NINTH ANNUAL REPORT

OF THE

International Association of Dairy and Milk Inspectors

INCLUDING PAPERS READ AT THE ANNUAL
CONVENTION IN CHICAGO, ILLINOIS
OCTOBER 11-12-13, 1920

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

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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 Association of Dairy and Milk Inspectors.

OBJECT

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

MEMBERSHIP

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

OFFICERS

The officers of this Association shall be a President, three Vice-Presidents, a Secretary-Treasurer, and two Auditors, who shall be elected by a majority ballot at the Annual Meeting of the Association, and shall hold office for one year or until their successors are elected. An Executive Board, 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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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, 1919-1920

President, ERNEST KELLY.....Washington, D. C.
First Vice-President, PROF. C. L. ROADHOUSE..Davis, Cal.
Second Vice-President, H. E. BOWMAN..Somerville, Mass.
Third Vice-President, DR. HARRY W. REDFIELD,
New York, N. Y.
Secretary-Treasurer, IVAN C. WELD....Washington, D. C.
Auditors—
THOMAS HOLT.....Hartford, Conn.
W. E. WARD.....Brookline, Mass.

COMMITTEES

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

BOVINE DISEASES—THEIR RELATION TO THE MILK SUPPLY AND TO THE PUBLIC HEALTH

Dr. Hulbert Young, *Chairman*
Dr. Frank P. Dorian
Dr. C. W. Eddy
Dr. G. H. Grapp
Dr. J. B. Hollingsworth
Dr. L. F. Koonce
Dr. Harry S. Lucas
Donald W. MacNair
Dr. John F. Miller
Prof. C. L. Roadhouse
Dr. Clarence E. Smith
Dr. F. P. Woolf

DISEASES OF MAN—THEIR RELATION TO THE MILK SUPPLY AND TO THE PUBLIC HEALTH

A. F. Stevenson, *Chairman*
Dr. A. O. Diaz
Dr. E. Kanasugi
Horatio N. Parker
Dr. L. E. Pollock
Dr. Wm. H. Price
Prof. C. L. Roadhouse

NEW LEGISLATION AFFECTING MILK AND MILK PRODUCTS

Hermann C. Lythgoe, *Chairman*
Gustaf L. Berg
Dr. A. T. Charron
Prof. J. A. Gamble
John Gaub
Emmett R. Gauhn
Prof. T. J. McInerney
Benj. L. Purcell
M. J. Smisek
Dr. O. P. Thompson

TRANSPORTATION AND MARKETING OF MILK AND MILK PRODUCTS

Russell S. Smith, *Chairman*
Herbert E. Bowman
Dr. C. W. Eddy
Thomas Holt
Prof. C. B. Lane
Prof. W. P. B. Lockwood
James E. Thomson
F. D. Walmsley

METHODS OF BACTERIAL ANALYSES OF MILK AND MILK PRODUCTS

Geo. E. Bolling, *Chairman*
L. B. Cook
Dr. J. R. T. Gray
Dr. David Wilbur Horn
Horatio N. Parker
G. C. Supplee
Geo. B. Taylor
Dr. T. Watabiki

ORGANIZATION AND ADMINISTRATION OF MILK CONTROL

Dr. Wm. H. Price, *Chairman*
Prof. H. A. Harding
Thomas Holt
A. W. Lombard
Annetta Nicoll
Horatio N. Parker
Benj. L. Purcell
Ole Salthe
M. J. Smisek
Willard E. Ward

CONSTRUCTION OF DAIRY BUILDINGS AND ITS RELATION TO SANITATION

(a) Stables
(b) Farm Milk Houses
(c) Country Receiving Stations
(d) City Pasteurizing, Bottling and Distributing Plants

Ernest Kelly, *Chairman*
E. F. Burke
H. O. Daniels
A. N. Henderson
Ralph E. Irwin
E. C. Krehl
Prof. C. B. Lane
C. W. Simpson
Dr. O. P. Thompson

REMADE MILK

Leslie W. Ferris, *Chairman*
Prof. James O. Jordan
Prof. C. B. Lane
Dr. Wm. H. Price
Dr. Harry W. Redfield
A. F. Stevenson
Geo. B. Taylor

PASTEURIZATION OF MILK AND CREAM

C. E. Clement, *Chairman*
L. B. Cook
Dr. R. E. Dyer
C. H. Kilbourne
E. C. Krehl
Prof. C. B. Lane
Prof. C. L. Roadhouse
Benjamin Vener

RESOLUTIONS

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

FOOD VALUE OF MILK AND MILK PRODUCTS

Geo. B. Taylor, *Chairman*
Brooks Brown
A. N. Henderson
Frank A. Jackson
Prof. W. P. B. Lockwood
Annetta Nicoll
Fred J. Widmayer

DAIRY METHODS

(a) Sterilization of Utensils
(b) Cooling of Milk
(c) Cleanliness of Buildings and Surroundings
(d) Care of Cattle

Prof. T. J. McInerney, *Chairman*
Thomas F. Flanagan
Prof. James A. Gamble
Clarence W. Horton
John F. Johnston
Thomas J. Strauch
Alexander R. Tolland

COOPERATIVE WORK IN BACTERIOLOGICAL ANALYSES WITH OTHER ASSOCIATIONS

Dr. Wm. H. Price, *Chairman*
Geo. E. Bolling
Annetta Nicoll
Dr. Harry W. Redfield
Prof. C. L. Roadhouse
Dr. T. Watabiki

Members

Archibald, R. W.... Bacteriologist, Div. of Sanitation, Minnesota Board of Health ..... Minneapolis, Minn.
Banov, Leon..... Health Officer, Charleston County Health Dept..... Charleston, S. C.
*Berg, Gustaf L.... Inspector of Milk..... Worcester, Mass.
Billingsley, W. B.... Veterinarian. State Dept. of Health of Maryland..... Baltimore, Md.
Bolling, Geo. E..... Director of Laboratory and Inspector of Milk..... Brockton, Mass.
Bourbeau, E..... General Cheese Inspector..... St. Hyacinthe, Quebec, Canada
Bowman, Herbert E. Inspector of Milk..... Somerville, Mass.
Brown, Brooks..... Dairy Inspector, State Dept. of Agriculture..... Augusta, Maine
Burke, E. F..... Chief, Bureau of Dairy Products, Dept. of Farms and Markets, Div. of Agriculture, State of New York..... Albany, N. Y.
Campbell, Harry J.. Milk Inspector..... Racine, Wis.
Charron, A. T..... Director of Provincial Dairy School and Provincial Agricultural Chemist..... St. Hyacinthe, Quebec, Canada
Chilson, C. H..... Director of Dairy and Food Inspection, Board of Health. Detroit, Mich.
Clement, C. E..... Market Milk Specialist, Dairy Div., U. S. Dept. of Agriculture ..... Washington, D. C.
Cook, L. B..... Manager, Kane Dairy Cooperative Asso..... Kane, Pa.
Cooledge, L. H..... Research Associate in Dairy Bacteriology, Michigan Agricultural College..... East Lansing, Mich.
Cornehl, Hugo..... Dairy Inspector and Supervisor, Board of Health..... Detroit, Mich.
Daniels, H. O..... Deputy State Dairy and Food Commissioner ..... Middletown, Conn.
Diaz, A. O..... Milk Examiner, Board of Health ..... Cienfuegos, Cuba
Dorian, Frank P.... Veterinary Inspector, Bureau of Health..... Yonkers, N. Y.
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.

*Deceased.

Evans, Fred	City Veterinarian	Sioux Falls, S. D.
Ferris, Leslie W.	Asst. Chemist, Bureau of Chemistry, U. S. Dept. of Agriculture	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	With Libby, McNeil & Libby	Morrison, Ill.
Gauhn, Emmett R.	Chief Milk Inspector	Rochester, N. Y.
Gault, Thomas C.	Chief, Dairy and Food Div., Ohio Board of Agriculture	Columbus, O.
Gibbons, John F.	Farm Inspector	New Haven, Conn.
Grapp, G. H.	State Dairy Inspector	Baltimore, Md.
Gray, J. R. T., Jr.	City Bacteriologist	Chester, Pa.
Harding, H. A.	University of Illinois	Urbana, Ill.
Henderson, A. N.	With Davis-Watkins Dairymen's Mfg. Co.	San Francisco, Cal.
Hiscock, Ira V.		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 Milk Work	Bryn Mawr, Pa.
Horton, Clarence W.	Milk Inspector	Swampscott, Mass.
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.
Jackson, Frank A.	Chairman, Board of Food and Drug Commissioners of Rhode Island	Providence, R. I.
Johnston, John F.	Inspector of Milk	Newport, R. I.
Jordan, James O.	Inspector of Milk	Boston, Mass.
Kanasugi, E.	President, Tokio Medical Association	Tokio, Japan
Kelly, Ernest	In charge Market Milk Investigations, U. S. Dept. of Agriculture	Washington, D. C.
Kilbourne, Chas. H.	Food and Sanitary Specialist	New York, N. Y.
Koonce, L. F.	Milk and Meat Inspector	Raleigh, N. C.
Krehl, E. C.	With Detroit Creamery Co.	Detroit, Mich.
Lane, C. B.	In charge Scientific Dept., 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.
Lucas, Harry S.	U. S. Public Health Service	Miami, Okla.
Lythgoe, Hermann C.	Director, Div. of Food and Drugs, Mass. State Dept. of Health	Boston, Mass.

MacNair, Donald W.	State Dairy Inspector	Saratoga, Cal.
McInerney, T. J.	Milk Inspector	Ithaca, N. Y.
McPherson, Andrew.	Chief Milk Inspector, Health Dept.	Detroit, Mich.
Miller, John F.	Chief Milk Inspector	Albany, N. Y.
Moore, Fred J.		Detroit, Mich.
Nicoll, Annetta	City Food Inspector	Topeka, Kansas
Parker, Horatio N.	City Bacteriologist	Jacksonville, Fla.
Phipps, W. H.	Supervisor of Production, Missouri Dairy Co	Kansas City, Mo.
Pollock, L. E.	In charge Milk Control	Toronto, Canada
Price, Wm. H.	With Detroit Creamery Co.	Detroit, Mich.
Purcell, Benj. L.		Richmond, Va.
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.
Salthe, Ole	Asst. Director, Bureau of Food and Drugs, Dept. of Health	New York, N. Y
Sharwell, S. G.	Chief Dairy and Food Inspector, Dept. of Health	Newark, N. J.
Shaw, A. G.	Inspector, U. S. Public Health Service	Columbus, Ga.
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.
Stevenson, A. F.		New York, N. Y.
Strauch, Thos. J.	Chief Dairy Inspector, Bureau of Health	Richmond, Va.
Supplee, G. C.	Director of Research Laboratory for 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, Alexander 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.	Inspector, Borden Company	New York, N. Y.
Ward, Willard E.	Agent, Board of Health, for Milk and Food Inspection	Brookline, Mass.
Washburn, R. M.	Director of Laboratories, International Dry Milk Co.	Minneapolis, Minn.

Watabiki, T.	Professor of Bacteriology, Tokio Charity Hospital Medical College	Tokio, Japan
Weld, Ivan C.	Investigator for Chestnut Farms Dairy	Washington, D. C.
Whittaker, H. A.	Director, Division 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.
Woolf, F. P.	Chief Meat and Milk Inspector	Mobile, Ala.
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.

Ninth Annual Convention

CHICAGO, ILLINOIS

MONDAY, OCTOBER 11, 1920

FIRST SESSION

The Ninth Annual Convention of the International Association of Dairy and Milk Inspectors convened at the Saddle and Sirloin Club, and was called to order at 11 o'clock, President Ernest Kelly presiding.

Prof. H. E. Van Norman, President of the National Dairy Show, in a brief address welcomed the Association to Chicago and to the Dairy Show. President Kelly responded on behalf of the Association, after which he delivered the presidential address.

In the absence of Dr. Hulbert Young, Chairman of the Committee on Bovine Diseases—Their Relation to the Milk Supply and to the Public Health, his report was read by Prof. James Alexander Gamble.

President Kelly announced the death of the following members of the Association during the past year: Dr. W. G. Bissell, Dr. Harry E. States and Gustaf L. Berg. In honor of the memory of the deceased members, the Association voted to adjourn.

