasteurization at 145-148° F.

Attention has already been called to the fact that the early unpopularity of pasteurized milk was due to the fact that it had a cooked taste and lacked a cream layer. Any attempt to pasteurize at 145-148° F. will certainly introduce the cooked flavor question. Like other flavors, there is no standard for measuring cooked flavor and the keenness of taste varies considerably in individuals. Accordingly the public will probably tolerate a small amount of this flavor in the milk. There is so little actually known of the factors influencing the production of cooked flavor that it is hard to say how far this difficulty may be avoided by proper management.

It is quite generally agreed that the public demand a cream layer in their milk bottle. This is in part because the housewife uses the cream layer as an index of the richness of the milk and in part because she needs cream in her culinary operations and is accustomed to obtain this cream from the top of the milk bottle.

There has been wide difference of opinion regarding the effect of the temperature of pasteurization upon the cream layer in the milk bottle, largely because there has not been available a simple and accurate method of measuring this cream layer.

An accurate method of measurement has recently been perfected. This method consists in filling one-inch round-bottomed test tubes to a depth of 104 millimeters, approximately eight inches, with the milk to be tested. This tube of milk is promptly cooled in ice water and when cool is held at 40° F. for approximately 24 hours. The thickness of the resulting cream layer is measured in millimeters and each millimeter of cream is equivalent to one-half per cent of cream by volume.

Even with this method of measurement available it would not have been possible to get data upon the action of modern pasteurizing machines without the cooperation of the milk companies. However, through their cooperation the effect of various temperatures of pasteurization upon the creaming power of milk has been measured, using the modern machinery in some of the largest plants in Milwaukee, New York, Detroit, St. Louis and Chicago. The study thus covered a wide range of territory and included practically all the various types of pasteurizing machines.

While this study in each plant usually covered the effect of each of the steps in treating the milk between the receiving vat and the bottle, the present presentation is restricted to the effect of the pasteurizing temperatures.

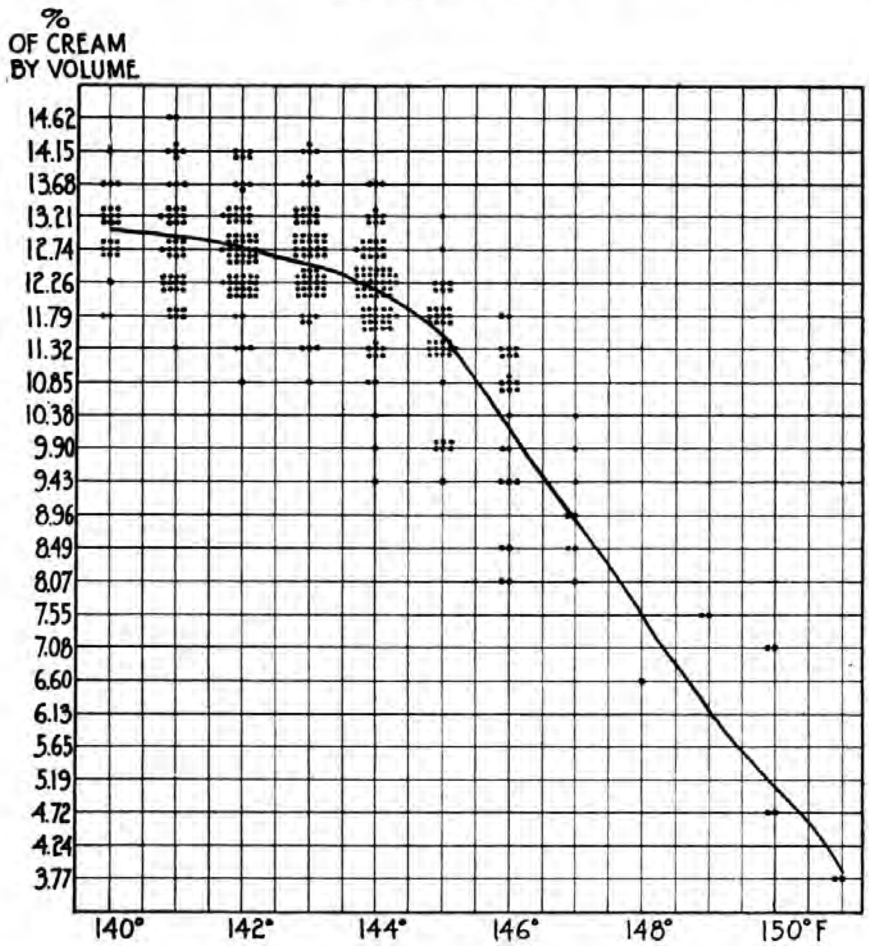
The manufacturers of many pasteurizing machines have for one of their talking points the statement that with their particular machine the layer of cream resulting from pasteurization at any given temperature is deeper than with any other machine on the market. These measurements show that with the wide range of machines tested the rate and manner of heating was without noticeable effect and given a holding for thirty minutes the effect upon the depth of cream layer depended upon the temperature.

The samples obtained in commercial plants were taken under regular working conditions except that the temperature of pasteurization was deliberately varied from the lowest temperature consistent with safety to the milk and the local ordinances, up to 145-151° F., all temperatures being those at the close of the thirty-minute holding period. In some plants the lower limit was 140° F., while in others it was 142° F., and in the plants of one company no samples were obtained after pasteurizing at a temperature of less than 145° F.

Ideal conditions for testing the effect of the pasteurizing temperature upon the creaming power of the milk would include a sufficient supply of raw milk of uniform composition which could be run through a single pasteurizer with all conditions kept constant except the temperature of pasteurization. In commercial plants the most common difficulty is variation in the fat content of the supply. While there is much uniformity in the average fat content of the milk handled on successive days by a milk company there are often fairly wide variations in the fat content of individual portions of milk passing through the machines. The extreme variations encountered amounted in one plant to one per cent of fat.

Notwithstanding the variations introduced by the fat con-

CHART. 401 TESTS OF EFFECT OF TEMPERATURE OF PASTEURIZATION ON CREAM LAYER.



tent and other disturbing factors, there was such a marked uniformity in the results obtained at five milk plants where the average fat content ranged between 3.4 and 3.6 per cent and the holding period was thirty minutes that the data from 401 such observations is here presented.

In this chart each dot shows the results from a single test and by its position indicates the temperature of pasteurization and the per cent of cream by volume which developed; for example, the upper lefthand dot indicates that a sample of milk pasteurized for thirty minutes at 140° F. developed 12.74 per cent of cream.

The line running across the chart connects the averages of the results at each temperature and shows their relation. The line in the chart tends downward from the beginning, suggesting, as is supported by other observations, that even with the lowest pasteurization temperature which is recognized as safe there is some destructive action on the cream layer. As the temperature of pasteurization rises from 142° F. to 144° F. there is a distinct shortening of the cream layer. At about 144° F. there is a marked downward turn in the line, indicating that from this point the increase in temperature exerts an increasingly severe action on the creaming power. The resulting loss in volume of cream rises so sharply that at 145° F. it amounts to slightly more than 10 per cent, at 146° F. it has increased to 16.6 per cent, and at 148° F. to approximately 40 per cent.

It needs but a brief study of these results to appreciate that pasteurization at 145-148° F. is commercially impossible.

A number of cities have regulations calling for 145° F. as the minimum temperature of pasteurization. Observations in a considerable number of plants ostensibly pasteurizing at 145° F. showed that they were keeping as close to 145° F. as possible, taking care not to exceed that temperature. As a result much of their pasteurization is actually accomplished around 144° F., with the temperature occasionally falling distinctly lower. Only one company was found which pasteurized essentially at 145° F. This one was careful not to exceed 145° F., but its temperature control was more perfect than on the other plants. If this result is attained by one company, why not by all? The ability of this one company to pasteurize at this high temperature was apparently due to a combination of the three factors: almost unlimited capital, the highest engineering skill, and the best of supervision. It is rare indeed that this combination of resources is available to a milk company.

The problem which confronts a milk dealer unable to produce a marketable product when complying with the local regulations is not an enviable one. He is loath to abandon pasteurization because he recognizes in it his only hope of producing a safe milk. He is familiar with the fact that the scientific evidence is overwhelming as to the safety of milk pasteurized at 142-145° F. for thirty minutes. He is puzzled to comprehend the state of mind of the health official who forces him to choose between distributing a safe pasteurized milk which has been arbitrarily made illegal and distributing raw milk which he knows is an unsafe food. Taken as a group the milk dealers are just as law abiding and as self respecting as any other group of business men and they naturally shrink from choosing between these two alternatives presented by regulations requiring the pasteurization of milk for thirty minutes at 145-148° F.

The milk inspector knows that the object of pasteurization is to produce safe milk. He is aware that all careful measurements of the resistance of disease germs to heat indicate that those liable to occur in milk are killed by fifteen minutes' exposure to 140° F. He understands that the requirement of pasteurization for thirty minutes at 142-145° F. carries a margin of safety of about 150 per cent when a 25 to 50 per cent margin of safety is considered sufficient in most undertakings.

When he understands that pasteurizing at 145-148° F. involves such a destruction of the creaming power of the milk as to make the pasteurized milk unable to compete commercially with unsafe raw milk he will be quick to see that pushing the margin of safety above 150 per cent is liable to harm the spread of pasteurization more than it can possibly do good.

"Errors to be dangerous must have a great deal of truth mingled with them."

IMPROVEMENT OF QUALITY IN MILK THROUGH COLLEGE EXTENSION WORK

W. A. Stocking, *Professor of Dairy Industry,* Cornell University, Ithaca, N. Y.

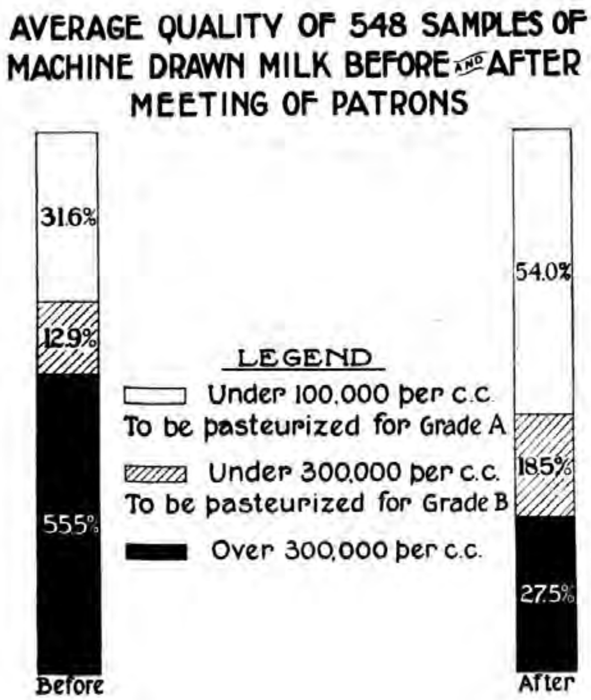
The development of extension work in connection with the milk industry in our Department has been planned primarily for the purpose of assisting the milk producers to improve the quality of their milk in conformity with the requirements of the city's department of health standards.

The term quality, as applied to milk, has been subject to much discussion and perhaps even yet has not been reduced to a single accepted definition. The factors which make up quality are somewhat complex and a discussion of this subject would without doubt bring out much diversity of opinion.