SECOND SESSION

President Kelly called the Association to order at 2 o'clock, and introduced Mr. Leslie W. Ferris, Chairman of the Committee on Remade Milk. Chairman Ferris announced the report of his committee would be made by

chairmen of subcommittees investigating different phases of the question. That section of the report dealing with commercial aspects of remade milk, prepared by Mr. Geo. B. Taylor, Chairman, was read by Prof. C. B. Lane. The section of the report dealing with remade milk for infant feeding was presented by Prof. James O. Jordan. The section of the report dealing with experiments for developing methods of detecting remade milk was presented by Mr. Oscar L. Evenson. That part of the report embracing the conclusions of the committee was presented by the chairman of the committee, Mr. Leslie W. Ferris.

A paper prepared by Mr. C. E. Clement on the subject of "Some Economic Problems in Milk Handling," in Mr. Clement's absence was read by Mr. Krehl, of Detroit.

Mr. Ralph E. Irwin, of the Pennsylvania State Department of Health, read a paper on "How the Consumption of Milk may be Increased."

A paper prepared by Prof. H. A. Harding and Dr. M. J. Prucha, of the University of Illinois, on the subject of ropy milk, was presented by Dr. Prucha, after which the convention adjourned.

THIRD SESSION

The Association was called to order by President Kelly at 8 o'clock.

Miss Jessie M. Hoover, Milk Utilization Specialist, U. S. Department of Agriculture, addressed the Association.

Mr. C. H. Kilbourne, New York City, read a paper on the value of the bacteria count in raw and pasteurized milk and milk products.

Dr. R. A. Pearson, President of the Iowa State College, Ames, Iowa, then delivered an address and offered several valuable suggestions for the upbuilding of the dairy industry and the betterment of milk supplies, after which the Association adjourned.

TUESDAY, OCTOBER 12TH

FOURTH SESSION

The Association was called to order at 11 o'clock, President Kelly presiding.

The report of the Committee on the Food Value of Milk, prepared by Mr. Geo. B. Taylor, was in Mr. Taylor's absence read by Prof. James O. Jordan.

Secretary Caldwell, of the American Guernsey Cattle Club, spoke on the origin, history and development of the Guernsey cattle.

Prof. W. D. Frost, of the University of Wisconsin, gave a demonstration of the little plate method of counting bacteria in milk.

Mr. T. J. Strauch, of Richmond, Va., presented a paper on the plan adopted and results obtained in grading the milk supply of Richmond, Va.; after which the convention adjourned.

FIFTH SESSION

The afternoon session was called to order by President Kelly at 2 o'clock.

Prof. T. J. McInerney, of Ithaca, N. Y., presented the report of the Committee on Dairy Methods.

Prof. Cooledge, of the Michigan Agricultural College, read a paper on "A Simple Method for Determining the Keeping Quality of Milk."

The report of the Committee on Transportation and Marketing of Milk and Milk Products was presented by its chairman, Mr. Russell S. Smith, of Washington.

Mr. J. G. Watson, Secretary of the Ayrshire Breeders' Association, addressed the Association on the origin, history and development of the Ayrshire cattle, after which the convention adjourned.

SIXTH SESSION

The evening session was called to order by President Kelly at 8 o'clock.

Dr. Carl W. Larson, Acting Chief of the Dairy Division, U. S. Department of Agriculture, gave an address on "The Dairy Situation of This and Other Countries."

Prof. James O. Jordan, of Boston, read a paper on the relation of labor to the production and sale of milk.

Prof. W. P. B. Lockwood, of the Massachusetts Agricultural College, read a paper on the results and costs of milk campaign work in Boston, after which the convention adjourned.

WEDNESDAY, OCTOBER 13TH

SEVENTH SESSION

President Kelly called the convention to order at 10.20.

Mr. Geo. E. Bolling, Chairman, reported for the Committee on Methods of Bacterial Analyses of Milk and Milk Products.

Mr. L. B. Cook, of Kane, Pa., read a paper describing a successful farmers' cooperative milk plant.

Mr. Benjamin Vener, of Springfield, Mass., read a paper on milk plant control.

Dr. H. A. Harding, of the University of Illinois, read a paper on "The Milk Inspector's Duty to the Public." President Kelly called former President Wm. H. Price to the chair, and after discussion the convention adjourned.

EIGHTH SESSION

The afternoon session was called to order by President Kelly at 2.15 P. M.

Mr. Kelly, as chairman of the Committee on Construction of Dairy Buildings and its Relation to Sanitation, presented a report of his committee. Mr. L. A. Rogers, Bac-

teriologist, Dairy Division, U. S. Department of Agriculture, presented a paper on the disposal of waste from creameries, cheese factories and milk plants.

The report of the Committee on Pasteurization of Milk and Cream, prepared by Mr. C. E. Clement, Chairman, was read by Mr. L. B. Cook.

Mr. A. W. Lombard read a paper on "The Milk Inspector, the Part Time Man."

A paper on "Milk Inspection," prepared by Mr. H. E. Bowman, Somerville, Mass., was read by Prof. Gamble.

A paper on "The Milk Situation of Scranton, Pa.," was presented by Mr. Fred J. Widmayer.

Papers presented during the convention resulted in much profitable discussion, which for lack of funds cannot be published. All reports, papers and addresses delivered during the convention were by the Association referred to the Executive Board.

BUSINESS SESSION

The annual business session of the Association was called to order at 3.20 P. M.

Reports of officers, including that of the auditors and that of the Secretary-Treasurer, were adopted. The Association by vote expressed its thanks to the Secretary-Treasurer.

The following resolutions were adopted:

1. WHEREAS, The International Association of Dairy and Milk Inspectors in annual convention assembled has learned of the death during the year of Dr. W. G. Bissell, Mr. G. L. Berg and Dr. Harry E. States, late members of the Association; therefore be it

Resolved, That it is with deep regret we note the taking away of these respected and honored members of our organization. All were active in behalf of this Association and in promoting efficient dairy and milk inspection. They were a credit to this Association and of great service to the communities which they served. And be it further

Resolved, That the Secretary be instructed to send a copy of this resolution to their respective families.

2. *Resolved,* That with the inclusion of the following paragraph the latest 1920 revision of "Standard Methods for the Bacteriological Examination of Milk" as adopted by the American Public Health Association be declared official for this Association:

"The committee is not opposed to the continued use of meat infusion agar in those laboratories that have a number of years' records based on its use; but in the interests of uniformity it urges the use of meat extract agar."

3. *Resolved,* That the International Association of Dairy and Milk Inspectors appreciates the many courtesies extended to the organization by the National Dairy Association during the ninth annual convention held in Chicago October 11-12-13, 1920; and be it further

Resolved, That the Secretary be requested to forward a copy of this resolution to the National Dairy Association.

The Association then proceeded to the election of officers, and the following were elected:

President, Prof. C. L. Roadhouse, Davis, Cal.

First Vice-President, Mr. H. E. Bowman, Somerville, Mass.

Second Vice-President, Dr. Clarence E. Smith, Greenville, S. C.

Third Vice-President, Mr. Geo. E. Bolling, Brockton, Mass.

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

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

Invitations for the tenth annual convention were received from several cities and referred to the Executive Board.

After expressing its appreciation and thanks to the retiring President, Mr. Ernest Kelly, the convention finally adjourned.

ADDRESS OF WELCOME

PROF. H. E. VAN NORMAN, *Dean of the University Farm School,* University of California, and *President,* National Dairy Association; Davis, California.

Mr. President, ladies and gentlemen:

I have made something between thirty-five and forty addresses of welcome to organizations meeting at the Dairy Show in the last few years. Therefore I can and do say, only in the plainest and straightest words, that we who are charged with the official responsibility do welcome you to this show. We welcome you from several motives. Selfishly, we are glad to see you, because of what you mean to the show; but even more do we welcome you here because of what the show may mean to you, and what it may mean to the communities from which you come.

We believe that we cannot have a national show on one side of the country, because the country is so big that the fellows from the east side do not get to the west side, and the fellows from the west side do not get to the east side, but they will come to the center. You say you can't get your farmers to come so far; but you cannot have an army without having corporals, sergeants, lieutenants, captains and majors and so on, up to generals.

We do not expect to bring all the privates to the National Dairy Show, but we do hope to bring the great body of leaders, to the end that you people from the East may rub shoulders with the people from the West; the man from the North may meet the man from the South. Although climate and conditions are different, after all the problems are pretty much the same.

Somebody has to lead the profession so that the rest may have something to follow. The leader has got to re—what shall I say, refill, re-enthuse, re-enlarge his outlook from

some source if he is not to go stale on his job. That is what these annual meetings do. That is what the annual Dairy Show does. It furnishes the Mecca, it furnishes the excuse to get together and see what has been done.

I have been much impressed in the little while I have been here in going around to see the progress that has been made in so many different branches of the industry; and there is more progress to be made.

Some of you will recall when this great dairy supply industry was represented in one big room, and half of the arena, and the arena was not as big then as it is now, and all of the cattle were in this other room now occupied by machinery at this show. Take time enough to go around through every room in our show and just simply try to realize how big this Dairy Show has become. Realize how many interests there are today besides your own. One thing that the managers and directors of this show have been attempting to do for years was to broaden the unconscious, selfish absorption of the different branches of the industry in their own little sphere, and the greatest development and by-product of this great show, I think, has been the growing breadth of interest and viewpoint of all branches of the dairy industry.

Now then, the thought that is uppermost in my mind this year at this show is this: I am told that in the early history of this country 88 per cent of the people lived on the land and produced their own food, and, largely, their own clothing. They wove their own clothing and made their own shoes and were almost self-sufficient. Today we are told there is only about 33 per cent of the people who actually live on the land and are producers.

The reason you do not have to be producing your own food is because there is somebody out in the country who is producing the food for you, and for all of the people in this great city, and for all of us whose business is not production. One hundred and fifty to two hundred years ago

every man had to feed himself. Today each man on the land produces food enough for himself and about two others.

We are told that the farmer, before the Civil War, spent over three hours of labor to harvest a bushel of wheat. Today he harvests a bushel of wheat with ten minutes of human labor. Now that is why men can have a job in the city, because the farmer out there has got mechanical help to take your place.

The men that are left on the farms have been producing food enough for us up to this time. Are they going to continue producing food enough for us? I am told that two million pounds of butter a month are coming into this country from abroad, largely from Denmark. Do you know that Denmark has an exhibit of her own butter right down here in this building, and that she can make the kind of butter we like to eat? What does that mean? Does that mean that America has reached the point where so many of us have gone to the city that those who are left on the farm cannot feed us, and we have to go outside and buy food to make up for it?

Is this condition a temporary condition, an aftermath of the war, or is it the forerunner of a great, fundamental change in the industry of this country?

Now, while you are looking to see whether the farmers are keeping the dairies clean, and so forth, do not forget this larger side of the problem. The greatest need of America today, men and women, is that somebody shall think of the problems of the relation of the city and its welfare to the country and its welfare. Somebody has got to think bigger than his own little job from which he makes his bread and butter. That is the thing that this dairy show stands for. It is an effort to try and make every man whose business is builded on the cow think in terms larger than his own little part of it.

Why, I remember when in the councils to arrange side lines, the supply men said, "Well, if it wasn't for these blankety blank cowmen and the premiums they pay these cowmen, we could have a show down here for half that this show costs us, and we would not have all these city kids and women around bothering us when we are trying to sell somebody a thousand-dollar machine." Then the cattle men on the other side said, "If these machine men didn't have all this space, we could have a space to show our cattle. Let's have a cattle show all by ourselves," forgetting that they took home in paid premiums more money than there was paid in at the show. We have passed that condition now, and we have a great body of men and women who realize the interdependence of this great industry.

We are here as non-producers only because somebody back there is a producer. After all is said and done your business depends on the fact that there is a producer back there and a consumer over here, and you have a service to render in between the two extremes.

Now, this show will not have fulfilled its purpose when it renders the service it does render to a few thousand men who are only indirectly connected, as you are—it will not have fulfilled its purpose until it brings in ten thousand men who own cows, and brings in a hundred thousand people from our cities who will consume the product of their cows, and they mingle together here in this great enterprise.

That is the dream and hope that some of us have in our minds. When that is fulfilled, the little fifty-cent piece that these hundred thousand people pay will give us the fund to enlarge still further our great educational activities that are helping to develop the right relation between all these branches. Mr. Skinner has a vision, more or less crystallized in a great building down town somewhere where this show can be held, and where the city people will come to it, as they do not come now. Now, then, what is your part in

this enlarged activity? To spread the gospel out among the people that you come in contact with that there is needed, from every community from which you come, from which the milk for your cities comes, that more men shall get out of the rut of their every-day job and come to this show and meet the fellow that is doing the same kind of thing from some other part of the country. It is the great federal mixing, equalizing ground. Therefore your service to your industry is not complete when you simply come here and absorb from each other all that you can for yourselves. Your mission is only complete when you go home and are able to point to the fact that as a result of your trip here this year you have seen five, ten or twenty citizens from other circles of interest, to the end that your interest may be multiplied by their cooperation and their assistance.

I hope that your councils here may prove helpful, helpful in solving the immediate problems of your business and occupation. But don't forget the great, big, broader side of it, the interdependence, the interrelation of all of these branches of the industry. The industry needs support, and it needs pushing, because I want to say there is no industry in America that I know of that has the double opportunity which we of the dairy industry have. Gillette started out to make safety razors, and I don't suppose there were ten men in the United States asking, "Where can I get a safety razor?" or wanting a safety razor. He had to create the want. And look at the business that he has built up.

Now Wrigley, on the other hand, had the advantage that there were a lot of us that had the gum-chewing habit, and look at the gigantic business he has built up. Yet here are the dairy men with all the business opportunities that these two men had, because only half the population needs safety razors; the other half don't use them at all. Another big part of the population does not chew gum. But everybody needs milk. Half of the babies born in this United States

would not live six months if it were not for cow's milk. Now, we have the advantage of a created market. But more than that, we have on the other side of it the demonstrated necessity that when we teach that mother of a pale-faced, bow-legged, anemic child that all he needs is a quart of milk a day to make him healthy, we are rendering a real service to that mother and society, aren't we? We have a chance then to render missionary service to somewhere from one-quarter to one-half of society, by just simply convincing them that all their children need is more milk.

"It matters not how long you live, but how well."

RESPONSE TO ADDRESS OF WELCOME

ERNEST KELLY, *President*

Those of us who have attended the Dairy Show year after year have been amazed at the great increase, not only in the size of the show, but also in the increased scope of the dairy industry. Old problems have been solved; new problems have come up to be solved; year after year have come increasing complexities in the dairy industry that have been answered through the Dairy Show.

While this enlargement of the dairy industry has been going on, dairy and milk inspection has also had new problems presented for solution. Things which are new are hard to understand. When dairy inspection was in its infancy, there were many conflicts between the various branches of the industry and the inspection forces. As we have grown, we have come to study problems closer as the various parts have dovetailed together, and there has been a smoothing over, a better understanding of each of these problems, and a desire to help others. The dairy inspectors have come to a realization of the great problems that are to be met. We try to develop through our Association a healthy sympathy with the problems of the dairy industry. Not so far, however, that the problems of the dairy industry eclipse the sanitary features and the duties that we have to perform; but we realize that by a fuller understanding of the problems of the dairy industry we may have the privilege of helping spread the gospel of more and better milk throughout the country.

We have found in our work that the successful dairyman is usually the sanitary dairyman. If we can help a man in his problems so that he is on a better economical footing, we will get much better results from him from a sanitary standpoint. One of the most discouraging factors

in inspection is to work with a down-and-outer who is barely making a living on the dairy farm, or the renter who does not want to put any money in improvements, and who cannot persuade his landlord to make any improvements. So we have developed a very great sympathy and are trying to develop a greater understanding of the problems in the industry, just as progressive dairymen are developing a great understanding of the milk inspection forces, whose primary duty is to safeguard the consumers of milk from any possible contamination.

So we take great pleasure this year in meeting at the time of the Dairy Show, and I am sure that our Association will obtain a great deal of pleasure and profit from studying the problems and the solution of the problems as presented in the great Dairy Show, and on behalf of the Association I want to thank President Van Norman sincerely for his kind words of welcome, and to assure him that we appreciate them deeply.

"The company in which you will improve most will be least expensive to you."

PRESIDENTIAL ADDRESS

ERNEST KELLY, WASHINGTON, D. C.

Another year of usefulness for our Association has passed, and we are again gathered to discuss those methods by which, individually and collectively, we may be enabled to promote still further the cause of dairy sanitation.

Recent years have seen rapid development in the science of dairy inspection. As pointed out by Prof. Jordan last year in his presidential address, the field of economics is so interwoven with our work as sanitarians that cognizance must be taken of such factors.

The question of milk prices was brought to a head by the world war. For years there had been much dissatisfaction on the part of milk producers with the prices paid for milk. With the war came a greatly increased market for our dairy products, and the dairyman was in a much better position to have some say in the disposition of his product. Coincident with this expansion of markets came attempts on the part of Federal and State agencies to arrive at fair prices for dairy products, not only for the protection of our consumers, but for the stimulation of legitimate agricultural enterprises. This movement brought to the front the question of the cost of production. Unfortunately, up to that time little concerted effort had been made to determine the cost of milk production on any comprehensive scale.

There is considerable doubt as to whether the cost of production will be able to govern the selling price of milk. Supply and demand are the great factors. Nevertheless, the cost of milk production should be carefully studied and the fundamental factors should be well known. Such knowledge will guide farmers in the amount of milk produced, and will educate consumers as to what is a fair price for the product. Consumers should not be, and generally

are not, averse to paying fair prices for agricultural products, provided they are convinced that such prices are warranted. The effects of war-time conditions on milk prices will be far reaching. There is now a greater tendency to arbitrate prices. Consumers, dealers and producers alike are interested in this question, and a number of cities are holding frequent conferences to adjust prices, taking into consideration cost of production, market condition, etc. Generally speaking, the lower the price of milk the better, provided the producers and the dealers are assured a fair profit. Such conditions stimulate a greater consumption of dairy products, and provide for the operation of dairy plants at maximum capacity.

Numerous attempts have been made in these conferences to apply a universal formula for determining the cost of production in particular localities. I do not believe that such procedure is wise. In the work of the Department of Agriculture we have found that different sections of the country have very dissimilar requirements for local productions. There is a great need for accurate local study along these lines.

In the field of sanitation, changes have been equally striking. All of us remember old conditions under which milk for our cities used to be produced. A tremendous change has taken place. Market milk production has become more highly specialized, sanitary knowledge has been developed, and methods of procedure have been improved. I have no hesitation in saying that the world today has a better milk supply from a sanitary standpoint than ever before. This is very largely due to the conscientious efforts of milk inspectors. In this great work, our Association has had no small part. It is true that there have been many obstacles, and complicating factors have handicapped the dairy inspector in his work. Opposition has had to be overcome; cities have had to reach out to greater and greater distances for their milk supply, involving problems

in transportation and complexities in distribution; producers new to market milk production have had to be taken on and educated in the sanitary requirements for city milk supplies; frequent changes in the personnel of health departments and limited appropriations for carrying on the work of dairy inspection have hampered the work in many places. Dairy inspectors who have learned their territory, and have obtained intimate contact with their milk producers, have had to give way to new and sometimes untrained men. On the whole, however, the personnel of dairy inspection forces has improved remarkably. Misunderstandings have become fewer and fewer, and the whole fabric of dairy inspection has become better standardized and more efficient.

Within recent years we have come to a greater realization of the food value of dairy products, and have come to know that an abundance of these products has an important bearing upon the health of any community. The progressive dairy inspection service, therefore, has a complex function. Its duty is to prosecute when wilful and harmful violations occur. Its privilege is to help and guide the honest dairymen who constitute the great mass of market milk producers. Its greatest mission is to help in securing an abundant supply of safe milk. Such a mission constitutes the salvation of our infant population, and benefits all ages.

Our Association was founded with broad vision. Our members have been kept in touch with all phases of the industry, and are keenly alive to the many problems of all who are engaged in the industry. My earnest hope is that we will continue with the same broadness of vision, growing not with the world, but ahead of it. Let us place each forward footstep on secure ground; looking ever upward, but not star-gazing to the extent of ignoring our more intimate surroundings; eschewing chaotic radicalism, and holding fast to sane progress; not scoffing at innovations,

but giving them the acid test of practicability before embracing them; not critical, but imbued with a helpful spirit of cooperation. With these ideals, we as an association can go forward into the far reaches of time, laying stable foundations for the welfare of mankind.

"We may be personally defeated, but our principles never."

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

DR. HULBERT YOUNG, *Chairman*

Our subject is two-sided. We pray your leave, therefore, to discuss it from each side as well as a whole. Although some sort of a supply of milk has long been recognized as essential to every community, but very lately has the adjective "adequate" been given much prominence in this connection. From authoritative sources we are taught that the volume of the supply is a matter that should engage serious thought. No longer do we believe it the whole duty of inspection authorities to cause to be eliminated dangerous supplies or to drag into the courts those responsible for their production. This is but one side of our duty and problem. The other is in many respects more important, that of fostering the production and distribution of adequate, safe and clean supplies for the consumers in whose interests we serve.

Coming now to the specific relation of the diseases and conditions among our dairy herds that tend to reduce the supply of milk therefrom and, contrariwise, the absence of which tend to increase such supply, we are struck with the fact that we have to deal in the main with old and long recognized enemies.

Strikingly, from whatever angle the whole subject may be viewed, two diseases stand out as the greatest menace to an adequate supply of milk in almost any neighborhood of the United States or Canada—bovine tuberculosis and contagious abortion of cattle.

The unfavorable influence of the first mentioned in its reduction of the supply from individual affected animals and from the herds wherein it has gained a foothold is well

recognized everywhere and needs no statement of fact in support of it as a general proposition. Also the salient facts relating to the existence of the disease, its communicability to the human family, to other cattle and certain other farm animals, the general methods to detect its presence in a herd and in individual animals, its destructive influence, etc., are now fairly well understood by the public. There does not seem to be entire accord as to several specific features relating to the methods for its detection. We do not feel, however, that it is our province to make any attempt to assemble the known or agreed facts nor to state the variously held opinions about the matters in dispute or disagreement. Suffice it to say that the methods to detect its presence are probably more accurate now than ever before and that further work will probably clear up all matters in dispute. One fact, however, we believe needs to be specially noted for our guidance at this time and that is that where formerly efforts to accomplish the eradication of tuberculosis from our herds were directed almost solely along police lines, the "thou shalt and thou shalt not" way, with but little, if any, progress toward the desired goal as a reward for such efforts, lately the emphasis given the matter as an economic problem, as well as one of public health, has brought about a much greater accomplishment. The trend of events in this connection seems to justify this conclusion to your committee, that successful efforts to rid our municipalities and States from the menace of bovine tuberculosis must take into account that the existence of entire cooperation between officials, stock owners and the public is the first absolute essential.

May we repeat, also, that in our opinion, no dependence may be placed upon a more or less casual, necessarily intermittent and rather infrequent physical examination of our herds. The number of affected and dangerous animals thus discovered and eliminated is, we believe, but a very small proportion of those that are throwing off active, viru-

lent tubercle bacilli, and furthermore a false sense of confidence is encouraged. Officials, stock owners and the public are apt to believe that the menace is being removed, whereas, as a matter of fact, it very certainly is not.

If inexpensive and reliable methods are ever developed to insure immunity among cattle against this disease or to make it possible to easily and certainly detect those affected animals that have recovered to the extent that they do not eliminate live, virulent tubercular organisms from their systems, then the problem will be practically solved from a professional standpoint; and the succesful outcome of efforts to rid us of this disease of cattle will wait only on the existence of the state of cooperation above mentioned. Unfortunately, our knowledge of immunity against tuberculosis at this time is not such as to justify hope of lessening or solving the problem.

Differing from tuberculosis in this respect, abortion presents a problem that is almost universally recognized as economic rather than as one of public health. Its influence on the milk supply is probably second only to that of tuberculosis. Statistics to set forth this fact, we believe, would be superfluous since practically every State live stock board has so reported for several years. Unfortunately the profession is not in entire accord on all of the facts of abortion, as it is on practically all of those on tuberculosis, and we cannot set forth the authoritative views without the publication of a volume. In view of this lack of unanimity, perhaps we should repeat several of the facts that seem to meet almost universal support.

1. Abortion is widespread and on the increase.

2. The fact of abortion or the act of abortion is but one of the manifestations of the diseased condition.

3. The disease is specific and frequently spreads fairly rapidly in a herd even in the face of intelligent efforts to prevent.

4. No specific individual or herd treatment is universally accepted as having much, if any, value in bringing about a state of resistance to it or a state of quickly restoring health following an attack.

5. General measures of decent cleanliness and sanitation, with individual symptomatic treatment, seem to be looked upon as about as effectual as anything at present known.

6. Animals in an affected herd and the live progeny of those animals seem to acquire or inherit, as the case may be, a considerable measure of resistance to the disease.