During the past year or two, however, we have been working on the assumption that the bacteria count is the best single index on which to determine milk quality, at least from the sanitary standpoint. Believing that this problem is of much importance from the standpoint of the producer, as well as the consumer, and therefore the inspection officer, our Department during the past year has given special attention to field work, the purpose of which is to enable the farmer to produce milk with bacteria counts satisfactory to the city health authorities. Just how this result could be brought about has been the question for which the Department has been seeking an answer.

Since the presence and growth of bacteria are largely responsible for the quality of any given lot of milk, it was believed that an educational program which would help the farmers to better understand the relations existing between bacteria and milk quality would produce the best results.

When we consider the difficulties encountered by milk inspectors and research men having access to modern laboratory facilities, it is not hard to understand how difficult it is for the farmer who has never seen any bacteria, and who knows only in a general way what they are, to appreciate their significance in connection with their milk supply. If your milk dealer should tell you that each quart bottle of milk delivered contained a thousand monkeys of microscopic size, I venture to say that you would be somewhat skeptical. Is there any more reason why the farmer should believe that this milk contains one or more million microscopic plants, simply because we tell him so? My experience in attempting to present this subject to groups of farmers, and to our Winter Course students, convinced me some time ago of the necessity of finding some means of making the farmer realize that bacteria are real objects, not products of the imagination. In order to try this out, our Department co-operated in a three days' extension school in one of our dairy sections at which I endeavored to remove the mystery



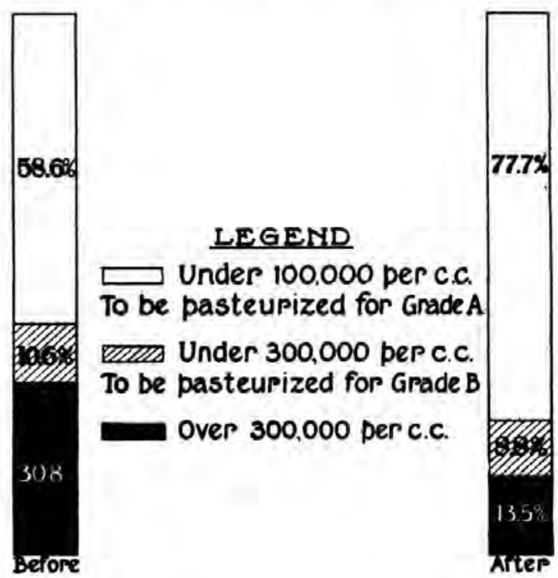
surrounding this subject by means of some simple laboratory work. By means of a microscope the farmers were able to actually see the bacteria, both living and in stain preparations, transferred directly from milk, and by plating two or three samples of milk on the first day of the school they were able to see the colonies in the plates and figure out the bacteria count on the third day.

The results of this first attempt were so encouraging that we have developed this work, and during the last two or three years Prof. J. D. Brew, Extension Professor in our Department, has done work similar to that described above in a number of extension schools. During the past summer season, Professor Brew has extended this in a number of milk plants in different parts of the state.

It is the results of his work which I wish to report to you. A brief statement regarding the work in one plant will indicate the methods and the results obtained. A plant having eighty-two patrons had been notified by the New York authorities that unless they reduced their bacteria count their milk would be excluded from New York City. Professor Brew went to this plant and took samples of each patron's milk as it was delivered on the 7th, 8th, and 9th of March.

Direct microscopic counts were made from these samples and the averages showed that 77.6 per cent of the patrons were delivering milk with bacteria counts below 100,000, and 6.8 per cent with counts between 100,000 and 300,000, while 15.8 per cent showed counts above 300,000. At the end of this three-day period a meeting of the patrons was called and 130 farmers were present, in spite of the fact that there were only eighty-two patrons delivering milk to this plant. Professor Brew discussed the practical aspects of the situation with the farmers and gave them an opportunity to actually see bacteria under the microscope. The farmers were eager for information, showing their interest by many questions and much discussion. The fact that they were able to actually see that bacteria were living objects

AVERAGE QUALITY OF MILK AT 10 PLANTS BEFORE AND AFTER MEETINGS OF PATRONS



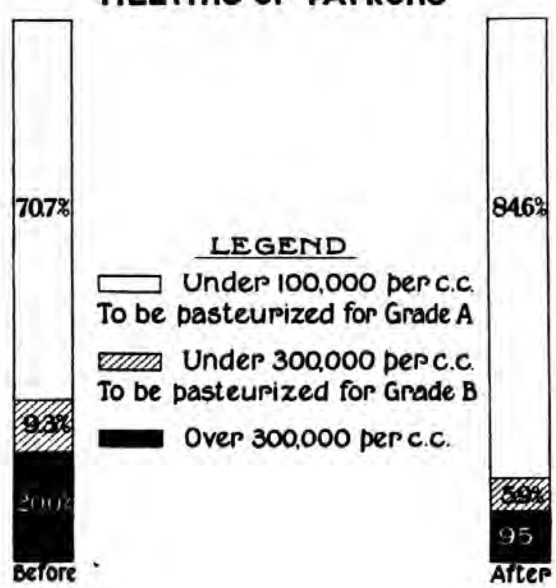
having power of increasing in numbers enabled them to understand their significance in milk much more clearly than before.

On March 30th and 31st, Professor Brew returned to this plant, again grading the milk of all of the producers as before. He found that 88.1 per cent of the producers were now in the group below 100,000, 5.6 per cent between 100,000 and 300,000, and only 6.2 per cent above 300,000. The bacteria count of the mixed milk from this plant also showed very marked improvement. On the mornings of the 8th and 9th the counts from the mixed milk were 260,000 and 430,000 respectively, while on the 30th and 31st the mixed milk showed counts of 80,000 and 140,000 respectively.

The results of this work led to calls from other plants and similar work has been done in fifteen plants in different parts of the state during the past summer. The summaries of this work are given in the charts which I think need but little, if any explanation.

Two features in connection with this work have been of special interest to us from the standpoint of our extension work, and we believe have been of special value to the milk producers. The first is the fact that it has been much easier than we anticipated to let the farmers actually see bacteria under the microscope, thus removing the element of mystery from this subject. The second is the opportunity which it gives the extension worker and the farmers for informal discussion of special problems, and in many cases statements made by individual farmers have been of much value. One case will illustrate this point. In one of the plants, one of the farmers, of his own accord, placed one can of his night's milk in water at a temperature of 35° and allowed another one to stand over night in the air, which during the night dropped down to freezing. The bacteria count in these two cans when delivered to the milk station the next morning

AVERAGE QUALITY OF 2001 SAMPLES OF HAND DRAWN MILK BEFORE AND AFTER MEETING OF PATRONS



were 10,000 and 900,000 respectively. An illustration of this sort is the best possible education on the subject of the necessity for properly cooling milk.

The results obtained in this work during the past season have been very encouraging and we believe that further development along these lines will give excellent results. We believe that work of this sort will be of value to the farmer in helping him to solve the difficult problem of controlling his bacteria counts; to the inspector whose troubles will be lessened in proportion as the farmer is able to deliver milk with satisfactory bacteria counts, and to the city health officials because it will enable the city consumers under their charge to receive a milk supply with lower bacteria counts and therefore of better quality.

"How long we live, not years, but actions tell."

PRODUCTION OF CERTIFIED MILK AND ITS RESULTS

AUGUSTUS FORREST, *Chief*, Bureau of Food and Dairy Inspection, Department of Health, Birmingham, Ala.

Birmingham until recently had a very inadequate and quite unsafe milk supply. Its safety has increased, but the inadequacy remains. By inadequacy is meant the amount consumed. No one who really wants milk has to go without it in Birmingham, but the unfortunate part of it is, not enough people want it.

Gradually they are gaining confidence in their city's milk supply, and gradually they are being made to realize the value of milk as a food. However, the consumption of milk is too low. Only about 6,000 gallons are being consumed daily in the city, or about one-tenth of a pint per capita.

Ridiculously low as this amount is, equally ridiculous is the fact that until recently there was no milk that could be considered safe for infant feeding.

Quite frequently the Health Department would be called upon to answer requests from newcomers or travelers for information as to the possibility of their securing certified milk. They had come from cities where they had used it and felt certain of securing it in Birmingham.

One of the recently organized milk plants conceived the plan of distributing certified milk if some one could be found to produce it. A man was found who had recently moved from Toledo, who knew enough about dairying but not too much to accept suggestions. He rented a dairy twelve miles from town, well suited for the production of certified milk, and things started.

The first point that was necessary to impress upon the mind of this producer was that of sterilization of utensils. He had all the other points necessary for the production of certified milk quite well in mind or received them readily. The necessity for sterilization of bottles and utensils was new to him. We ran a series of tests to teach him how and why.

For the purposes of sterilization we used a concrete room, 8 x 8 interior, arranged with racks for bottles and cans. A steam pipe a half-inch in diameter entering the sterilizing room at the bottom was connected with a six horse upright boiler.

At first some difficulty was experienced. This difficulty was soon overcome by the simple process of more steam at higher pressure and for a longer period. It was found very satisfactory to steam thirty minutes at 80 to 120 pounds steam pressure. At this pressure for this time we secured on a test of seventy bottles 83 per cent sterile bottles, the remaining bottles not exceeding nor equaling except in one case five bacteria per c. c. In no bottle were gas-producing organisms found.

The method used in determining the efficiency of sterilization was that of selecting five bottles from various parts of the rack in the sterilization room. Having five water blanks containing 100 c. c. of sterile water, the five bottles to be tested would be rinsed with the sterile water and the water poured back into the sterile water bottles and returned to the laboratory for analysis. All bottles and stoppers were flamed each time, and samples were carried in Peter Gray sampling cases to reduce and retain temperature.

These methods are simple but very effective. So much skepticism had been established as to the possibility of securing a sterile bottle that it was very necessary for us to convince all concerned that efficient sterilization could be secured, and it was a fact that we very well established.

After these preliminaries were completed the remaining points involved were not so difficult. The complete scrubbing of the barn daily, the thorough washing of udders, brushing and currying of sides of the cows and washing of hands of milkers between the milking of each cow, was carried out consistently.

Because of the comparatively small amount of milk being produced and sold, the amount being only fifty gallons, no cooler was used, but the milk was cooled in five and ten-gallon cans as the cans were strained full. The cooling was then done by setting the cans in ice water and stirring for ten minutes. This may be a feature of technique to which considerable objection may be given, but we never experienced any increase in counts as we have from an air exposed or unclean cooler.

While the equipment at this dairy was complete, efficient and durable, it was not elaborate or so expensive as to make its installation under like circumstances at all prohibitive.

This producer had a lucrative offer from a mining company to furnish its employees with pure milk, and it became necessary for us to establish another dairy to supply the trade established. The dairy that was built for this purpose more or less under our supervision cost, according to the owner, about $14,000.00. This included cows, which numbered fifty, deep well, truck, and lighting system. The barn, milk house, and feed room, with equipment, cost approximately $5,000.00.

Why the production of certified milk should be encouraged when the danger of the dissemination of contagious diseases, particularly those of childhood, is so well known may seem somewhat incongruous with our desire to secure the complete pasteurization of all milk; but certified milk has many champions, and among them are some physicians who limit their practice greatly or entirely to the care of infants and children.