7. From our standpoint perhaps the most important fact is that herds that undergo an attack of abortion do not, as a rule, suffer more than a proportionate loss of supply for the first year, less the second year, still less the third, and possibly none the fourth, so that they do not become progressively less productive and progressively more of a menace to the public health, so far as we know, as in the case of tuberculosis.

Clinical evidence to support the view that the consumption of milk from affected cows is detrimental to human health seems to be lacking. Experimental evidence upon laboratory animals is more plentiful but somehow not very convincing. We fail to find reason, therefore, to urge restrictive measures as to the use of such milk save as an individual animal's condition would forbid such use for reasons of common decency.

Acute febrile diseases we probably always will have with us as long as we do not thoroughly understand the cause, nature and the proper methods of prevention for each. Such are found less frequently under intelligent herd management than when under unskilled care. Also, I believe, such conditions are found less frequently amid cleanly surroundings than amid filthy surroundings.

Epidemics that threaten to destroy or seriously cripple our dairy herds and menace our supply of milk are, fortunately, rare on this continent and such as have made their

appearance have been most successfully combatted by a co-operative action between municipal, State and federal services. Our lesson therefrom seems to be that it is the part of wisdom to report suspicious cases to the proper authorities at once and to insist that they in turn solicit federal aid before such a disease becomes widespread.

Certain abnormal conditions of cattle we believe should receive more study as to the relationship between their existence and possible unfavorable influences on the consumers of milk. Specifically, such conditions as diarrhoea unquestionably cause the transmission of deleterious products to milk consumers and it also seems that the reverse condition is perhaps equally as bad.

Abattoir postmortems frequently throw light on cause and effect. From such inspections we are lead to believe that emaciation is much more frequently brought about by diseased conditions, such as tuberculosis, chronic pleurisy, chronic peritonitis, or by some pyaemic condition than by starvation. We believe, therefore, that milk from all emaciated animals should be prohibited human use even though sterilized and in the absence of any specific diagnosis of its cause.

Your committee has the honor to summarize in several recommendations:

1. That the menace from bovine tuberculosis be combatted by cooperative efforts rather than by those copied from a police manual.

2. That the physical examination of cattle for tuberculosis be recognized as but one short and very incomplete step toward the discovery of dangerous tuberculous animals and that whenever and wherever one or another or all methods of applying the tuberculin test are selected and used, provision be made for its repetition at suitable intervals thereafter.

3. That we recognize the incomplete state of our knowledge of contagious abortion and urge its study by compe-

tent agencies to determine more definitely how to prevent its spread, the most rational lines of treatment for the affected individual and herd both during and after an attack, and lastly the influence, if any, of the use of the milk from affected animals on consumers.

4. That greater efforts be made to rid our milk supplies of the product of animals affected by those frequently occurring and recurring conditions that are known to extend unfavorable influences to the milk product from such animals.

5. That there be efforts made to arrange a greater degree of cooperative endeavor in the inspection and supervision of our dairy cattle between those officials having to do solely with the actual inspection itself and those in education, experimental or research work in the same municipality, State or Province.

"Selfishness is the greatest curse of the human race."

REPORT OF COMMITTEE ON REMADE MILK

PART I

Commercial Aspects of Remade Milk—Data from Manufacturers of Powdered Milk and Opinions Expressed

George B. Taylor,

Washington, D. C.

One part of the report of the Committee on Remade Milk to this Association for 1919 dealt with the opinions expressed by heads of dairy departments of the various State colleges regarding the powdered milk industry and its future in relation to the dairy industry in general.

It was thought advisable to follow this up with a view of the subject from the standpoint of the manufacturer.

In this connection it might be interesting to note the figures given below regarding the industry for the whole country. These figures were furnished by the Dairy Division of the U. S. Department of Agriculture.

Figures for United States.

	1918.		*1919.*	
Product.	*Factories.*	*Pounds.*	*Factories.*	*Pounds.*
Dried buttermilk	14	4,951,296	15	5,278,827
Dried whole milk	23	4,005,663	20	9,042,236
Dried cream	10	620,886	6	607,190
Dried skimmilk	57	26,202,406	55	34,945,416
Malted milk	19	15,622,876	11	17,435,887
Total		51,403,127		67,309,556
Less buttermilk		4,951,296		5,278,827
Total		46,451,831		62,030,729

Increase excluding buttermilk, 33.5%.
Increase including buttermilk, 30.9%.

The above figures indicate a great increase in production, especially of powdered whole milk and powdered skim

milk. An increased supply, of course, indicates an increased demand.

Various phases of this subject were taken up directly with manufacturers of powdered milk. Seventy-five per cent of the manufacturers written to replied. It is believed, therefore, that the abstract herein given represents the views of the whole industry along lines indicated below.

1. What proportion of your product, whole and skimmed powdered milk, is sold by you or through your dealers to consumers direct, bakeries, confectionaries, ice cream factories, milk plants, or dealers to be made into remade milk?

Answers to this question indicate that most of the powdered milk manufactured, whether whole or skim, is sold to bakeries, ice cream factories and confectionaries. A very small percentage of this product is sold to be made into remade milk. Only one manufacturer claims to sell some of his product to consumers direct. The answer of one manufacturer may be used as a summary to indicate the trend of all answers to this question:

"It is impossible to give more than an approximation of figures showing the general distribution of powdered whole and skim milk. As a large quantity is sold through dealers from whom we have no information as to whether it goes into one line of trade or another, it becomes largely a matter of guess work of the proportion each trade uses. We would estimate, however:

"Consumers direct	10%
Confectionaries	10%
Bakeries	50%
Ice cream factories	20%
Milk plants and miscellaneous	10%

"What proportion is sold to milk plants and is made into remade milk, we have no idea, but we do know that it is a very small percentage. Among the miscellaneous is included the prepared flour manufacturers and others putting out speciality products such as prepared cocoa."

2. Do non-dairy sections use more of your powdered product than dairy sections?

The greater part of dried milk products is used in the larger cities; and as the larger cities are surrounded to a greater or less extent by thickly settled dairy and intensive farming communities, we might say that more of these products are used in dairy sections. On the other hand, some answers indicate that non-dairy sections use more of the product in proportion to their population. The question is hardly a fair one.

3. Do you export to foreign countries in which dairying is an important industry?

Replies indicate that there is only a small amount of export trade in dried milk to foreign countries where dairying is an important industry. One firm reports sales to England. Another states that small quantities are exported to oleomargarine manufacturers.

4. Will you give us your opinion as to the future of powdered milk reconstructed by machinery to be placed on the market as remade milk in competition with normal milk? Can you give any facts upon which to base your opinion?

Most of the answers to this question are covered by the following:

"I am of the opinion that the powdered milk to be used for reconstructed milk by machines in the near future will be done on a large scale. I think this to be the logical way to handle the fluid milk supply for the following reasons: Milk can be bought at the flush season, can be reduced to powdered form and stored away until the supply of raw milk is not equal to the demand, when powdered milk can be used to great advantage, as powdered milk requires no refrigeration and will not deteriorate to a noticeable extent and remade milk would cost a great deal less than fluid milk at various periods of the year."

The statement is made that several large restaurants had a year ago practically decided to use reconstituted milk in place of fresh milk, but deferred taking action on account of the lack of supplies.

5. Along what line do you look for the greatest development of the powdered milk industry?

The consensus of opinion seems to be that this industry will reach its greatest development along the line of home consumption either in the form of the powder in retail packages or as reconstituted milk.

6. What regulations, if any, would you suggest for the sale of remade milk?

This question has developed more real difference of opinion among manufacturers than all the others. Here we have two extremes as seen in the two replies following:

(a) "At this time I would not recommend any regulations whatsoever regarding the sale of remade milk as remade milk is not a substitute. The bacteria count is lower in powdered milk than in milk of any other form and with the great advantage in having control of the supply of fluid milk under all conditions, I am of the opinion that extreme regulations would be more detrimental than beneficial at this time."

(b) "It should be under government regulation and supervision, and the fact that it is reconstituted should be advertised. The place of manufacture and source of supply should be inspected."

It must be added that most of the replies regard some regulation as necessary. This is especially true of the label on the package containing the product.

7. In view of the increasing use of dried milk for infant feeding, do you not think that regulations should be adopted to control the quality of raw milk used in the manufacture of dried milk? What regulations would you propose?

It is generally believed that great care should be taken in the manufacture of powdered milk for infant feeding. One manufacturer states that in the process of manufacture no method should be employed which removes or coagulates any of the natural ferments of the milk.

The following reply deserves special consideration:

"It seems to us that the adoption of any regulations governing the quality of raw milk delivered to a milk powder factory would by no means insure the quality and purity desired in a product to be used as a baby food. It would seem to us that the test of the milk powder itself should be the criterion of its suitability as a baby food, and if the quality of the powder itself is right, it is a safe assumption that the milk from which it is made was right. However, these are big questions in which decision is very likely to be influenced by the point of view, and for that reason, in this as in all other similar questions, we are strongly inclined to the opinion that officials should be careful to insure that the point of view of all elements concerned should be fully represented in deliberations upon such regulations."

Summary: The manufacture of powdered milk is increasing rapidly. Most of the product is sold to ice cream factories, bakeries and confectionaries in the larger cities. Only a small percent is at this time used in the manufacture of remade milk and very little is exported to dairy countries.

The powdered milk industry will develop most by introducing the use of its products in the home either in powdered form or as remade milk.

It is the general opinion that regulations are necessary to provide proper production and manufacture of the raw material and proper labeling of the finished product

"A few things gained by fraud destroy a fortune otherwise honestly won."

REPORT OF COMMITTEE ON REMADE MILK—PART II

Statement Regarding Experiments Using Remade Milk as a Food for Infants.*

Prof. James O. Jordan, *Inspector of Milk,* Boston, Mass.

The study of dry milk powder as a food for infants, begun in August, 1919, by the U. S. Public Health Service, the Boston Baby Hygiene Association, and other cooperating agencies, will close October 1, 1920.

The question, the answer to which it was hoped the study would give, was: "What place can be accorded dry milk in the artificial feeding of infants? Is it as good as natural milk? If not as good, in what particular is it not as good?"

Dr. W. H. Price† in his preliminary report on the study told the method employed in the study and the difficulties experienced. In completing the study the method is practically the same, and the difficulties, too, remain the same. But the conclusions reached will have the added weight resulting from prolonged study. In December Dr. Price left Boston and the work had to be continued without his interested and helpful supervision. In January, 1920, one of the staff nurses of the Baby Hygiene Association, Miss Helen Falvey, was granted a leave of absence by the Association to work for the U. S. Public Health Service in connection with the study, and for a few weeks Dr. Milton H. Veldee of the U. S. P. H. Service was in Boston and had the work under his direction. Miss Falvey, with the

*The facts and conclusions upon which this statement is based were obtained through the kindness of Winifred Rand, R. N., Director, Baby Hygiene Association.

†Report of the Committee on Remade Milk, Part III, by Dr. W. H. Price, U. S. P. H. Service, in Eighth Annual Report, International Association of Dairy and Milk Inspectors, pp. 120-147.

help of the staff nurses, kept in close touch with all the babies in the study and careful records were kept of each case. Since June 1, 1920, every baby has had at least one thorough physical examination, made by Dr. Wright of the U. S. Public Health Service, and social histories have also been taken in order that all factors affecting the babies' welfare should be considered.

As was explained in Dr. Price's preliminary report, the babies in the demonstration were divided into these three groups:—

Group 1—Consisted of babies who were fed on modifications prepared from Grade A Milk.

Group 2—Babies who were fed on modifications prepared from whole milk powder.

Group 3—Babies who were fed on modifications prepared from milk reconstructed from unsalted butter and skimmed milk powder.

319 babies have been included in the study, of which 71 were in Group 1, 194 were in Group 2, and 54 in Group 3. 213 babies have been taken off the powder, and 106 are still on the powder on October 1, 1920.

The 213 babies taken off are the interesting ones to study. Of these 213 babies:

	Group 1.	*Group 2.*	*Group 3.*
60 babies were taken off because of age and diet	23	27	10
24 babies were taken off by private physicians	..	24	..
35 babies were taken off because family moved	14	15	6
32 babies were taken off by the mothers	3	19	10
14 babies were taken off by hospitals	2	11	1
26 babies were taken off by conference physicians	..	16	10
9 babies were taken off because of lack of cooperation on the part of the mothers	..	9	..
12 babies were taken off because of death	5	7	..
1 baby was taken off because breast milk returned and artificial feeding no longer necessary	..	1	..
	47	129	37

The private physicians and the hospitals perhaps through lack of understanding took the babies off without consideration, but the 26 changed by conference physicians presumably showed definite signs why the powdered milk should be discontinued.