"There are opinions which come from the heart, and whoever has no fixed opinions has no constant feelings."

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

Geo. E. Bolling, *Chairman*

From time to time severe criticism of the value of bacterial milk analysis in the supervision of milk supplies has emanated from various sources, so much so as to be taken as a matter of course, and fairly recent events have proved no exception to this condition. There are a sufficient number of records of collaborative work of individuals or laboratories in which the data are in such close accordance as should definitely convince any unprejudiced inquirer of the probability of competent workers achieving like results. Well-trained technicians, properly supervised, employing standardized technique, have proved this repeatedly.

Calling attention to large variations in results obtained upon identical samples by different individuals simply emphasizes that they are not well-trained, are not properly supervised or do not use standardized technique or are otherwise incompetent. To permit any such to continue in milk control work without attempting to remedy the condition should be deemed a reflection upon the officials or community wherever such are found.

A few years ago this committee recommended the seeking of such legislation in the various states as would necessitate the procuring of a state license or certificate for those engaged in this work. We are strongly of the opinion that the need of such legislation still exists.

Years ago the New York Milk Committee stated that milk with a high bacterial content indicated one or more of three things: dirt, age, or lack of proper refrigeration. All of these are undesirable and this committee is unaware of any method of examination that will disclose the character of any milk as well as a bacterial count.

The present official medium for making plate counts is one that even its strongest proponents admit falls short of telling the whole truth of any milk under examination. For certain economic reasons, particularly to have but one medium for both milk and water bacterial counts, the present medium was adopted. While acquiescing in its use the members of this committee were not altogether complaisant in the matter.

Our attention the past year has been devoted to the trial of a new medium for bacterial counts as described by Ayers and Mudge of the Research Laboratories of the Dairy Division of the U. S. Department of Agriculture, their article "Milk-Powder Agar for the Determination of Bacteria in Milk" being published in the Journal of Bacteriology in November, 1920. This medium gives a much higher count than the present standard meat extract agar or even the former standard meat infusion agar. In short, it comes nearer to telling the truth about the sample under examination. To use the words of the authors: "If bacteria are in milk there is no logical reason for counting only a portion of them. A bacterial count is made to determine the number of bacteria in milk, and if one medium shows higher counts than another, it is evident that the highest count comes closest to the actual number of bacteria in the milk. With either the infusion or extract agar medium nothing but a simple count can be obtained. If a medium can be devised which gives an indication of different groups of bacteria or even only a single group, in other words, a medium which will give any information relative to the bacteria in milk besides a simple count, it should prove to have distinct advantage over the media now in common use." With these statements the committee agrees. There is a reason for all bacteria found in milk. If we are to correlate the work of the field men and the laboratorians we must have a medium that comes nearer the truth than the present standard. If a field inspector, tracing a particular

fore must be pure, he may well wonder what it all amounts
contamination, is told by the laboratorian that it contains only a few hundred bacteria per cubic centimeter and therefore must be pure, he may well wonder what it all amounts to.

Five laboratories, represented by as many members of this committee, have given this medium sufficient trial to confirm the work of the authors as regards its quantitative aspects. As regards its qualitative features, while the results were not as clear, it is evident that a certain amount of desirable information is obtained.

The formula for milk-powder agar calls for the following ingredients to make one liter of medium:

Sol. A

5 grams skimmed-milk powder 1 gram sodium dibasic phosphate	dissolved in 250 c. c. distilled water

Sol. B

5 grams peptone 3 grams meat extract	dissolved in 250 c. c. distilled water

Mix A and B and add 500 c. c. of 3% washed agar solution.

Relative to the comparative labor involved in making this and the present standard medium, four of the five members who have worked with it have expressed an opinion. One thought it to be easier to prepare, two that it was harder and one that the labor was about the same. It was quite generally thought, however, that increased familiarity would render easier the preparation of successive lots of this medium.

The committee is unanimously of the opinion that milk-powder agar is a valuable contribution and will continue its study, therefore wish this report to be regarded merely as progressive.

One of the committee, Prof. L. H. Cooledge, who had previously developed a method for judging the keeping quality of milk by its colorimetric hydrogen ion determination has compared the present standard agar and milk-powder agar by this method. He finds that counts made upon milk-powder agar plates check more closely with the actual keeping quality of the milk; the different methods placing samples of milk as to their actual keeping quality in the following order:

Hydrogen ion score	16% error
Milk-powder agar	17% error
Standard agar	31% error

The committee realizes that a significant reason for variation in results reported upon the same milk by different laboratories is variation in the media employed. With this in mind steps will be taken to ascertain the feasibility of preparation of both the present standard agar and milk-powder agar commercially.

If a satisfactory and uniform preparation can be made the committee feels that a prolific source of error would have been eliminated.

"An error is the more dangerous in proportion to the degree of truth which it contains."

TRANSPORTATION AND MARKETING OF MILK

DR. C. W. EDDY, Telling-Belle Vernon Co., Cleveland, O.

Transportation and marketing of milk is a problem for each community, but broadly speaking, and for the purpose of discussion, cities of this country can be divided into three general classes:

First: The large metropolitan areas, as New York and Chicago, where milk is shipped in large amounts from considerable distances to the various distributing points in the cities.

Second: The small communities where the producer is also the distributer in many cases, or the producer hauls the milk directly to the distributer.

Third: The cities having a combination of all these methods. This latter class of cities have the most difficult problems of both transportation and marketing.

The ideal method of transporting milk is the shipment in refrigerated cars of milk which has been received at a creamery or gathering station in the country, properly pasteurized and cooled, bottled or canned. This method is not economically feasible except where large amounts are handled, and the revenue derived by the railroad warrants the service. This method of transportation is for the most part limited to the larger metropolitan areas.

In the small community, the problems of transportation are solved by the producer hauling the milk in wagons or trucks directly to the distributer. In many instances producers organize routes and employ some one to haul the milk, or take turns in hauling. In many instances the distributing company organize routes and render their service, and deduct the charge from the price paid for the milk.

In the third class of cities the problem becomes more complicated. In addition to the methods described, vast amounts of milk are shipped by railroads and trolley lines, and more and more by motor trucks, as improved roads are extended into the country. This class of service has many features to commend it; it eliminates the necessity of the producer hauling long distances to shipping points and has the great advantage of conveying the milk directly to the distributer's plant, doing away with the haul from the depot to the distributing plant. In some cases trailers with glass lined tanks can be attached to trucks, doubling the capacity. This is especially advantageous in the care of milk hauled from gathering stations in the country. Milk transported in this way has reached the distributing point under the observation of the writer, with a minimum of loss and expense. No refrigeration is practical in any of the instances. Milk shipped on trucks can be protected by wet blankets or canvas from the sun, but prevention of freezing in severe cold weather is more difficult and indeed impossible on long hauls in severe weather. A serious objection to this method is complete break-down due to severe snow storms, with consequent blocking of roads. In northern climates this forces the railroads and trolley lines to take up a service for which in many cases they are not adequately prepared, and milk shortages, more or less temporary, result.

Railroad and trolley transportation is the most reliable, but with the exception of carload lots, no refrigeration is possible, and the milk must be hauled from the depot to the distributing plant within the cities. Transportation is by motor truck or horse drawn vehicles. For short hauls, horse equipage is far more economical and reliable; for long hauls where repeated trips are made, motor trucks are more satisfactory.

Milk properly produced and reasonably cooled will reach the distributing point in satisfactory condition, even during the hottest weather, by any of these methods. In this connection a well organized plan of municipal dairy inspection will be of invaluable aid.

The distributer in the large city with one or more branches has the problem of transporting the bottled milk from the main plant to the branches. This problem is most satisfactorily met by the use of insulated refrigerated trailers which are hauled by tractors to the various branches. The trailer contains 220 cases of milk and can be detached and the milk taken from them directly to the retail wagons, doing away with the necessity of a branch depot with its attendant expense. Breakage of bottles is materially reduced. These trailers can be returned to the plant with the empty bottles in the morning, and returned loaded at night. Depending upon the distance from the main plant, one tractor can make several trips. The advantages and economy of this method of transportation for branch service in the case of bottled milk are too obvious to need much comment.

Marketing problems vary somewhat in proportion to the size of communities. Wholesale distribution to large consumers involves only the problem of conveying the milk in containers, usually cans, to the customer in as good condition as possible. This often is combined with retail delivery.

The most economical and sanitary method of marketing milk at retail is the direct sale to the customer from the distributing plant, making a charge for the bottle or demanding one in return, and refunding for empty bottles returned. A method growing very rapidly in vogue in congested areas of large cities is the wholesale delivery of large amounts of bottled milk to stores, confectioneries, stands, markets, etc. These sales are made for cash, and the charge for bottles included. The store proprietor in turn collects from the customer and charges for bottles. A distinct bottle is used for this trade, which eliminates an immense amount of bottle loss. In congested areas of large cities, with a large floating population, this is the only practical method that is commercially sound. Any other method involves such a severe loss as to make it prohibitive. Only bottled goods should be sold in this manner, and good refrigeration provided by the store proprietor.

Delivery at retail on the credit plan is the most expensive method, but in all probability can never be eliminated. The night delivery of bottled milk to individual customers constitutes a large proportion of the retail business of every dealer, and in the case of small dealers, oftentimes the entire business. The problem involved is to deliver in as small areas as possible, to minimize bottle losses, to collect as promptly as possible, adjust complaints, and extend business by addition of new customers.

No refrigeration is practical with retail deliveries. Delivery should be made at night during summer months and daylight delivery can be made during the cold months.

A well organized system of municipal dairy inspection, with a permanent and competent personnel, can be of invaluable assistance to both distributer and to consumer. Indeed such assistance under present day methods of strenuous competition and high costs is an absolute necessity.

"Difficulties spur us whenever they do not check us."

SAFE MILK, THE OBJECT OF PASTEURIZATION

SAMUEL M. HEULINGS, New York City.

The temperature treatment of milk, termed PASTEURIZATION, must be such as to eliminate from the milk all pathogenic organisms. It must create a barrier through which milk-borne infections, pathogenic to man, cannot pass. Any temperature treatment of milk that does not create such a barrier is not pasteurization. The determination of the temperature treatment of milk required to effect pasteurization is the result of scientific investigations in the laboratory, and as it is conceivable that there may be some variations in the heat-resisting qualities of some groups of the same species of organisms, it is reasonable that there should be some variations in the results obtained by different scientists in different laboratories.

If one scientific investigator finds that all of a certain species of organisms were destroyed at a certain temperature, this simply refers to the field covered by his work and does not indicate in any way that another scientist finding greater heat resisters of the same species is wrong in his conclusions. Therefore, from the protection of the public health point of view, it is necessary to define the pasteurizing treatment of milk as at that minimum time and temperature that will destroy the greatest heat resisters of any species of pathogenic organisms which do not form spores.

The treatment of milk in a laboratory and in a commercial milk plant are by no means parallel. The variations in the laboratory treatment are negligible, if any, while in the commercial milk plant, with the best of equipment, there are constant fluctuations, so that there must be added to the minimum necessary treatment, as shown by the laboratory, such degrees of temperature and time of holding as a factor of safety that will serve to surely protect the commercial milk against the lowest temperature or shortest time swings of these fluctuations.

After careful consideration of the scientific data on elimination of pathogenic organisms from milk and of the engineering problems in applying commercially this pasteurizing treatment to milk, the Committee on Milk Supply of the Sanitary Engineering Section of the American Public Health Association decided, as stated on pages 6 and 26 of its 1920 report, to define pasteurization of milk as milk heated to not below 145° and held at not below 145° for not less than 30 minutes.

In support of this definition of the pasteurization of milk, the following authoritative references are quoted:

"Milk heated to 60° C. (140° F.) and held at that temperature for 20 minutes will kill the viruses of tuberculosis, typhoid fever, scarlet fever, diphtheria, malta fever, dysentary, foot and mouth diseases; this time and temperature will also kill streptococci, staphylococci, and practically all non-spore-bearing micro-organisms pathogenic to man. To provide a factor of safety it is advisable in commercial practices to heat milk to 65° C. (149°-150° F.) for a period of 30 or 45 minutes.

"The holding method consists in heating the milk to the desired temperature, say 65° C., and then holding it in a suitable tank or series of tanks at that temperature for a given period of time, say 30 or 45 minutes. This method has proven satisfactory in practice under commercial conditions."*

The following authoritative letters were written to and are on file at the Department of Health of the State of Pennsylvania, Harrisburg, Pa.:

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*Extract from "Preventive Medicine and Hygiene," by M. J. Rosenau, page 518, 1913 edition.

THE ROCKEFELLER INSTITUTE
FOR MEDICAL RESEARCH
Department of Animal Pathology
Princeton, N. J.

February 28, 1921.

I have your letter of February 26th asking my opinion of the regulation of the U. S. Department of Agriculture concerning the pasteurization of milk. My opinion, subject to further thorough experimentation on the tubercle bacillus in commercially operated plants, is that a temperature of 145° F. for not less than 30 minutes allows a slight margin of safety which should be maintained under commercial conditions. If further experimentation, as stated above, should actually show that this is a larger margin of safety than is needed, then I think it would be time enough to change the figures.

Very truly yours,

(Signed) Theobald Smith,
Director.

THE JOHNS HOPKINS UNIVERSITY
School of Hygiene and Public Health
Monument and Wolfe Streets

Department of Chemical Hygiene,
E. V. McCollum, Professor.

March 3, 1921.

Replying to your letter of February 28th. It is the consensus of opinions of all bacteriologists and health laboratory directors, so far as I am aware, that pasteurization of milk at a temperature of 145 degrees F. for 30 minutes renders the milk safe, and insures that it will not contain living tubercule organisms, or typhoid fever, scarlet fever, and sore throat organisms. Of course my own knowledge on this point is all derived from others, since I am not a bacteriologist.

Yours sincerely,

(Signed) E. V. McCollum.

UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Animal Industry
Washington, D. C.

Dairy Division.

March 2, 1921.

I have your letter of February 28th and note your statement of the definition of pasteurized milk as given in Food Inspection Decision 178, U. S. Department of Agriculture, which defines pasteurized milk as milk subjected to a temperature not lower than 145 degrees F. for not less than 30 minutes.

I can see no reason why this definition is not proper for a State regulation. It must, of course, be realized that in practical work it is difficult to maintain any exact temperature, particularly where small amounts of milk are handled. There is therefore likely to be an occasional drop below 145 degrees during the process when the temperature desired is 145. With careful automatic control it is, of course, much easier to maintain a constant temperature. This is a point which might have to be considered in the enforcement of the regulation.

(Signed) S. H. Ayers,
Bacteriologist.

DEPARTMENT OF AGRICULTURE
Bureau of Chemistry
Washington, D. C.

Address reply,
Chief, Bureau of Chemistry.

March 11, 1921.

This will acknowledge the receipt of your letter of February 28th, advising that your Department is considering regulations regarding the pasteurization of milk. I note that you are familiar with the provisions of F. I. D. 178 which defines pasteurized milk as milk subjected to a temperature not lower than 145 degrees F. for not less than thirty minutes. This Department believes that this is a proper definition for pasteurization whether for Federal, State or municipal enforcement.

Respectfully,

(Signed) C. L. Alsberg.

TREASURY DEPARTMENT
Bureau of Public Health Service
Washington, D. C.

Office of the Surgeon General.

March 9, 1921.

Receipt is acknowledged of your letter of February 28th, inquiring whether in the opinion of this Bureau, the pasteurization of milk at a temperature not lower than 145 degrees F. for not less than 30 minutes would be satisfactory as a State regulation.

While experimental data indicate that satisfactory pasteurization of milk may be accomplished at a somewhat lower temperature and with a shorter holding time, it is believed that in large-scale commercial handling it is better to adhere to the figures given above.

By direction of the Surgeon General.

Respectfully,

(Signed) J. W. Schereschewsky,
Assistant Surgeon General.

UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Animal Industry
Washington, D. C.

Dairy Division.

March 2, 1921.

In reply to your letter of February 28th, we wish to state that we consider a temperature of 145 degrees F. for a period of thirty minutes to be the proper temperature and holding time for pasteurizing milk, and we would consider the definition you mention as proper for a State Regulation.

Very truly yours,

(Signed) L. H. Burgwald,
Ass't Market Milk Specialist.

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

Office of Hygienic Laboratory.

March 5, 1921.

I have your letter of the 28th ult. concerning temperature for the pasteurization of milk. Asking you to consider this as my individual opinion, I would state that while the experimental data indicate that satisfactory pasteurization of milk may be accomplished on a small scale at a somewhat lower temperature and with a shorter holding time than those indicated (145° for 30 minutes), it is believed that considering the vicissitudes encountered in large scale commercial handling, it is better to adhere to the figures given in your letter in drawing up State Regulations.

Very truly yours,

(Signed) G. W. McCoy,
Director.

The following letter was written to S. M. Heulings, New York City:

THE JOHNS HOPKINS UNIVERSITY
School of Hygiene and Public Health,
310-312 West Monument Street,
Baltimore, Md.

Dept. of Bacteriology.

November 14, 1921.

I have received your letter regarding milk pasteurization and in reply will state that I am in favor of pasteurization at as high a temperature as is consistent with the avoidance of a burnt taste and the retention of a satisfactory cream line. I believe that a temperature of 145° F. maintained for 30 minutes offers a greater margin of safety than one of 142° F. If it could be pushed up to 149° or 150° F., the margin of safety would be correspondingly increased; after such pasteurization the milk should be cooled and kept cool till used.

Very sincerely yours,

(Signed) William W. Ford.

Means of applying the pasteurizing treatment to milk should be employed that will be positive in its thorough treatment of all the milk with as little change as possible in the natural conditions of the milk. It is desirable to raise the temperature of the milk as rapidly as possible with a heating medium of but a few degrees higher than the temperature to which the milk is to be heated. This can best be accomplished, if, as is frequently the case in milk plants handling a small volume of milk, the ordinary commercial milk vat with coil is used by having a relatively large proportion of heating surface in the coil to the cubic milk content of the vat and by forcing the circulating water through the coil rapidly with a positive acting piston pump. The small, high speed rotary pumps frequently used for this purpose are very apt to become air or vapor bound and the volume of water circulated is often very uncertain.

The importance of this rapid and positive circulation of the heating water may be made clear by taking into consideration that when the coil is submerged in cold milk at the start of the heating of the milk, if the flow is sluggish, the hot water in the coil will be cooled by the milk soon after entering the coil and all the coil surface thereafter is of no value until the milk is nearly heated, while if the flow is rapid it is driven through the coil and the whole coil surface becomes effective.

The rotary pump for the circulating water and the steam jet for heating and circulating water at the same time have caused a great deal of trouble and inefficient work with pasteurizing apparatus.

The steam used for heating the water should not enter the coil but should be applied to the water in a small jet tank controlled by a temperature regulator.

The vat should be well insulated so that when the milk reaches a temperature of 146 to 147° F. the circulating water may be shut off and the temperature of the milk will not drop more than 1 degree in 35 to 40 minutes.

With the end of the holding period ends the temperature treatment for the elimination of pathogenic organisms. If the milk is to be bottled and the cream line is of importance, the milk should be drawn from the vat over a separate cooler and cooled to 40 to 50° F. as rapidly as possible.

Every safeguard should be taken to prevent reinfection of the milk after the end of the holding period. All apparatus and containers must be sterilized.

The cream line in a bottle of milk is often a matter of importance commercially, but in no other way; therefore, it seems important to consider this from the commercial view when the milk is in the bottle. A small theoretical variation in the cream line is not important in bottled milk. This will be understood when it is considered that in milk bottles where the cream line is about 3½ inches from the top of the bottle, 1 per cent in the cream volume will be less than 1/16 inch in depth along the side of the bottle, a variation that could not be noticed commercially and one which is constantly occurring on account of the variations in the shape of the bottles. The above applies to whole milk. It may be possible that milk that has been partially skimmed and is sold under the camouflage, mystic designation of "Standardized," or without any designation at all calling attention to its partial skimming, may react differently from whole milk as to its "cream line" when heated to 145° and held for 30 minutes.

The small, and often many of the large milk dealers, are at the mercy of the manufacturers of pasteurizing apparatus, and in endeavoring to comply with health regulations buy such pasteurizing equipment as they think adapted to their business. They have no experts in their organization, nor can they afford to employ experts to test this apparatus to determine whether or not it is effective for the purpose for which it is sold. Therefore, it might be well to consider legislation that would compel the manufacturers of pasteurizing apparatus to furnish with each outfit a certificate specifying in detail its capacity and conditions under which it is to be operated, guaranteeing the effective results to be produced thereby, so that in the event of failure of the apparatus to produce guaranteed results, the milk dealer would not be without redress at any time thereafter.

In consideration of the Report of the Committee on Milk Supply of the Sanitary Engineering Section of the American Public Health Association, published in 1920, defining pasteurization as milk heated to not below 145° F. for not less than 30 minutes, and also in consideration of the authoritative scientific support for this definition included herein, and in further consideration of its being practical to apply this process of pasteurization in large or small milk plants without impairing the commercial condition of the milk, all Federal, State or municipal legislation should define the pasteurizing process of milk as milk heated to not below 145° F. and held at not below 145° for not less than 30 minutes and cooled to 50° or below promptly at end of the holding period. Also, in view of its importance to the public health, all milk marked "Pasteurized" shall have had this treatment as defined by law and any marking or selling of milk as "Pasteurized" that has not had the legal pasteurizing treatment should be made a criminal offense.

"If thou art wise, incline to truth; for truth, not semblance, remains in its place."

VITAMINS IN THE DAIRY RATION AND THEIR EFFECT ON MILK AND MILK PRODUCTS

RAYMOND C. COLWELL, *Chairman*, Board of Food and Drug Commissioners of Rhode Island, Providence, R. I.

Accessory food factors are being accepted by investigators of nutrition as the much needed third member of the adequate food ration, the other two members of which are the calorie producing proteins, fats, and carbohydrates and the inorganic salts. It is well recognized that purified proteins, fats and carbohydrates in whatever proportions they may be combined do not furnish an adequate food ration. This insufficiency, although lessened, is not eliminated by the addition of essential inorganic salts. But a ration combining proper amounts of these calorie producers and essential salts supplemented with a third group, the vitamins, or accessory food factors, does furnish an adequate food ration. Fresh, raw cows' milk from a healthy herd furnishes such a ration for humans under most circumstances. If we define a healthy cow as one secreting milk capable of rearing her calf it is safe to say that milk from healthy cows is always a complete or adequate food. To maintain a cow in the production of this complete food she in turn must be furnished with foods containing the vitamins themselves, for our present knowledge indicates that the cow does not manufacture vitamins, and therefore can supply in her milk only those vitamins which have been contained in her feed and which are in excess of the amount needed for her bodily maintainance.