Reasons taken off:

5	had diarrhoea
4	had persistent vomiting
16	failed to gain satisfactorily
1	had obstinate constipation
26	

After taking off:

13	improved on natural milk
6	showed fluctuating results, then gradually improved
4	have shown no improvement
2	moved and were lost track of
1	developed tuberculosis
26	

There is a question whether the conference physicians always gave the powder a fair trial but it was wise to err on the safe side.

Of the 12 who died the causes were as follows:

4	diarrhoea
1	diarrhoea and pyelitis
1	acidosis
1	diphtheria
5	pneumonia
12	

At least 5 deaths were definitely due to digestive disturbances; 2 of these 5 were on Grade A milk. Of the three in Group 2, one was on powdered milk about 2 weeks, one for about 4 months, and one for about 6 months. The baby

that had been on powdered milk 2 weeks died at the age of 3 months. It had been breast fed for 6 weeks. It was then given a market milk formula until put on powdered milk. This baby gained well at first, with a total gain in 2 weeks of 1 lb., 13 ounces. On August 10 it was in good condition, but was taken sick with diarrhoea on August 11. A private physician was called, but the baby died on August 15. The mother had been cooperative and followed directions.

The baby that was on powdered milk for 4 months did well nearly all of the time, then developed diarrhoea on August 24th and died August 30th at the age of 9 months.

The baby who was on powdered milk for 6 months commenced using this food when 6 months old with a weight of 8 lbs., 12 ounces. It gained steadily for 2 months, rapidly at first and then more slowly; it had about one week of diarrhoea in June and then improved and gained again. On August 17 vomiting and diarrhoea set in; the baby was referred to the hospital and died August 19.

The history of these three cases is similar to the history of babies using Grade A milk, and who later developed diarrhoea and died; i.e., there does not seem to be any significant point which would indicate that *powdered* milk was the root of the trouble.

The physical examinations do not seem to show any greater tendency to rickets among the babies in Groups 2 and 3 than in Group 1. Scurvy showed in one baby in Group 1 and one in Group 3. The mothers of these babies had not been giving orange juice although it had been ordered, and as soon as it was administered the symptoms cleared.

The babies have seemed to develop normally and the three groups have compared favorably, so that the conclusions that have been drawn by the field workers are that as a substitute for natural milk, powdered milk seems adequate. It would be wiser to use it than an unknown mar-

ket milk supply at least for a short period. There is a feeling among the nurses that the babies do not continue over a long interval of time to do quite as well on the powdered as with the natural milk.

In several instances babies did unusually well at first, but did not continue at such a rate of progress, striking in the long run about the average. Early abnormal gains were offset by a later subnormal tendency. This fact may count against powdered milk for the prolonged feeding. For example, most of the babies taken off the powdered milk because they failed to gain satisfactorily had improved for a short time and then ceased to do so, and so were changed to other foods.

But there have been enough problem feeding cases in which the babies have done well on powdered milk, and where there had been previous failures from the employment of other foods, to show that powdered milk has a place in infant feeding which this study and further investigations will fairly definitely define.

"Honest men fear neither the light nor the dark."

REPORT OF COMMITTEE ON REMADE MILK—PART III

Progress Report of Experiments for Developing Methods of Detecting Remade Milk.

Oscar L. Evenson, *Asst. Chemist,* Bureau of Chemistry, U. S. Dept. of Agriculture, Washington, D. C.

The problem of differentiating remade, reconstructed or manufactured milk and cream from the natural product has puzzled analysts and food control officials for some time and has been considered a difficult problem, especially when these products are mixed with the natural product.

Leaving out of consideration the question as to which is the better product, some method of distinction is desirable so that the consumer may know whether or not he is getting the genuine article.

Several methods of attack have been investigated. Most of these were found to be of little or no value, especially in detecting mixtures, but the results obtained will be briefly discussed in order that others may avoid unnecessary duplication of work.

The samples used in this investigation were made up in various ways and combinations and the ingredients were so chosen as to bring the fat and non-fatty solids within the range for natural milk. Two types of emulsors and homogenizers were used. The milk powders were obtained from different manufacturers. Some of these powders were made by the same general process, others by different processes. These include the spray, drum, combination drum and spray and heated air processes. Samples were obtained from eleven manufacturers using the spray process.

In the preparation of these samples the cooperation of the Dairy Division of the Bureau of Animal Industry of

this Department, and certain dairy and ice cream plants in the city was obtained, for which appreciation is expressed.

The investigations here reported, unless otherwise stated, were made in the Food Control Laboratory of which Dr. I. K. Phelps is Chemist in Charge. Appreciation is also expressed for the suggestions and interest of Dr. C. L. Alsberg. The aid of Dr. H. W. Redfield, in obtaining a large number of samples, is also acknowledged.

HYDROGEN ION CONCENTRATION

This investigation was made in the laboratory of Physical Chemistry by Gerald H. Mains. Results similar to those reported here have been obtained by Taylor[1] and Van Slyke and Baker[2].

The hydrogen ion values were determined by the use of the hydrogen electrode. Measurements were made at 25° C. and the values were calculated in the customary form of pH units, where $pH = \log \frac{1}{\text{hydrog. ion conc.}}$ Titration curves were determined for various milk samples by adding portions of 0.1N Hcl. and 0.1N NaOH to 25 cc. portions of milk and measuring the pH value of the resulting mixture. To obtain the titration curves, pH values were plotted as ordinates and volumes of acid and alkali used, as abscissae. The following points were brought out in the investigation: the pH value for normal milk is a constant and equal to 6.6.

Milks made from a certain sample of drum powder had a pH value averaging 7.3, much higher than that found for natural pasteurized milk and such a powder can be readily distinguished from the latter.

Milk made from spray powders did not differ appreciably in hydrogen ion concentration from natural pasteurized milk.

A characteristic fixed titration curve was determined for natural pasteurized milk.

The titration curve for a milk made from this drum powder was found to lie in a different position from that found for natural pasteurized milk and was steeper in the region of the neutral point. The deviation from the normal curve became a maximum with the addition of a certain amount of alkali and the comparative deviations of various mixtures at this point might be used to determine the percentage of this kind of milk present.

The titration curves of milks made from spray powders and of natural pasteurized milk are practically identical.

SURFACE TENSION

This investigation was made by L. W. Ferris with the assistance of the writer.

According to Zangger[3] and Kobler[4], the surface tension of milk is quite constant. Carapelle and Chimere[5] confirmed this and also found that watering raises the surface tension, while Burri and Nusbaumer[6] and also Quagliariello[7] observed that cooling lowers the surface tension.

The surface tension was calculated from the number of drops formed by a given volume of liquid at 25° C., using distilled water as a standard as follows:

$$\text{Surface tension} = \frac{\text{Sp. gr. of milk} \times \text{number drops of water}}{\text{sp. gr. water} \times \text{number drops of milk}}$$

The surface tension of eighteen samples of natural milk ranged from .74 to .77, while that of the same number of remade milk ranged from .73 to .79. The surface tension was not affected by pasteurizing, homogenizing or emulsifying the milk and showed no direct relation to the per cent solids within the range of natural milk, although skimming increases the surface tension.

RENNET TEST

This test was made by L. W. Ferris and the writer.

According to Monier-Williams,[8] Cazalas,[9] Porcher[10] and others the curd produced by rennet in milk made from dried milk differs from that of natural milk in being more flocculent and finely divided.

In view of these statements, an attempt was made to obtain a measure of this difference.

One c.c. of a 1 per cent rennet solution was added to 50 c.c. of milk and kept at about 40° C. for one hour. The weight necessary to force a rod to a certain depth in a certain time was noted. The results showed that generally the natural pasteurized milks gave a firmer curd than the milks made from milk powder, while some of the milks made from drum powders and one spray powder did not curdle at all. No conclusive results can, therefore, be obtained from the rennet test, but indications of value may be obtained in some cases.

FREEZING POINT AND MOLECULAR CONCENTRATION CONSTANT

Apart from the fact that these constants are used in detecting watering, it is conceivable that the heat and dessication to which milk powder has been exposed and the process of remixing two substances like water and milk powder might have some influence.

Most investigators have obtained values for the freezing point averaging —0.555° C. Others get lower results. Stutterheim[11] —0.52 to —0.536; Koning[12] —0.52 to —0.53; Bordas and Genin[13] —0.512 to —0.529; Dekhuyzen[14] —0.502 to —0.537; Monier-Williams[15] —0.519 to —0.558 for single cows and —0.514 to —0.5375 for herd milk.

The freezing point apparatus was contained in a Dewar vacuum vessel and the necessary low temperature was obtained by the passage of a current of air through ether. An

electrically operated stirrer was provided and an ordinary Beckmann thermometer. For this comparison of natural and remade milk, it was thought desirable to use a 0.15N sodium chloride solution freezing at 0.517[16] for standardizing the thermometer. A super cooling of not over 0.7° C. and bath temperature of about —0.8° C. was used.

The molecular concentration constant varies between 74 and 79 for genuine milk according to Mathieu and Ferre.[17] They calculate the constant by adding the weight in grams of lactose per liter of milk to the weight in grams of sodium chloride per liter, x 11.9, giving 1 gram of crystallized lactose the isotonic equivalence of 11.9 grams of sodium chloride. This apparent constant is corrected for the volume of fat and casein, using 0.94 as the specific gravity of fat and 1.35 as the specific gravity of casein.

Monier-Williams[15] found values for this constant varying from 70.0 to 78.1 while those found by Ferris[18] ranged between 71.1 and 82.6.

The sodium chloride was determined by the Volhard method on a copper sulphate serum and lactose by the Munson-Walker method.

The casein was calculated from the percent of total nitrogen as determined by the ordinary Kjeldahl digestion method.

The results obtained are shown in Table I.

TABLE I

FREEZING POINT AND MOLECULAR CONCENTRATION CONSTANT

		Per cent					*Mol. conc. constant.*	*Freezing point.*
No.	*Description*	*fat.*	*casein.*	*Nacl.*	*lactose.*	*S.N.F.*		
39	Remade skim milk	0.13	2.54	0.19	4.71	8.67	71.2	—0.521
40	Remade skim milk	0.16	2.70	0.159	4.67	8.86	67.1	—0.489
41	Remade milk.....	3.70	2.67	0.174	4.37	8.34	68.5	—0.499
42	Remade milk.....	3.47	2.76	0.175	4.35	8.62	69.2	—0.497
40	Natural past. skim milk	0.37	2.69	0.211	4.67	9.17	73.6	.....
41	Nat. past. milk....	....	....	.....	....	8.95	....	—0.526
42	Nat. past. milk....	....	....	.....	....	8.76	....	—0.519
	Market cream	....	....	.....	....	7.64	....	—0.553

The results recorded in table I are too few in number to permit a definite statement as to the range of the freezing point and molecular concentration constant of remade milk, but the figures obtained indicate that remade milk tends to have lower values for these constants than natural milk. The differences found, however, are not great enough to make it seem probable that these constants would be of any value in detecting mixtures of natural and remade milk.

SOLUBLE ALBUMEN

According to Cazalas[9], Knoch[19] and Monier-Williams[8], the albumen in milk powder has been more or less coagulated, the degree of coagulation depending upon the temperature and the length of time over which it has been maintained.

In the experiments recorded here, the casein was precipitated from 50 grams of milk by saturating with sodium chloride and 25 cc. of the filtrate was diluted with an equal volume of water and heated in boiling water for about fifteen minutes. The albumen was then filtered off and washed with half saturated sodium chloride solution. The nitrogen was determined by the ordinary Kjeldahl digestion method. The weight of nitrogen together with the percentage as referred to the total nitrogen in the sample, is given in table II.

TABLE II

SOLUBLE ALBUMEN.