The Association has had the privilege of hearing addresses from some of the men who were the pioneers in the investigation of accessory food factors, workers who have made and are now making valuable contributions to this subject. To correlate certain of the findings of the nutrition laboratories and to interpret field observations in terms of their researches is the real purpose of this paper. Total solids, butterfat, and their relative proportion to each other have long been the criteria of the food value of any clean milk. Should we try to encourage the dairyman to produce milk with an abundance of vitamins as well as total solids? Most assuredly we should do so, and we should hasten to equip ourselves with information as to the best methods of maintaining the vitamin content of milk.

In the case of those dairymen who breed and raise their own stock this problem takes care of itself in great measure, for they retain in their herds only their most vigorous cattle, specimens able to reproduce; and where this characteristic is predominant, obviously vitamins must have been present in the feed of the cattle and in their milk. The dairyman who is a cow trader can easily overlook the breeding qualities of his cattle and treat them more nearly as a piece of machinery. In dairies of this sort we are more liable to find a vitamin deficiency in the milk.

Let us summarize some of the present knowledge of vitamins in its relation to the dairy cow;

1. Dairy cows require vitamins for bodily maintainance.

2. Dairy cows store vitamins abundantly in their glands and in small amounts in the fleshy portions of their bodies.

3. Many dairy cows furnish vitamins abundantly in their milk.

Since the dairy cow does not manufacture vitamins she must have furnished in her food an abundant supply of vitamins, or she will evidence the lack of them in some one or more of the following ways:

1. A diminution in the vitamin content of the milk.

2. A depletion of the reserve store of vitamins in the glandular tissues.

3. Injury to the health of the cow.

Nutrition researches have already demonstrated that the vitamin content of milk usually is less in winter than in summer, due to the lessened amount of vitamins in the winter dairy ration.

However, the variation in the vitamin content of milk from cows fed on the same ration has not received from investigators the attention which it deserves. The maximum production of total solids and fat of individual cows varies remarkably. The bacterial flora of individual udders vary in kind and number even more remarkably. Is it not reasonable to expect the maximum content of the milk of individual cows to vary?

In summer the disposition of the cow probably controls this variation in great measure, for certain cows in a herd are better foragers than others.

The best foraging cattle have a better opportunity to replenish their stores of vitamins than the less active cattle and so are in better condition to go through the winter. Even when turned into a good pasture some cows prefer to get most of their feed at the barn. This difference in the foraging appetites of cows cannot help being reflected in the quality of their milk. The amount of vitamins required for bodily maintainance by different cows of the same size probably varies very little, but the tendency to store vitamins in the glandular tissue may vary individually just as the tendency to store fat varies.

Other things being equal, the greatest source of variation in concentration of vitamins in the milk is due to the variation in quantity of milk produced by different cows. Often the dairy cow has been likened to a machine which converts the raw materials, dairy foods, into the finished product, milk. Such an analogy does not allow for the autonomous maintenance, repair, and reproduction of the machine. The dairy cow which is being pushed to the peak of her production is washing out of her body every bit of fat, protein, carbohydrate and essential mineral salts that she can manufacture into milk. She even robs her own body of some of these materials. While the cow elaborates within her own body the other constituents of her milk, she merely incorporates into the milk whatever vitamins are present in her ration. The heavy producer needs vitamins for maintenance and has little surplus for her milk. The small surplus is diluted with a large amount of milk and the resulting milk is lean in vitamins.

The cow which is not forced to the limit of her production has a much better chance to produce milk rich in vitamins than the cow which is forced to her limit.

Milk products obviously are dependent on the vitamin content of the milk from which they were made for their own vitamin content. Skimming milk naturally concentrates the vitamin "A" in the cream with the fat, and the vitamins "B" and "C" in the skim milk. This is merely a mechanical separation, and the total amounts are not lessened. The same is true of butter and buttermilk. The relative concentration of vitamins in cheese depends on the original concentration in the milk from which the cheese was made. Heating of milk seems to lessen and even destroy the "C" vitamin. Butter made from pasteurized cream or cheese made from pasteurized milk is practically devoid of "C" vitamin. The filled milks have only the vitamins of the skimmed milk, the vegetable oil being devoid of vitamins. Oleomargarine has vitamin "A" only in proportion to the amount of butter incorporated in the oleomargarine. Oleo oil itself has little if any vitamin present. Milk powders dried in vacuum have a large amount of all the vitamin of the original milk from which they were made but those powders dried by heat lose much of their vitamin. Ice cream contains the vitamins of the milk and cream from which it was made.

Raw milk from vigorous healthy cattle still holds its position of being the one best food for children and when properly modified the best substitute for mother's milk for babies.

Pasteurization has played a tremendous part in the reduction of infant mortality, especially during the summer months. Conditions of production and delivery of the major portion of municipal supplies make pasteurization desirable. While removing dangerous organisms by this method we may also eliminate the anti-scorbutic factor, vitamin "C." This deficiency must then be corrected by the use of orange juice or some other rich source of vitamin "C."

We need a series of cattle rations to insure the proper vitamin content of milk, and we are fast accumulating the information necessary for such a dietary. In the meantime let us avoid the rocks of preformed conclusions and the whirlpools of single track research enthusiasm and steer a middle course in the attempt to improve the vitamin content of milk.

Some stock breeders have already solved this problem by the trial and error method. Our laboratories by examining their successful methods of dairy feeding may be able to apprise us what the essentials of those methods are.

"He who does his best does well."

EDUCATIONAL WORK AND ADVERTISING AS AN AID TO MARKETING MILK

PROF. W. P. B. LOCKWOOD, Amherst, Mass.

Cooperative milk advertising and educational work has been undertaken on the campaign plan, these campaigns varying from one to twelve weeks in length. Some places, however, are doing continued year round work. In this paper the writer will describe the development of the work in Boston, which is continuous year round work, and work with which the writer has had intimate personal contact.

The Railroad Commissioners' reports show the following amounts of milk and cream shipped into Boston, in quarts:

1913	106-½	million	quarts
1914	104	"	"
1915	109-½	"	"
1916	121-½	"	"
1917	140-½	"	"
1918	148-⅓	"	"
1919	156-½	"	"
1920	165	"	"

Previous to 1916 there was a fluctuation in milk shipments and consumption. All advertising and educational work had been done by individual distributers. The above shows steady gain in shipments since 1916. When the United States entered the war, the National Food Administration, U. S. Department of Agriculture, State Food Administration, State Departments of Agriculture, and agricultural colleges took up among other things the utilization of milk, stressing its value for growing children and its economy as a food. In 1917, Mr. Endicott, Food Administrator for Massachusetts, in every way possible supported a milk advertising and educational campaign that was financed cooperatively by the distributers. In 1918 and 1919 the Boston Milk Compaign, lasting about nine months, was carried on. This was handled by a committee representing the producers, the State Board of Agriculture, the Chamber of Commerce and the agricultural college. The campaign was financed by the distributers and producers to the extent of $36,000. The campaign finally stopped from lack of proper organization and support.

In June, 1920, a meeting was called and attended by commissioners of agriculture, state and local health officials, agricultural college representatives, and representatives of charitable organizations, distributers and producers. It was the unanimous opinion of those present that it was desirable to continue the work.

The outcome of this meeting was the organization of the New England Dairy and Food Council, a non-stock, non-profit corporation, chartered under Massachusetts laws with the following purposes:

a. "To collect and disseminate information relative to the food value, health value, and economy in the use of milk and dairy products, and of other food products.
b. "To collect and disseminate information concerning the production, distribution and consumption of milk and dairy products, and of other food products.
c. "To encourage and promote a sound dairy industry, to insure an adequate and satisfactory supply of milk and dairy products, and of other food products for new England."

The following statement of policy has secured for the Council the heartiest cooperation of state and local officials and other organizations:

"WHEREAS, data collected by health authorities, the United States Departments of Agriculture and Labor and others interested in children and school work shows:

1. That there is a large amount of undernourishment in

school children varying from 10 per cent to 40 per cent;

2. That it is found among country children, as well as city children;
3. That it is found in all classes—in the families of well-to-do, as well as in families of the poor;

"WHEREAS, years of experience and experimental work show the necessity of the use of milk and dairy products as a food for children:

1. To stimulate growth and development both mentally and physically;
2. To promote better health;
3. To prevent certain diseases:

"WHEREAS, the New England Dairy and Food Council believes that increased use of milk and dairy products will produce better nutrition, promote health, help in more economic living and at the same time help New England's greatest single agricultural industry;

"Therefore, we propose to present to the public through dietetic and other qualified workers and through direct publicity the facts relative to the use of milk and dairy products.

"In this work it will be the aim of the New England Dairy and Food Council to publish material which meets the approval of Federal, State and local authorities regarding food values and health, and in no case to put out matter under the name of a cooperator without his approval."

Having this definite policy for work gives confidence in the work and leads to conscientious work by the management and workers.

From the results of the previous campaigns and inquiry for work between these campaigns, it was felt that continuous work should be carried on. With this in mind, continuing contracts for the distributers were made, being subject to cancellation, ninety days previous to the beginning of a calendar year. In this contract the distributer agrees to pay one-half cent per 100 pounds of milk purchased and to deduct from each producer's check one-half cent per 100 pounds of milk sold, provided the producer authorizes the deduction. He further agrees to send the sum of these deductions along with his own contribution to the treasurer of the Council. (The writer understands that in some other markets these deductions of producers are made without individual authorizations, but on the vote of the producers' organizations).

The actual amount from each producer is 25 cents per year, per 5,000 pound cow. Collection in this way from the producer reduces collection costs to the minimum. The Boston project, under this financing, will amount to about $22,000 this year.

The Boston and suburban milk dealers' association is now running a $25,000 newspaper advertising campaign with which the Council is not connected. On the other hand, this relieves the Council of all newspaper work, allowing it to handle all other advertising and educational work.

The Council renders all distributer contributors a monthly financial and work report, and sends to the producers, along with their checks, through the distributers, a quarterly report of work done. In addition to this the agricultural press of New England is giving us feature stories and good write-ups.

From the standpoint of the Council, every person, from the growing baby to the aged adult, is either an actual or a potential consumer of milk and dairy products. According to Dr. McCollum and others they should all use milk. With this in mind the essential thing was to group these prospects in such a way that we could approach effectively the largest number at the minimum cost. We wanted to make non-consumers use milk and those that used some milk to use more, or increase the actual milk consumption.

From data already presented, the children naturally furnished the first group. In order to reach them systematically, it was necessary to get to them through the schools. From work already done many contacts had been established with schools, nutrition clinics, and settlement groups.

Our problem is to help the school authorities to "sell" good health to the children by following good health rules, and the selection of proper foods. One cannot talk health without talking food and cannot talk food without talking milk.

Our workers are all trained dieticians and immensely interested in the work. They use stories illustrated with dolls, charts and colored lantern slides, as well as milk and food plays and pageants. (One of our workers wrote a food play that is published in the Massachusetts State Board of Health's monthly magazine. This play has been given in several schools and will be staged on 72 play grounds next summer. "Milk" is the leading character). As new children come to school and others are advanced from grade to grade it becomes necessary for us to prepare interesting material for each group. It is also necessary to have several additional stories, etc., as we are frequently called to go to a school the second, and even the third time, particularly where the interest in milk drinking is lagging; in other words, to "resell" the milk part of the health program to the children. An instance of this happened recently: The teacher informed us a week after the talk was given, "that previous to the talk only fifteen half-pints of milk were being consumed per day by the children, but after the talk the amount increased to sixty half-pints per day."

The teachers use the stories and material presented as a basis for language, essay and poster work. Some of the essays and posters gotten out by the children are very interesting. Teachers are beginning to call on us to fit into the regular health programs for their schools. We have worked in public, private, parochial and evening schools. Our workers have made studies of the different methods of serving milk in the schools, and are often called on to help plan and start this service.

The problem of "selling" health and growth to the child through use of proper foods, including milk, is followed by "selling" to the parents the idea that they can come nearest to giving their children health and good physical and mental development by providing milk for their children. This latter is accomplished by sending proper literature home with the school children and through talks to mothers' clubs, women's clubs, parent-teachers associations, church clubs, etc.

We find that school authorities and others are very glad to use good literature, posters, etc., treating on health and milk, providing they do not bear the imprint of individual distributers.

Talks with workers in stores and factories have resulted in the permanent increase of the use of milk for lunch of from 50 to 300 per cent. In other places they have made workers want milk, and caused the employers to make it possible for the workers to secure it.

We have used literature published by the U. S. Department of Agriculture, and the National Dairy Council. In addition to this, with the cooperation of the Boston Dietetic Bureau, the State Board of Health, and State Board of Agriculture, we have developed material of our own. The getting out of literature in this way has made this literature of much greater value. We have aimed to put out only such material as the best authorities could well back up. As a result one of the State Health Departments of a neighboring state purchased a good-sized order for their own work.

The agricultural shows and fairs, Home Beautiful Expositions, Child Health weeks, Food, Community and Church fairs, are all attended with proper exhibits and literature distribution.

Mechanical exhibits always attract attention. We have used two mechanical cows and three mechanical milk bottles almost continuously. These are used at exhibitions and fairs, in store windows, schools, factories, and in fact, any place where people can see them.

The use of milk plays or pageants on the play grounds in summer presents the work before numbers of people that we could not reach otherwise.

One of the most interesting pieces of work that the writer has been doing, personally, has been to talk to milk drivers and salesmen. From contact at these meetings he is led to believe that many of them are not "sold" on milk, themselves, and that they fail to realize that they represent the company in the eyes of the public, and that their answers to questions either help to increase or decrease business. All this in spite of the work done by the distributers to try to educate and enthuse them.

The report of November 1st will show the work done this year to that date:

753 schools talks given in 253 schools; 100 other talks, given to adult groups, reaching a total of 84,446 children and 6,511 adults;
140,121 pieces of literature have been distributed through the schools and mailed outside;
15,000 pieces have been sold outside;
74,300 pieces have been sold to and distributed through dealers;
71,500 pieces have been distributed at exhibits, fairs, etc;
4,700 posters and 583 milk games have been distributed, making a total of 306,200 pieces.
Mechanical exhibits have been exhibited 75 weeks. The "Milk Fairies" play and food pageants have reached 10,000 and the "Milk Fairies" film 8,000.

Results: More schools are serving milk as a mid-morning lunch.
Milk is replacing other foods for mid-morning lunches.

Two distributers have told the writer that their retail sales of milk were increasing in districts where milk was being served for mid-morning lunches in the schools.

Milk sales have increased steadily from 1916 to 1920, while this type of advertising and educational work has been going on, even on an advance in price.

The milk business, even in the present business depression and time of unemployment, has not decreased as other businesses have.

During the first seven months of this year, in Boston, there has been a loss of milk sales of less than 3 per cent as compared with 1920. Some markets are reporting a decrease of from 5 per cent to 10 per cent for this period.

Some of our distributers who were a little skeptical at the start are enthusiastic about the work.

Forty-two Providence distributers and thirty-three Worcester distributers have signed contracts and expect to start work in those cities soon.

We believe in cooperative advertising and educational work, and believe the producer should pay his share of the expenses.

"Observe and reflect if you would know the truth."

PLEA FOR DISCRIMINATION IN THE SELECTION OF MILK DISTRIBUTERS

PROF. JAMES O. JORDAN, *Inspector of Milk*, Boston, Mass.

There is a phase of milk inspection which has apparently received inadequate attention: namely, that of careful selection of the dealers to whom licenses are granted for the sale of milk and cream from wagons.

In recent years much energy has been exerted by health departments and other agencies in placing before the public the advantages to be derived by the use of generous amounts of these commodities in the diet of children and adults. The necessity for the safeguarding of milk which is to be used exclusively in the feeding of infants has also been exploited to such a degree that the facts in relation to that portion of the commodity may be said to be fairly well known. From the interest which health departments have taken in the dissemination of propaganda as outlined, the citizen is justified in assuming that the officials in charge of these departments would do all in their power to at least surround the immediate handling of milk and cream with all possible precautions. How many health departments have so proceeded in the granting of wagon licenses?

We have always had faulty dairies, and they will be with us for many years to come; they are tolerated only by reason of necessity, for it is an official obligation to provide these foodstuffs for communities. This necessary tolerance of condemnable production methods may account for the apparent slackness in the granting of wagon milk licenses. With respect to this latter feature, however, the proposition of furnishing milk and cream to the public should be considered from a different angle, for the reason that there is not the necessity for numbers in the matter of distributers that exists with relation to dairy farmers. Communities at present have no difficulty in procuring ample supplies of milk and cream, and keen competition, which has always been a feature of the milk business, gives assurance that the price element will be adequately controlled. On the basis of a cold business judgment, the decision would probably be with respect to the present number of wagon dealers, that if there is any embarrassment, it comes from a surplus of distributers rather than from a deficiency.

With respect to the custom of the past, milk permits have generally been granted to all applicants, irrespective of qualifications. Many individuals are of the opinion that it is a sovereign right to engage in this traffic if they so desire; probably the majority of officials charged with the control of this matter coincide with this view. This belief, whether of the individual or the official, should not prevail. The official who so contends and acts, is not doing his duty either to the community, to the prospective licensee, or to his position. From the standpoint of the public, protection is lacking; the licensee is allowed to engage in a business for which by experience and temperament he is usually unfitted; for the official there is the probability of disappointment over results, and an inevitable expenditure of time spent in attempting to correct the dealer's faults. All this entails a waste of the tax payer's money.

The policy of granting wagon milk licenses to those unfamiliar with the rudiments of the business, with the expectation that thereby the public's interests will be adequately conserved, inevitably ends in disappointment. Such a course savors of the farcical.

Furthermore, health departments cannot, in the majority of cases, subsequently and successfully educate these ignorant fledglings in the essentials of their calling. Too often, with the inexperienced dealer, official attempts to lead him to a better understanding of his trade are so misconstrued that opposition instead of cooperation follows. The dealer fails to comprehend why he is expected to do certain things, especially if a money expenditure is involved. To put it tersely: licensing on the above basis followed by educative efforts, commonly means failure. It is attempting the impossible; it cannot be done.

On the ground of sound judgment and business procedure there is every reason why prospective wagon milk dealers should possess some familiarity with good milk handling before being permitted to engage in its sale. The opposite course means imposition to milk consumers. It is the expectation of the public that health officials will conserve their interests in this matter. Protection should not only be granted by the authorities by reason of this confidence, and for the welfare of the community, but also because the law indicates that milk permits are to be given,* "subject to the regulations established by the board of health * * * to suitable persons." While there may be degrees of unsuitability, it cannot be maintained that familiarity with this perishable foodstuff is not an essential in determining who are "suitable persons" under this law to hold these permits.

We have but to follow what has been the policy with other avocations for the public weal to point to the true course with respect to prospective milk dealers. Physicians, dentists, lawyers, pharmacists, plumbers, undertakers, and those in other pursuits, must show a degree of fitness before engaging in their respective occupations. Surely with these examples, we are remiss in our duty if we continue to foist ignorant milkmen upon the public.

This feature is not presented for the purpose of advocating that tests like those required in the above mentioned undertakings be given those with a desire to be the milkmen of the future, but with the idea that the promiscuous issuance of these permits ought to end, and that the possession of skill on the part of the applicant should be a prerequisite for obtaining them. It is not a difficult matter to determine the eligibility of the candidate.

*Massachusetts General Laws, Chapter 94; Sec. 41.

Conservatism in the granting of these permits has more in the way of advantage than that already outlined; the holders of permits will be a great aid, not only through official cooperation, but from their own efforts not to imperil their business, in improving methods of milk production and handling. The new type of dealer ought to be one who is willing to pull with the authorities for improvements in the milk business; an aid to progress, rather than a retarding agency.

Embarkation on this advocated policy for granting this class of licenses is not an undertaking for those who lack the courage of their convictions. It is foreign to the easy course. The official who attempts such regulation will be the subject of much criticism. He will be accused of being "a monopolist," and his motives will be otherwise misconstrued. Nevertheless, the official must decide whether a passive plan, or some process of regulation, will best conserve the interests of those dependent upon him for the protection of their milk supplies. In the analysis of this proposition an outstanding feature must be that the right of the individual, the would-be dealer, must be and is subordinate to the rights of the public.

While, as previously indicated, the object is not to require an examination on the part of those who desire to be milk distributers, it is nevertheless felt that these candidates should give the authorities in writing some statement of their familiarity with the subject; consequently, for this purpose, the following blank has been prepared, and is offered solely as a suggestion:

Information blank to be filled out by those who desire to be granted licenses for the sale of milk or cream from wagons in the ....

Name of applicant (in full)..

Residence ....

Proposed place of business ....

What amount of money do you expect to invest in this venture ....

What is the extent of your experience, if any, in the milk or cream business. (Give dates and length of service)..........................

....

Have you ever been convicted of crime against milk or cream laws ....

If so, number of convictions..............When..............Where..............

Do you plan to sell raw or pasteurized milk or cream....................

Are you expecting to deliver milk in bottles or cans........................

If you propose to sell pasteurized milk or cream state fully your experience in processing milk or cream in this manner

....

....

What equipment do you intend to install in your place of business ....

....

What are to be the sources of your milk or cream supply

....

The above is a true statement.

(Name)..

Date ....

(favorably)
Application considered (unfavorably) by

....

....

....

Date ....

"The good you do is not lost though you forget it."

PERTINENT OBSERVATIONS OF CONDITIONS AT COUNTRY CREAMERIES

WILLARD E. WARD, *Agent,* Board of Health, Brookline, Massachusetts.