	Remade Milk.				*Natural Past. Milk.*		
No.	*Wt. N.*	*Per cent of total N.*	*Powder used.*	*Pasteurization temp.*	*Wt. N.*	*Per cent of total N.*	*Pasteurization temperature.*
1.	0.00912	3.58	whole milk spray	30 minutes 63–60½°C.	0.01360	5.55	30 minutes 65½–62½° C.
2.	0.00314	1.27	skim spray	20 minutes 63–62½° C.	0.01590	5.49	20 minutes 66–65° C.
3.	0.10450	4.20	skim drum	.....	.....	....	.....
4.	0.00953	3.60	skim spray	20 minutes 64–60½° C.	0.01547	5.86	30 minutes 66–62 C.
5.	0.00032	0.11	skim spray	20 minutes 61½–59½° C.	0.01395	5.52	30 minutes 68–63° C.
6.	0.00265	1.27	whole milk drum	20 minutes 62–56° C.	0.01270	4.65	30 minutes 71–65° C.
+7.	0.01093	4.23	skim spray	20 minutes 63–60° C.	0.01179	4.84	30 minutes 66–61° C.
+8.	0.00818	3.56	skim spray	20 minutes 65–62°C.	0.01172	4.65	33 minutes 66½–60° C.
+9.	0.01067	4.95	skim spray	20 minutes 62–58° C.	0.01203	4.99	30 minutes 68–60° C.

+100 gms. milk and 50 c.c. filtrate used.

It may be seen from Table II that although in some spray powders, as well as drum powders, a large part of the albumen has been coagulated, this test would be of no value in case of the best grades of milk powders.

NITRATE TEST

The value of the nitrate test as an indication of added water is limited by the fact that all waters do not contain nitrates in sufficient quantities to permit detection in mixtures of natural and remade milk. Since it has a certain corroborative value, the test was made on thirty-one samples of milk containing from 15 to 20 per cent remade milk in which city water had been used, and twenty-two samples gave a positive test for nitrates.

Tillman's[20] method was used, the test being made on the serum obtained by adding to 20 c.c. of milk an equal volume of a mixture of equal parts of 5 per cent mercuric chloride and 2 per cent hydrochloric acid and filtering. To one part of the clear filtrate was added four parts of the reagent, made up as follows: 0.085 grams of diphenylamine dissolved in 190 c.c. of 1-3 sulphuric acid and made up to 500 c.c. with nitrate free concentrated sulphuric acid.

RATE OF EXTRACTION OF FAT

In emulsified remade milk, a large proportion of the fat added in the form of butter, separates as a buttery layer on standing or when centrifuged. It was suggested by Dr. Alsberg that the rate of extraction of the fat by a solvent would be greater in such a remade product. This was investigated, petroleum ether being used as a solvent, and it was found that as a rule considerably more fat was obtained in a given time in case of emulsified remade milk than from natural pasteurized milk, but with mixtures the results obtained were of no value.

Further work in this Laboratory, as well as the Laboratory of Microbiology, on the peptonization method of Dr. H. W. Redfield as reported by your committee at a previous meeting, has shown that, measured by the nephelometer, the greater turbidity of remade milk when inoculated with peptonizing bacteria and incubated was due to the presence of large numbers of small fat globules which failed to separate with the cream in the experiments and not to any less degree of peptonization. This was shown by gravimetric determinations of the per cent fat as well as nephelometric observations and was further corroborated by making up a series of samples showing approximately the same differences in turbidity as shown by the peptonization samples and making a gravimetric determination of the per cent fat. That there was no greater degree of peptonization in natural milk than in remade milk was shown by determinations

of the per cent of the total nitrogen precipitated with acetic acid.

Investigations of other methods of detecting remade milk are in progress.

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"We make others' judgment our own by frequenting their society."

REPORT OF COMMITTEE ON REMADE MILK—PART IV

General Conclusions of the Committee

Leslie W. Ferris, *Chairman*

1. COMMERCIAL ASPECTS

Your committee believes while, at present, only a small per cent of the powdered milk manufactured reaches the consumer as remade milk, that the future offers a greater development in this line.

2. RESULTS OF INFANT FEEDING

A report of the results from a continuation of the investigation originated and conducted by your committee of last year indicates that remade milk may be used to advantage for infant feeding for a short period, especially where there is an unknown market milk supply, but that when used over a long interval of time may not be as desirable as natural milk.

3. CONTROL OF REMADE MILK

Your committee believes, in general, as reported in the committee's conclusions of last year, that regulations are necessary to provide proper production and manufacture of the raw material and proper labeling of the finished product, and of the products made therefrom.

4. DETECTION OF REMADE MILK

The detection of remade milk may be presented in three phases: first, as a product by itself; second, when used in mixtures to supplement the natural milk supply; and third, when water and milk solids not fat are used to adjust the fat content of natural milk.

The detection of remade milk as a product by itself is one that should offer no serious difficulty.

As at present made, besides the slightly different flavor, there is either the absence of the cream line or a separation of a portion of the fat as butter when the product is allowed to stand. Two tests that may be of value in this case are the rennet test and the test for nitrates.

The detection of mixtures of remade milk with natural milk will depend upon the quantity of remade added to the natural milk and the age and quality of the products used in its manufacture.

The third phase presents an impossible proposition since it involves either adulteration of natural milk with a water solution of solids not fat; or if an attempt is made at the proper labeling of such a mixture it presents an impossible labeling situation, since no label or set of labels can be devised to enable such an article to be sold for what it is.

DISCUSSION

Prof. Prucha: Every year when the school opens in our community, there has been about eight thousand people added, and the milk question always becomes acute along with other things. Local dealers go out of town, before they get finally adjusted, and buy milk, and invariably that milk gets more or less powder in it. Nothing has been done about it. I don't know whether there is anything to be done about it except we know that it occurs, and it is unlabeled. A person acquainted with the milk and powder taste can detect it. The milk is sold as fresh milk.

Dr. Supplee: I would like to ask Prof. Jordan if he has data in connection with the powder, as to whether it was powder made from stall fed or from cattle pasture fed. The reason I bring up that point is that a recent research would seem to indicate some of the vital factors in milk, liquid milk as well as dry milk, are affected by feeding.

Has Prof. Jordan information on that point regarding the milk fed to these babies in Boston?

Prof. Jordan: There is no direct information, but the powder was procured from the manufacturers throughout the state, so it may be fairly presumed that it came from animals that were fed throughout the year. In summer they would be fed naturally on pastures, and in cold weather the other way.

Prof. Washburn: I would like to ask if the committee was able to get information regarding the temperatures used in the production of that product? Will not that be a factor in the feeding value of any product?

Dr. Price: The temperature used in manufacturing the powder? Of course there are different processes of the drying as used in the manufacture of milk powder. There is the roller process, the spray process and several other processes. So far as I know the spray process is accepted as the best process for manufacturing powder. The remade product made from powder manufactured by the spray process is perhaps closer to the natural milk than that manufactured by any other process. Under that process the whole milk is concentrated or condensed to a ratio of about three and a quarter to one, and then the powder is injected in the very fine spray under about three or four thousand pounds of pressure through a very small opening into a chamber, and this place which carries in the milk, backed by this pressure, is in the center of a large area, probably eight or ten inches in diameter, and hot air immediately mixes with that fine spray. This air is of a temperature of about 240° as it enters that chamber. The adjustment is made so gradually between the pressure back of the milk, the amount of milk which is going into the chamber, the volume of air going in, and the temperature of air which is going in that the process of evaporation immediately reduces this temperature to about 170°. So that the moisture in this condensed milk is extracted from it,

and the moisture of the milk neutralizes, if I may so express it, the excessively high temperature, so that the temperature of the milk particles never exceeds 170°. That assertion is perhaps borne out by the fact that the vitamines are not destroyed.

Within the last two weeks I had a letter from Dr. Albert Hess, who has done a lot of work on that in New York, inquiring if more recent studies had been made in the matter of infant feeding with powdered milk. He volunteered the information that he seriously doubts now whether the anti-scorbutic element is removed by the drying process. There is perhaps, and always has been, a question whether the removal of that anti-scorbutic element did not depend more on subsequent long storage rather than on the drying process.

Dr. Supplee: Our laboratory has been cooperating with Dr Hess on this very matter, with particular reference to the anti-scorbutic process. I think that in the very near future Dr. Hess, as the senior officer, will issue a report dealing with the anti-scorbutic properties of dry milk as affected by temperature, and also affected by the feeding and storage period.

In that connection I would say it would be well worth while for this Committee on Remade Milk to consider in the future as these developments come out those aspects. It is a new matter; at least the killing and destruction of vitamines is a new matter which seems to me very important, and apparently on which the future of the dry milk industry of infant feeding is going to hinge.

Dr. Price's remarks relative to temperature were quite to the point, and I have heard Dr. Hess personally say that there was serious doubt in his mind as to whether or not the anti-scorbutic properties were killed in all dry milk. I think that concerns the point Dr. Price brought out. In view of the importance of dry milk in infant feeding, the destruction of vitamines is even more vital than possible changes in physical and chemical properties.

SOME ECONOMIC PROBLEMS IN MILK HANDLING OF INTEREST TO MILK INSPECTORS

C. E. CLEMENT, *Market Milk Specialist*, Dairy Division, United States Department of Agriculture

There are many problems in the milk business which, while they are mainly of economic importance to the milk dealer or milk plant operator, are nevertheless of considerable interest to the milk inspector.

RECEIVING THE MILK

It is important both from sanitary and economic standpoints that the milk be transported to the plant quickly from the railroad depot and that it be handled rapidly at the receiving room. In order that milk may be received and dumped rapidly an efficient arrangement of the plant at this point is essential. There are numerous types and layouts of receiving rooms and platforms, many of which provide for receiving the milk rapidly and efficiently. In U. S. Department of Agriculture Bulletin No. 849 some of the different arrangements are considered and tables are presented showing the effect on the "man hours" required to receive and dump the milk. It was shown that much more rapid work could be accomplished by having the plant so arranged that the milk could be received at an exterior platform adjacent to the receiving tank than could be accomplished where the milk trucks drive to the interior of the building and are forced to turn and drive out before another truck can be unloaded. It was also shown that from the standpoint of "man hours" required for receiving a certain quantity of milk the system of pumping the milk from the receiving tank on the ground floor to a floor above was more economical than raising the milk in cans by elevators or conveyors and permitting the whole operation to be handled by gravity. Although milk pumps are objec-

tionable, there is no great objection to pumping the milk before pasteurization, provided the pump is of sanitary construction and properly cleaned. Various systems of unloading delivery wagons have also been studied and the results indicate that the most rapid method of receiving the empties and "returns" is by some form of a conveyor system.

At one plant it was noted that there was a very efficient and convenient system of unloading the delivery wagons and also of receiving the milk from the milk trucks. Each operation by itself was very efficient and the work was accomplished rapidly by means of well arranged conveyor systems. However, the layout as a whole was not good, as there were considerable delays due to congestion and interference of the operations with each other. The same platform and driveway had to provide for both operations and the milk trucks often had to wait for the delivery wagons to unload and *vice versa*. If the driveways had been separate or if the receiving platform for receiving the milk had been independent of the platform where the delivery wagons were unloaded, the interference of the two operations and the resulting congestion would have been avoided. With such an arrangement, as fast as one truck is unloaded it can drive on and make room for another.

What has all this to do with the milk inspector? Simply this: that these delays may cause sour milk and the milk inspector is of course interested in preventing such losses. It was noted at one plant that a truckload of milk was allowed to remain in the hot sun for over two hours while waiting for its turn to drive up to the platform. If the milk inspector is able to suggest a more efficient arrangement at such plants so that the milk can be received more rapidly as it comes from the depot and delays reduced to a minimum, losses from sour milk may often be materially lessened. He will thereby render a service to both the producer and the dealer.

BUYING MILK BY MEASURE

It is quite generally recognized that the system of buying milk by can or gallon measure is not equitable. However, much milk is still bought by can measure and no attempt made to weigh it at the plant. Producers are often naturally opposed to selling their milk to dealers who weigh and pay according to weight. Figures obtained showing the differences between the quantity of milk actually received as shown at the weigh can and the can measure at many plants fully justify them in their preference when the amount of the milk check is considered. However, it is desirable that the system be fair to both producer and dealer, and the system of depending on can measure is inaccurate and unfair. The milk inspector is a sort of intermediary between the producer and the dealer and should be of assistance to both in helping to solve this problem. He can often show the producer as well as the dealer that the weight system is the more accurate. He can explain to producers that they can not expect to receive full credit for milk when shipped in cans that are dented and battered. On the dealer's side it is important that all the milk from the cans is properly drained into the weigh can and that the scales are tested from time to time for accuracy.

At one plant handling a little over 4,000 gallons of milk daily a careful comparison was made for two successive months. The difference for both months between the can measure and the actual quantity received as shown at the weigh can amounted to nearly 2 per cent of the total quantity received.

The Dairy Division recently made a study of this problem, making observations on 1102 cans of milk. These cans held by measure 6185.32 gallons, but the scales showed that there were only 6068.72 gallons. Here is a difference of 116.60 gallons or 1.88 per cent. All cans were observed before the milk was dumped and in the cases

of those not full a measuring stick was used to determine as accurately as possible the quantity in the can by measure so this was an actual difference caused by the two systems of buying milk of 1.88 per cent.

MILK PIPING AND PUMPS

For both economic and sanitary reasons the quantity of milk piping and the number of milk pumps in milk plants should be reduced to a minimum. Great lengths of milk piping cause extra labor and expense for care and cleaning and tend to increase the quantity of shrinkage, both on account of milk sticking to the sides and from leaks at joints. Both milk pumps and milk piping cause considerable labor in cleaning and sterilizing. If milk pipes must be used, they should be of simple and sanitary construction, with frequent unions to permit them to be taken apart after each use for cleaning and sterilizing. All turns in the pipes should be easily accessible for cleaning. Milk should not be pumped after pasteurization if it can be prevented. Not only may it be recontaminated if the pump is not clean, but the added agitation may injure the cream line. If pumps are used, they should be of sanitary construction and should be of sufficient capacity to do the work without running fast. They should be thoroughly cleaned and sterilized after each use.

PASTEURIZING AND COOLING

It is important that milk be pasteurized properly, but it should also be done at the least possible expenditure for equipment, labor, steam, and power. It is desirable that the pasteurizer have a large heating area so that high temperatures of the heating media will not be required. In this way the work can be done more economically and the dangers of scorching certain parts of the milk will be lessened. By using a pasteurizer with a large heating surface

permitting the use of a large quantity of heating medium, the milk is also heated faster, which is a good thing, as slow heating may cause sour milk.

The milk cooler should be of sufficient capacity to permit the milk being cooled to a low temperature. For this purpose a large cooling surface is required. At small plants the mistake is often made of getting a cooler of too small a capacity. When this is done the milk is usually not properly cooled. In their haste to get through with their work, the men will often let the milk over the cooler too fast, and the result is that the milk goes into the storage room at a temperature at which it will soon become sour.

BOTTLING AND CAPPING

The filling of the bottles with milk must be done quickly, efficiently, and in a sanitary manner. Modern machinery of a sanitary type must be used. All capping should be done by machine as far as possible. The cost of labor being very high, it is of the utmost importance that the work be done with the lowest amount of work possible. A study was made by the Dairy Division to determine the amount of labor required at various plants using various methods of filling and capping.

A wide variation in efficiency occurred at plants using similar methods. At some plants more men were used than could be used economically while at others too few men were employed. The study indicates that many plants could well change from the system of capping by hand to the machine method, and thereby effect enough saving on labor cost in a short time to pay for the more expensive equipment.

When capping is done by machine, it is very important that the machine be in proper working order at all times. If some of the caps have to be put on by hand there will, of course, be a chance for contamination. A machine

should be used that will permit the inserting of a whole tube of caps into it without removing from the carton.

WASHING BOTTLES

The importance of bottle washing is sometimes overlooked in the milk plant and inferior men put on this work. When bottles are washed by automatic machinery a less responsible man may be used to feed the machine, but it is very important that reliable men be used at the other end of the machine and that the bottles be carefully inspected before they go to the filling department. The elimination of a dirty bottle here will not only prevent the extra labor of filling it, but will result in a further advantage in that dirty bottles detected at the filler must be dumped and the milk should not be again used in the general supply.

It is not claimed by the manufacturers of automatic jet washers that they will clean all bottles that have stood for several days and the dirt dried into them. A small brush washer is therefore required in addition to the automatic machine in most plants. At large plants the entire time of one man is often required to clean such bottles.

As in the case of filling and capping, there is a large variation in the labor used at various plants in bottle washing. Machines are necessary that will wash the bottles rapidly and thoroughly and insure clean, sterile bottles.

"Every age has its problem, by solving which humanity is helped forward."

HOW MAY THE CONSUMPTION OF MILK BE INCREASED IN PENNSYLVANIA

RALPH E. IRWIN, *Asst. Engineer,* State Department of Health, Harrisburg, Pa.

The title of this paper implies that there should be more milk used in Pennsylvania. The present milk consumption for household purposes is estimated at about one pint per capita. The usual family purchases one quart of milk from the distributer and uses but little condensed or powdered milk. The student of nutrition advocates the use of double the amount of fresh milk now used. The food economist tells us milk is one of our cheapest foods. Apparently we have not heeded the instructions of these two specialists.

Last year in Pennsylvania we used ten quarts of ice cream per capita and this expenditure for ice cream equals the expenditure for milk during 2½ months. Our ice cream consumption has increased 35 per cent in five years. Our milk consumption has not made this increase nor has it advanced as rapidly in price.

There are five qualifications for a domestic milk supply: first, food value; second, keeping qualities; third, cleanliness; fourth, safety; and fifth, price. Each of the five qualifications is important. The matter of food value is now governed by adequate laws, the keeping quality is being cared for by pasteurization, and by greater care for raw milks. Cleanliness is receiving attention as a matter of decency. Much is being done by the agricultural and dairy interests to promote this quality. The qualification concerning safety has not received adequate attention while price has held the attention of all.

Price is a topic of the day with us in Pennsylvania. Even the war could not attract our attention from the sub-

ject and since the war it has become a scandal. Frequently we see a body of otherwise peaceable and respectable citizens stalking the milk man with a noose and all because the milk man is said to have been intimate with Mrs. Milk Price. All good qualifications are forgotten during a scandal. Why not stop this adverse propaganda by counter propaganda proclaiming milk to be a clean, safe and necessary food for people of all ages? Make this proclamation true and I believe the consumption of milk may be increased in Pennsylvania regardless of price.

As a basic principle we must emphasize safety. Each year too many cases of disease are traced to raw milk to feel that our raw milk supply is safe. The consumer must be protected from communicable diseases transmittable through milk. To do this the production and distribution of raw milk must be carried on under strict sanitary control. This control should call for animals free from tuberculosis, disease-free milk handlers and sanitary surroundings. Milk not so produced must be pasteurized by subjecting the milk to a temperature not lower than 145° F. for not less than 30 minutes, and the exposed pasteurized milk handled by disease-free people working under sanitary conditions. These requirements are not new. Some milk dealers are already meeting them. We need, however, that these requirements become fundamental for all milk distributers so that there may be fair competition. Also we need the honest labeling of milk containers.

With a safe milk meeting the other four requirements for a domestic supply we have a basis upon which to promote our increased milk consumption campaign. On no other basis may we succeed. Failure to meet any one of the five requirements means defeat. Defeat means that the consumption of fluid milk will remain as at present and concentrated milk will be used to a greater extent.

"It is past all controversy that what costs dearest is, and ought to be, most valued."

ROPY MILK

H. A. HARDING AND M. J. PRUCHA,
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Ropy milk has been known for many years. Outbreaks involving one or more farms occur frequently. In most cases this condition disappears with a change in weather or with some variation in the operation of the dairy, and it sometimes disappears before any known remedy is applied.

During the past year the attention of the authors was drawn to a severe outbreak involving more than one hundred farms, and presented the characteristics of an epidemic. This outbreak offered special opportunity for observations, the results of which form the basis of this paper.

The term "ropy milk" is applied to milk which becomes noticeably more viscous than ordinary milk. When this viscosity, or ropiness, is only slightly developed it is usually overlooked by the consumer. When it becomes more pronounced it may be detected by the fact that the milk pours more slowly or that the last portions drip from the container with the formation of an evident thread of milk. In pronounced cases the milk may be drawn out into fine threads several feet in length.

This ropiness should not be confused with gargety milk, which is the result of an inflamed condition of the udder of the cow, although the milk from such udders frequently contains white masses or strings of coagulated material. On the other hand, milk which becomes ropy is normal when drawn and the ropiness does not appear until after twelve hours or so.

There is no evidence nor any reason to believe that ropy milk is in any way harmful to the health of the consumer. However, in our retail milk trade there is demand for

sweet milk of normal consistency and taste. The agitation of recent years for milk with low germ content has made the consumer very suspicious of any evidence of germ growth in milk, especially so when the germ growth manifests itself in visible and unusual form. Ropy milk is not acceptable to the consuming public, and hence causes financial loss to the milk distributer.

The sources from which germs producing a ropy condition get into milk have not been established in all outbreaks studied. The germs have been found in the water used for the washing of the utensils. They have been found in the water in pastures where the cows drink and through which the cows wade. It is easy to assume that the germs from such sources may eventually be found in milk.

There seem to be two distinct phases in the contamination of milk by this organism. First, the initial entrance of the germs into the milk, thus starting an outbreak; and second, the continuation of these germs in the dairy. In the latter case unsterilized utensils may carry the germs from day to day. Unsterilized utensils or cans may in this way spread the germs from one farm to another through the common meeting place, the washing vat in the central plant.

This, in brief, is the general information concerning the cause of ropy milk. The ropy milk epidemic which came under our observation has been of such nature that we have been enabled to enlarge our knowledge, and I shall briefly describe the outbreak.

About the middle of June, 1919, complaints of ropy milk began to pour into the office of a large dairy company. An investigation was started immediately. It was found that of 140 shipments examined, the milk from 116 farms contained the germs producing a ropy condition. Late in the season a cheese factory in that neighborhood closed and a number of its former patrons transferred their prod-

uct to the bottling plant in question. They also were found to be delivering milk which developed the ropy condition. Further inquiries in the community showed that a few families having only one cow were also troubled with ropy milk, although there was no commercial connection with the milk company.

Probably the most interesting point in connection with the distribution of the germs producing ropiness is that it seems to be present in the milk of most milk dealers. In other words, this germ is a regular and active member of the bacterial flora of the milk.

When milk which becomes ropy turns sour, the ropiness usually disappears. In other words, the development of acidity retards the development of ropiness. Thus milk with poor keeping quality may not develop ropiness, even though the germs are in it. Another point of interest in this connection is the fact that the germs producing ropiness are able to mutiply at somewhat lower temperature than many other germs commonly found in milk.

From all information at hand, the authors are inclined to believe that the organisms producing ropiness in milk are widely distributed and that the trouble will increase along with the improvement in our methods for milk handling. We wish to emphasize this point, because if true, the ropiness will become much more troublesome in the future.

Attempts were also made in this investigation to locate the original source of these germs. While nothing conclusive was demonstrated, the findings at one farm are of sufficient importance to deserve special mention.

At this farm the germs were found repeatedly in the utensils. They were also found in the cooling tank. From this cooling tank the water flowed to the stock watering tank, located in the barn yard. The germs were found in this tank also. At times this tank overflowed, forming considerable mud in the barn yard. The cows had to come

to the tank through this mud. The material collected from the flanks and from the udder of the cows, when placed in sterile milk, caused the milk to develop ropiness.

The evidence is very strong for the conclusion that the coat and the udder of the cows became contaminated with the ropy germs from the water when these cows rubbed against the wet sides of the tanks, when their coats became moistened by the noses of their companions and when their udders and flanks became splattered with the mud.

Several cultures of the germs were obtained and were studied in the laboratory. These cultures fell into two distinct groups. Those in the first group resembled the typical organism producing ropiness, known as the *Bacterium viscosum*. These germs do not produce any gas or acid from sugar. They like neutral medium, and when grown in the milk turn it slightly alkaline.

The other group produces acid and gas in milk. It is a vigorous grower and makes the milk extremely ropy even in acid reaction. The germs in this group are more difficult to kill by heat than those of the first group. These germs belong to the *aerogenes* group.

Numerous tests were made in regard to the thermal death point of these germs producing a ropy condition in milk. When we used the Sternberg bulbs and used milk as the medium the germs did not survive the heating for 30 minutes at 140° F., which is the usual pasteurizing exposure. However, when the milk was pasteurized in the vats under factory conditions it was very difficult to eliminate the germ from the milk.

The remedy for this trouble is simple in principle. The means are hot water, steam or some disinfectant, such as hypochloride of lime. The application on a single farm or in a small dairy is not difficult, but when this trouble is established in a large milk plant the difficulties may become large. One large dairy has been fighting this trouble for

a year and a half. They are able to control it, but they still have it.

From all the evidence collected we have made the following deductions:

The germs producing ropy milk are widely distributed, but in milk of poor keeping quality they are usually prevented from producing ropiness.