During the summer and early fall an investigation of premises, equipments, and methods employed at distant country creameries shipping products to Massachusetts cities was made by Health Commissioner Dr. William C. Woodward and Dr. Charles W. Delano, both of Boston, and the writer. The objects of this investigation were: (1) to ascertain the sanitary conditions in those remote plants, shipping mostly cream and butter, which, because of their remoteness, had not been under as close inspection as seemed desirable, by officials into whose districts the products were distributed; (2) to verify reports that some plants were supplied with water from unprotected or polluted streams and ponds; (3) to study methods for more effectual screening, placement of equipment and protection to products; (4) to be in a position to formulate intelligently minimum regulations for the better sanitary control of such plants; (5) to develop a plan whereby health officials in municipalities to which the products are shipped may assist in enforcing such minimum regulations with the least expenditure of money and duplication of effort.

The investigation included 90 creameries located in 5 States and Southern Canada at distances ranging from 150 to 400 miles from Boston. These creameries are classified and divided as follows:

Class A: 25 having modern equipment were reasonably clean and employed sanitary methods.

Class B: 25 having poor equipment were reasonably clean and employed sanitary methods.

Class C: 22 having modern equipment were unclean and employed unsanitary methods.

Class D: 18 having poor equipment were unclean and employed unsanitary methods.

Regarding Class A, it seems unnecessary, in the interest of brevity, to make comment except to suggest that men responsible for such satisfactory conditions often receive too little encouragement from inspecting officials.

Class B represents creameries where it was evident that local managers were efficient but the proprietors negligent or ignorant as to the necessity for supplying modern equipment in the interest both of economy and health. These local managers were in a receptive mood for any suggestions that would help them to improve the products but usually they were powerless to make improvements which entailed the expenditure of money. We found such conditions to be largely due to the inertia of inspection officials in not bringing pressure to bear upon proprietors, while in a few cases it was evident that owners purposely sought to evade the expense. In this class were found various sanitary defects, such as open processing vats, exposure of the product to dripping grease boxes and cold water piping, inadequate equipment, lack of toilets and hand-washing facilities, presence of boilers, motors, etc., in processing rooms, and various other contaminating agencies.

In Class C about one-third were Farmers' Cooperative Creameries. It seems evident in many such cases that efficient local managers are not in a position to exercise proper supervision over either the products taken in, or method employed in their processing. Most of the buildings occupied by such cooperative creameries were of first class construction with modern equipment, indicating no lack of capital, but some were so filthy and poorly managed as to warrant the assumption that the products were unfit for human food. As an illustration, in one such plant there was a larger number of flies than one would think possible to congregate under one roof. They were massed on the ceiling in great numbers and when stirred up, filled the room like swarms of bees. The water supply was in part from a polluted stream and there was manure and slaughter-house refuse nearby, yet this plant, with few exceptions, had the best equipment obtainable. It had been scored by both city and State inspectors and other than leaving a copy of such scorings, no action was taken. In many of these cooperative plants the farmers bring in their milk in any condition of cleanliness and temperature, with apparent assurance that it will be accepted, as they are either directors or stockholders.

The plants in Class C which were not operated on the cooperative plan were either mostly in isolated districts and received little supervision from the proprietors or health officers; or, they were those in which the owners had invested their money in a business with which they were not familiar.

Creameries in Class D revealed many evidences of polluted water supplies; defecation about buildings due to lack of toilets; inadequate pasteurizing, refrigerating, sterilizing and other processing facilities; infestations of flies, cockroaches and other vermin; corroded equipment and many other instances of gross inefficiency and mismanagement. The causes of these intolerable conditions were primarily both the laxity of health officials of those States in which the creameries were located, and lack of united effort of those in the municipalities into which the products were shipped for distribution.

Twelve creameries in Classes C and D had water supplies which were from unprotected or polluted sources. That State health authorities would allow such water to be used in a food processing plant is, to say the least, incomprehensible.

This investigation opened our eyes to the fact that there are yet many unsolved problems connected with the control of milk supplies, and that while some municipal and even State departments are working diligently for sanitary improvements in certain directions, other phases, equally important, are entirely neglected. If similar conditions exist elsewhere it may be of interest to state briefly what steps have been taken by Eastern health authorities to control them. First the question of polluted water supply was taken up with several State officials having power to correct them. This proved unsatisfactory as it was found that while the dangers were fully appreciated, it was asking such officials in dairying States to commit political suicide to press for remedial action. Then the representatives of the unsanitary creameries were summoned to a hearing at the Boston Health Commissioner's office at which were present many of the health officials into whose districts the products were distributed. Through this action 8 creameries were closed and in the remaining cases where major sanitary deficiencies existed, the representatives were plainly told that unless they could effect immediate corrections the products would be excluded from the municipalities represented. In cases where but minor deficiencies existed, a promise that they would be corrected was exacted. It was soon known, however, that some of these creamery men, rather than make the corrections, were shipping their products to distributing centers in other States. The health officials in those adjoining districts were notified of the existing conditions and accepted an invitation to attend another conference. At this conference the writer proposed organizing a milk control council, to be maintained by funds from benefiting municipalities, which was unanimously adopted. Such a council was organized and will include representation from all the large distributing centers in New England. It is proposed to reinforce the regulations for the control of milk processing and distribution so as to make them more effective with respect to processing and receiving plants, inaccessible for frequent inspections; to define more clearly causes for exclusion; to arrange a cooperative working plan whereby existing duplication of inspection will be largely eliminated and to make it impossible for a supply excluded from one municipality to be distributed in another. The results already accomplished by the council have fully justified its organization and assure its permanency. It is obvious that no combination of milk dealers could successfully oppose any reasonable sanitary requirements of such a representative body.

In conclusion, it should be explained that the statements given above are by no means a reflection upon the efficiency of milk control officials in the indicated distributing centers, for they do not apply to the hundreds of creameries and distributing stations which are accessible for inspection, and are, therefore, in a reasonably sanitary condition.

"The dairy inspector is of greatest value who is able to impress upon the producer the importance of a healthy herd and proper farm sanitation, showing himself as an interested instructor rather than as a police officer."

THE FUNCTION OF THE SANITARIAN IN THE CONDENSERY

John Gaub, Washington, D. C.

The idea of having a sanitarian associated with the organization of a milk condensery is a modern one. This is due to the fact that condensed milk until quite recently was considered an imitation made up of materials that never saw a cow and used only in case of extreme necessity. This mistrust of the consumer undoubtedly was due to faulty methods of manufacture resulting in products of doubtful purity, cleanliness and wholesomeness.

Until recently the manufacture of condensed milk was open to all comers with but little investment. Today, the keen competition of business and the control of food products as practised by the govenments have caused systematized inspection and control to be practised in manufacture, thus assuring the consumer products having uniformity, purity, cleanliness and wholesomeness.

In locating a plant for condensing milk three items are paramount before beginning construction, viz; water, milk, and drainage.

Difficulty in obtaining an adequate supply of pure, cold water has caused much embarrassment and in many instances failures in the past. For there should be available two separate supplies of water—one for boiler purposes, the other abundant, pure and cold in such quantity as to be required for condensing, its temperature being paramount.

Next to the water supply in importance is the supply of milk, which should be in abundance, clean and pure. The community in which the plant is to be placed should be thoroughly adapted in every way to a high standard of dairy farming, having large, healthy and well cared for herds that can produce a grade of milk for a standard product.

Drainage must be such as to prevent any surface overflow from adjoining property and also ample to keep the stock in good condition. It should be ample to care for wastes, as they tend to accumulate and cause nuisances. Many times it is possible to connect the plant with a community sewer, thus saving a big expenditure. Where this is not possible the plant should be at an elevation sufficient for carrying off the wastes into a properly laid-out system of septic tanks and filters from whence the purified effluent may enter a creek, pond, river or lake without causing a nuisance. A plant with a poor location or insufficient or poor supply of water labors under a big handicap. It is advisable therefore to take advantage of hillsides; thus in addition to avoiding the features already mentioned, a means is provided for arranging and operating the plant on the gravity plan.

BUILDING AND EQUIPMENT

The plant should be designed with reference to the products to be manufactured—whether it be sweetened condensed milk, evaporated milk, evaporated buttermilk, skimmed milk, or filled milk or kindred products. Whatever the products are, there are several opportunities for making mistakes in constructing as well as arranging machinery.

The building should be modern, substantial and sanitary, provided with concrete floors, interior painted white, windows screened from insects and all surfaces made smooth and impervious so as to permit ease of cleaning.

All floors should slope to facilitate rapid drainage. Large water seal floor drains should be numerous and so placed as to rapidly carry off the water. The floor drains should be sunk in the floor, having a fall of one-eighth of an inch to the foot with the floor sloping toward them.

All rooms should be so arranged as to necessitate a minimum expenditure for machinery and labor.

Adequate ventilation and light should not be forgotten. Most efficient ventilation can be had from high ceilings and proper roof construction. However, if measures are employed for artificial ventilation a forced system of draft is advisable. Here the exchange of air is rapid, at the same time controlling the temperature and providing clean air.

Light should come from numerous windows or turrets or a saw-tooth roof construction. Either of these arrangements can be made to give a flood of light. An advantage of the saw-tooth roof arises from the cooling and drying effect it has on the plant.

Light has a beneficent effect upon employees, contributes to cleanliness and is an active disinfectant. Hence an abundance of light and good, clean air are necessary to contribute to maximum labor efficiency.

Apparatus and pipes should be so constructed as to permit ease in cleaning. Pumps should be avoided as much as possible. If pumps and pipes are used they should be smooth on the inside. However, excess piping for carrying milk should be avoided, as it becomes a liability instead of an asset the longer it is around the plant. All seams in vats, kettles and other apparatus used in handling milk should be flushed with solder.

Wood should not be used for interior construction due to its shrinking, swelling, and cracking with changes of moisture, thereby causing cracks that are difficult to keep clean, and leakage that is almost certain to occur, all of which conditions become aggravated as time goes on.

All tanks for holding milk should be glass-lined, thus avoiding the development of metallic flavors in the product.

Steam should be available for sterilizing in all rooms where milk is processed. Likewise should water for washing about the plant be provided with pressure for cleaning. All steam and cold water lines should be covered in order to prevent condensation.

Living quarters, such as dressing rooms, toilets and shower baths, should be separated from the rooms in which milk is handled. Besides adequate storage at a uniform temperature, a good system of sanitary sewers should be provided, having pipe large enough to carry off all waste in liquid form, and enough "clean outs" so arranged that in case of stoppage it will not be necessary to open the sewer.

MILK SUPPLY

It is impossible to produce canned milk of a high grade out of anything except strictly normal fresh milk. If the milk is dirty or is from diseased cows it will not stand processing and becomes a total loss. It is therefore essential that the most efficient and rigid sanitary control of the raw material be used.

The limits for accepting poor milk are very narrow; in fact processing the milk is in most cases a better test for the quality of the milk than the bacterial examination usually made in any control laboratory for municipal supply.

The passing of only one or two cans of "off" milk quickly manifests itself in one way or another. However, the problem for the sanitarian is to prevent receiving such milk and to instruct the producer how to avoid contamination or abnormality.

The fact that all condensers strive for uniformity and quality in their products points to the thoroughness of inspection the milk undergoes as it is received at the plant. The inspections of most municipal milk supplies are made usually at irregular intervals, at which time adulteration, cleanliness and safety are considered. In contrast to this every can of milk received at a condensery must be inspected every day. The usual bacteria count as made by the plate method is replaced by sensitive boiling and alizerol tests, which at times reject milk that would be satisfactory for municipal supply, however unprofitable to the condenser.

Where milk is not too abnormal it is held for further investigation, in order to advise the producer so that he may remedy the trouble. These investigations include not only bacterial counts, fermentation tests and hydrogen-ion determinations but also microscopic examinations by special methods which show the presence of disease and the kind of disease. These involve the use of specialized methods of bacteriology whereby certain groups of bacteria and other germ life present, together with other abnormalities, are readily identified, so that the producer can be informed as to the source of the contamination or abnormality in his milk. The speed with which these examinations are made is an important essential, for it is necessary to correct these defects in a producer's milk as soon as possible—usually the same day on which they were discovered. With these specialized methods of control it is possible to examine 150 to 200 samples of milk per day, as a result of which all necessary information, including bacterial counts, will be at hand.

PLANT SANITATION

In order to produce a good product of canned milk, the plant must be kept clean, free from flies, odor and all other enemies of sanitation that tend to affect the product; for it must be kept in mind that milk is a very sensitive food to handle in a place where the accumulation of filth is possible with such ease as at a condensing plant.

Any kind of canned food made under conditions ignoring sanitation will not keep, and many times contains products poisonous to the consumer. The pollution of condensed milk with filth shortens the keeping quality of the product and causes it to be rejected by the consumer, thereby resulting in a complete loss instead of a gain to the manufacturer. Hence the condenser is a quasi-public servant, and as such should practise common decency by paying attention to cleanliness in all operations.

The old adage that cleanliness is next to godliness is very appropriate in a condensery. For the first essential for a good product is clean and sterile apparatus. All pipes, pumps and valves must be cleaned thoroughly with flue-brushes, rinsed, and sterilized with live steam for at least twenty minutes after each day's run. The preheaters, vats, kettles and pans must be thoroughly washed, rinsed and steamed. In case there is milk scale present it is necessary to use 5 per cent alkali solution to dissolve it, after which the apparatus must be washed thoroughly. All pans, pumps, kettles and apparatus coming in contact with milk should be flushed and steamed before using. Milk cans should be brushed with alkali water, thoroughly rinsed, steamed until hot and dried before returning to the producer.

The cans for packing should be stored in a clean room and every precaution taken to guard against their defilement from the enemies of sanitation.

Germicides and disinfectants at one time thought to be necessary adjuncts have been discontinued for an ample supply of hot water and steam.

All water in the cooling tanks should be changed often in order to have it clean. All rubbish should be removed as soon as possible and sewers and drains should be steamed and cleaned out at regular intervals. All grounds adjoining the plant should be kept clean, oiled or sprinkled so as to keep down dust.

The problem of handling milk in the plant from the time of its arrival until it is processed is an important one, due to the bacteria present in the milk. In order to stop the bacterial action the milk must be heated to a temperature high enough to kill the germ life, or else it must be cooled to a temperature low enough to stop growth as soon as possible. Modern practise is to cool the milk in large circular glass-enameled steel tanks. The tanks are surrounded on the bottom and sides by a brine jacket and are equipped with a distributing device that causes the milk as it enters to be sprayed against the sides of the tank down which it percolates in a thin stream. This makes cooling instantaneous at a temperature around 40° F., at which temperature the milk is held until it is processed.

The value of mechanical devices in a condensing plant is apparent, for by them it is possible to handle large quantities of milk in a sanitary manner without coming in contact with human hands, and at the same time permit handling the product at a speed which is essential in producing a food commodity from a perishable product.

It is therefore evident that the development of scientific control from a sanitary standpoint has placed one of our most essential foods on the market in such a way that the consumer is always assured of uniformity in quality, purity and absolute cleanliness no matter how far distant he may be from the place of manufacture.

"He who has not health has nothing."

COMPARISON OF THE EFFICIENCY OF FOUR DIFFERENT TYPES OF PASTEURIZING MACHINES

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The importance of the proper pasteurization of milk supplies is being recognized more and more as the only practicable means of protecting the consumer against possible milk-borne pathogenic or other undesirable organisms.

General approval having been given this means of protection by many investigators and by public officials, manufacture of apparatus for the pasteurization of milk developed rapidly, and today we have several kinds of pasteurizing machines on the market. A detailed description of the various types has been very ably given by Kilbourne in his book, "Pasteurization of Milk from a Practical Standpoint." Detroit, like other places where laws compel pasteurization, has been invaded by manufacturers of all kinds of pasteurizing machinery, and it is the writer's belief that all the different types of pasteurization apparatus have at some time been used in our city. We can therefore furnish ample evidence of what they have accomplished.

Our pasteurization ordinance calls for the holding process. One hundred and forty-five degrees for 30 minutes is required, and any type of machine that will accomplish this may be used.

In October, 1920, a machine for the pasteurization of milk by electricity was introduced into one of our large plants. Although it was not the first time that this apparatus has been used, it was the first time that its trial in a large plant had been observed. With this machine and several other types of pasteurizing apparatus being operated in Detroit, an excellent opportunity was afforded the Health Department to make a comparison and to determine the efficiency of various types in use.

The object of the experiment was to determine:

1. The bacterial reduction efficiency of the pasteurizing machines.
2. The effect on the cream line.
3. The keeping qualities.

Standard methods were used in all laboratory work. Eight to ten samples of raw and pasteurized milk were taken on an average three times per week. The sampling period for the work on the electric pasteurizer extended over a period of ten weeks, or the entire time the machine was in operation.

The samples were taken from the vats just before the raw milk was run into the pasteurizer, and as the same milk was leaving the pasteurizing apparatus.

The samples from the other plants were secured during a period of seven months.

The machines used for this work were the electric pasteurizer (late model), vat, regenerative-continuous, and film-absolute type machine.

In case of the electric pasteurizer a pre-heater was used to heat the raw milk to 145 degrees. From this it was pumped into the electric apparatus. The milk on coming in contact with the two electrodes was heated to 160 degrees F., at which point an automatic valve opened, allowing the milk to leave the machine.

The vat pasteurizer and regenerative-continuous apparatus, I believe, are quite familiar, so a description of these is hardly necessary.

The results obtained with the electrical pasteurizer were not constant and the efficiency dropped below a 90 per cent efficiency 30 per cent of the time, and never reached a 99 per cent efficiency.

The regenerative system only fell below 90 per cent 10 per cent of the time, and was 99 per cent efficient 16 per cent of the time.

The vat pasteurizer was 99 per cent efficient 80 per cent of the time, or what could be said to be ideal efficiency. Not once did it go below 90 per cent.

The other type of absolute system had an ideal efficiency 83 per cent of the time and did not fall below 90 per cent.

The results above shown would indicate high bacterial counts in the bottled product to the consumer. The following table shows the exact counts and also the pasteurizing apparatus used.

The Average Monthly Count

	1920 Oct.	1920 Nov.	1920 Dec.	1921 Jan.	1921 Feb.	1921 March	1921 April
Electric	175,000	195,000	171,000	90,000	......	....	......
Regenerative	......	....	....	......	49,000	103,000	22,000
Vat-absolute	50,000	7,000	17,000	13,000	11,000	14,000	18,000
Film-absolute	40,000	50,000	50,000	18,000	8,000	50,000	60,000

In reviewing literature bearing on the subject of electrical treatment of milk, which is scarce, we find that no two investigators have used the same type of machine, neither have their experiments been along similar lines, so it is impossible to draw any conclusion from their work with electricity as a means of pasteurizing milk.

Anderson and Finklestein (Journal Dairy Science) made a study of electrical pasteurization at Camp Meade. Unfavorable results were obtained with that particular machine, which was entirely different from the ones used in this work.

One of their conclusions was that "from a practical standpoint the electropure machine in operation at this plant has not proved entirely successful in the long run. Modifications in construction must be made before the machines can be considered a commercial success."

From the author's description of the machine everything points to a holding for a short period at least. This, together with the temperature, which ranged from 159 degrees F. to 167 degrees, should give results. During the time the two investigators (Anderson and Finklestein) worked with the machine, the average monthly count was about 18,000 per c. c., but after a month or so the average was about 169,000 and later 234,000.

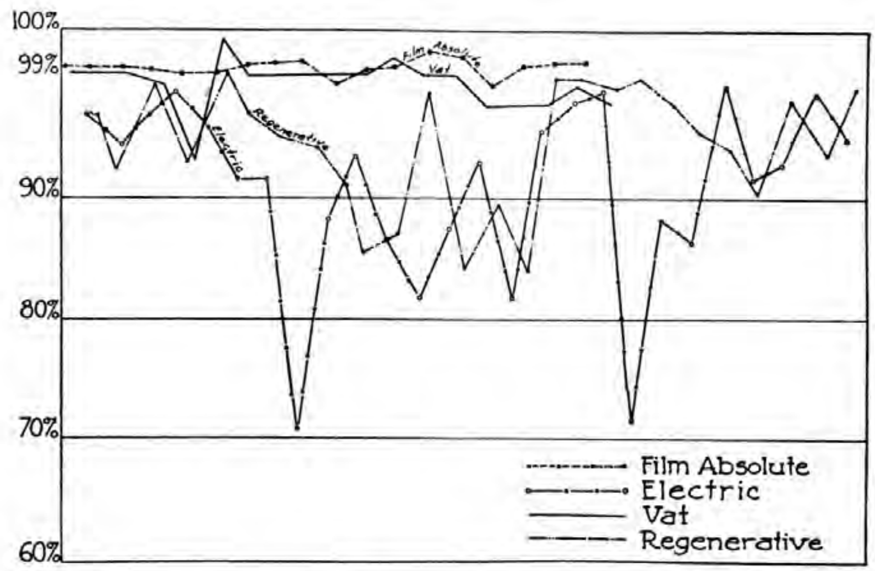
Cream Line.—A study of the cream line was made of all four machines, which showed an average reduction of between 18 and 20 per cent. Not one of the machines gave constant results in this experiment.

Keeping Quality and Safety Factor.—Lack of proper equipment and working personnel did not allow an exhaustive study on this important part of the problem. B. Coli tests were made once a week. The results showed B. Coli present 20 per cent of the time in the electrically pasteurized milk. No confirmations for color on Endo media in milk pasteurized by other types of machines.

No great difference was found in the keeping quality of the milk pasteurized by any of the machines. Samples taken in sterile bottles were kept in an ordinary home refrigerator, maintained at a temperature of 45 to 48 degrees. The samples were examined for flavor and odor every 24 hours. No great difference was noticed in the milk. Three to four days was the average time limit before souring. In this work, it was noticed that the milk from the electric pasteurizer had a purer lactic acid flavor than did the other milk. This, the writer believes, is further evidence against the effectiveness of this process to destroy bacteria.

In pasteurization three important results are to be expected. One is the killing of all pathogenic organisms. The second is the reduction of bacteria that will cause rapid deterioration; in other words, the keeping quality of milk must be improved. Third, a low count must be assured. A combination of these three results is an assurance of efficiency, but when one of these results cannot be shown, then the chain of efficiency is broken and it is impossible to claim that pasteurization is wholly successful.

In the work done with the four machines, those of the holding type (vat, regenerative-continuous, and film-absolute) gave the best results.



THE CHART SHOWS THE EFFICIENCY OF THE FOUR KINDS OF PASTEURIZING APPARATUS ABOVE REFERRED TO.

"An ounce of action is worth a ton of intention."