The production of ropy milk can be immediately reduced to a level where it will cease to be the occasion of complaints when the utensils are thoroughly sterilized and when attention is given to proper pasteurization and where the milk is protected from subsequent contamination by the germ.

When the milk plant becomes thoroughly inoculated, particularly if the milk producers continue to furnish the germs with the milk, the final and complete removal of the last traces of the germs is difficult and is likely to be a time-consuming process.

"Great works are performed not by strength but by perseverence."

ADDRESS

DR. R. A. PEARSON, *President,* Iowa State College, Ames, Iowa.

I am very happy to have had the invitation to speak to you this evening, because I believe thoroughly in you, gentlemen, and in the work you are doing. I have come in contact with every phase of milk inspection work. I have myself inspected, and I have directed that work more or less for a period of years, and I think I know fairly well what it is all about and what the results are and ought to be.

If I should ask each one now to write an answer to the question, "What should be the greatest aim of milk or dairy inspectors?" we would have some very interesting answers. If somebody would say that the greatest aim is to catch crooks, I would answer that by saying that if that was the greatest aim, then the audience that is before me would be a different audience than is before me now. That is an important item, to be sure, but I think we would find that the more thoughtful men in this audience would agree that the greatest aim should be to help increase the production and consumption of high grade milk and dairy products, and, incidentally, to decrease the production and consumption of low grade dairy products.

Now, why would the greatest aim be to increase the production and consumption of high grade dairy products? Because we want to help the farmer? No. Is it because we want to make business for ourselves? No. Any man who is successful in this business can make more money in some other, I am sure.

It is, briefly, because the very strength of our nation depends upon the prosperity of our agriculture, and that in turn depends upon the diversity of agriculture and the maintenance of our soil fertility, and dairying is one of the greatest if not the greatest of all the factors which con-

tribute to diversified farming, and to the maintenance of fertility.

Now, do you know what I mean? If you have ever lived in Texas where they have a drought once in a while, or if you have ever lived in Kansas, where they have an insect infestation once in a while; or if you have ever lived in the East, where they have all kinds of labor troubles once in a while; or if you have ever lived most anywhere else, where they have had to contend with outrageously low prices on their principal products once in a while, then you know what I mean by the advantage of diversified farming. The single crop system is a failure. It has failed everywhere. Once in a while a district can thrive for a period, but sooner or later it comes to grief, and it is a well established fact that we must have a diversified agriculture if we are to have a prosperous agriculture.

Then again, we need dairying because it is one of the great factors in maintaining fertility of land. I want to tell you that is becoming one of the big questions in our national development. Did you ever stop to think that these great areas of buildings in our cities, these wonderful evidences of prosperity that statisticians are constantly pointing to and that we point to with pride, are very largely the result of a destruction of natural resources. I want to tell you that this nation, which has developed such unprecedented prosperity, has done it chiefly by exploiting and destroying its resources. Natural gas is one of them, but what about it? It is practically gone, and the State geologist of West Virginia is authority for the statement that during a long period—not months, but years, decades of years, while they were exploiting natural gas and using it—they were allowing it to go to waste deliberately at a rate of a billion cubic feet a day; that the loss of natural gas during that long period of twenty or twenty-five years in West Virginia was equivalent to a total loss of forty-five tons of coal every minute, day and night, for twenty years.

You may think it has nothing to do with milk inspection. It has everything to do with milk inspection. We have been exploiting our coal; we have been exploiting our iron and our steel and timber in the same manner. I am not so much worried about these things, because we can find other ways of getting along when this gas and oil and coal are all gone; we are going to use water power and wind power and learn how to use the sunshine. I think God just gave us those things so that we could tide along until we learned how to use the other great resources; but the greatest of all resources in the United States is soil fertility, and there is no substitute that can be found for it, and soil fertility has been rapidly decreasing in our country.

There was a land of milk and honey in the history of this world once, and the crops just seemed to rush out of the ground and bear fruit. Today that land is a barren waste, because the fertility is gone. Egypt used to be a fertile country, but most of it now is a barren waste. Virginia used to be a fertile State, and New England used to be fertile, and even Iowa, where I come from, used to be a whole lot more fertile than it is now.

One of the greatest questions before us is, how are we going to check this loss of fertility of our soil? That cannot be fully answered tonight, but one of the very best agencies that is operating to reduce loss of fertility is the dairy cow. That is one reason for wanting to encourage that industry. Do we want to encourage it, then, so as to give the railroads more business? No, a thousand times no. The railroads have more business than they can do now. They never were so efficient, but they have been held down and have not been able to receive an income sufficient to carry on development to correspond with the increase of population of our nation, and we discovered it when we took them over and tried to run them ourselves. We will not advocate increasing dairying to help the men

engaged in handling milk, because they also could find other lines of activity that would be just as interesting, and provide them with as profitable employment as handling milk. We will advocate milk production in the interests of diversified farming and in the interest of maintaining fertility, and also, and important, in the interest of furnishing a food that is the best food we know and the cheapest as well.

We will not accomplish it with laws. There are men in this room who could go out without any law whatever and accomplish far more in the great purpose of dairy and milk inspection than some other men—I will say who are not in this room, because they are not the kind of men who attend meetings like this—could accomplish with any kind of laws. It is the man. It is his ideal. Does he realize just what he is after? Does he have an intelligent conception of how to get it? There was a time when some persons who had a little authority under a lot of ordinances thought that they must go out and throw out their chest and tell people where they got off and on. That is not the spirit of the modern, up-to-date inspector.

In these days, some of the greatest movements within our nation, in the line of advancement, are taking place within the different professions or industries, by reason of activities within those professions or industries, and not by reason of outside pressure.

When I got within two blocks of these stock yards the old-time odor filled my nose. I recognize it any time. What about the improvements that have taken place in these packing houses in the last ten or fifteen years? Do you believe it is because of laws? There have been some laws, but I want to tell you that the improvements that have taken place here, along sanitary lines, have been ten times as great because of the activities of the packers themselves, under the guidance of their own experts, as they have been because of any pressure from the outside. To be sure, they might have put these experts on in some instances because

of pressure from the outside, but the actual results along lines of improvement in the packing industry have been very, very largely due to the efforts of the packers.

A few years ago the orange growers of California were having all kinds of difficulty in marketing their fruit. Everybody was against them. They had no friends. Their fruit was banged around and neglected in shipment; cars were left on sidings; when they got down here, part of the fruit was rotten, and nobody cared for them, or the fruit, and they tried to get legislation that would help them, but it did not aid them. They got a little, but it did not help. They appealed to the railroad authorities, and they got a little attention, but that did not help; and they scolded the commission men, and they listened to their complaints, but that did not help. Finally they said, "We are going to clean house ourselves; we are going to take right hold of this business and find out where the trouble is, and remove it."

So they effected an organization which you all know about, the California Fruit Growers' Exchange. They employ their own manager, and they pay him $24,000 a year, and they said, "Nothing is too good for us; we don't care a tinker's whistle for state right laws; we are going to do things better than the state laws require." They went right at it and did their job so well in a big way that they are marketing about 50,000 cars of fruit a year, and they are suffering a very small percentage of loss, and they are doing well.

Now, in my opinion, the dairy situation in this country will never be what it ought to be until the dairymen of this country take hold of it and decide what ought to be done along the right lines, and then follow it up through their own organization and their own employees and establish their own standards, and follow these things out consistently, and then we will have it where we ought to have it. So a suggestion that I wish to make to you is that I would

encourage organization, the organization of dairymen, of farmers. I would encourage that, and I would encourage the organization to take into its membership only those people who will agree to maintain high standards, to make them as high as seems appropriate under the circumstances, and let any man who goes into the organization raise his own personal standard as much above that as he wants to, but let that organization say, "Absolutely no man shall stand with us unless he complies with these essential requirements." Do just as the strawberry growers out in Hood River Valley did while I was there one summer. One farmer had been under suspicion. He was putting some overripe and rotten berries into the bottoms of his crates, and covering them up with nice fresh berries. Of course they do not repack strawberries, they are too delicate. They are taken into the shipping station and sent on East. A shipment reached St. Paul and was opened. The condition was discovered; telegrams went back to the shipping point. The berries under a certain mark had been dishonestly packed. They knew that mark. They looked at his next shipment, and sure enough, he was up to his old tricks. The next morning when he drove up with a wagonload of berries, they said, "Good morning, Mr. So-and-so, we do not need your berries this morning." He said, "You don't need them, hey? Well, you can go to the hot place. I will take them over to the other association." Well, the other association had been warned by telephone, and Mr. So-and-so drove over to the other place and said, "I thought I would bring my berries to you this morning." The manager said, "Well, now, we are sorry, but we do not need them." Then he began to realize that the only way to ship berries out of the Hood River Valley was through one of those associations, because they could not go any other way; they had all of the refrigerator cars. Neither company would take his berries, and his whole crop rotted. Don't you think the merchants in St. Paul and Chicago and various places will

be glad to handle such products when they know how the growers are trying to maintain the standards? They will want the berries, and they will pay good prices. . .

Now that is the spirit we want to get into the dairy industry. We want to have an organization whose standards will be of the very highest, and who will want to have it understood that any milk that goes out with their brand complies with all the requirements; and then we want to have the dairymen understand the conditions. We have all had the experience of coming into contact with the man who did not know how to do things right. We know that they nearly all want to do it right, and if we will labor with them and put them on the right track, they will forever after go in the right way.

I remember one time a speaker on bovine tuberculosis went into a dairy district. Some of the farmers in that district had had a little bad luck with tuberculosis and had lost some cows. They were so incensed against anybody who came to talk to them about tuberculosis that they almost literally threw that fellow out of a second-story window; they just about scared the life out of him. He took the first train he could get out of town and went to the capital of that State and reported the matter to the authorities, and said that he thought the militia ought to be sent up there and shoot a lot of those farmers. What was done? A man who had charge of the situation said, "Poor farmers, they don't know. We will teach them." He called in his veterinarians, and he said, "Will you have some reactors within the next few days somewhere around the State?" The veterinaries said they had a lot of them. He said, "I want a carload of them to be sent to such and such a town," naming the town where the speaker had been. A lot of hand bills were printed, stating that there was to be a great meeting there on a certain day, just about a week after this thing happened, and all the farmers of the countryside were invited to come to it, and there would be a

carload of cows that had reacted to the tuberculin test shipped in there; they would arrive that morning and be ready for inspection. They were shipped in and tied to the fence along the country road, and the farmers came, hundreds strong, and looked over the cows. Some of them were nice, fat, sleek-looking animals. Most of the farmers pooh-poohed the whole idea. "Nobody can tell me that cow has got tuberculosis I have had cows all my life and I can tell," and so forth. That kind of talk was being passed up and down the line, and at noon an officer of the State got up on a barrel and called them all within the sound of his voice, and said, "We are going to have a demonstration here. We understand there is a little uncertainty in this district about what tuberculin means and what it will do. We have sent in a carload of cows that have reacted to the tuberculin test, and we are going to kill them, one or all, right here on the ground and let you farmers see how they look inside.

"Now, there will be a good deal of blood if we kill them all. We would like to have you pick out a committee of two or three of your own people and select which ones you want killed." The farmers selected a committee of three. The committee walked along, and they picked out the nicest, plumpest, healthiest-looking little black cow that you ever saw. They were all absolutely sure she did not have tuberculosis. The butcher was there and he knocked her down, and they opened her up and found great sacs of pus in her udder.

They brought in a second cow and knocked her down and she had a bad case of tuberculosis, an advanced case. She was sleek and fat. They brought up a third one, and they were beginning to mellow a good deal about that time. The third one had a still more advanced case. Then an officer of the State said, "Gentlemen, do you want to have more killed, or would you rather end now with just one more, and pick out now the one that you think is the worst?"

Then they agreed they had enough, and they picked out one they were sure was the worst. They picked out one that was about 15 years old, thin as could be, and they knocked her down, and the veterinarian had to search for about 20 minutes before they could find the faintest sign of tuberculosis, and that was just a little bit. The one they thought was the worst showed the least disease, and the ones they thought had tuberculosis least were the worst. The farmers were invited into a hall, given a lecture on the subject, and after the lecture they were told the meeting was over. One farmer came to the front and said, "Wait a minute, I want to say something. The State had a man out here last week to talk to us about bovine tuberculosis, and we did not treat him very well. I want to say I have learned something today. I want to say I believe I made a mistake last week, and I think that tuberculin has some value, and I believe that the State officers know what they are doing. I think that is what all the rest of the farmers in this crowd think." He said, "Those of you who think that way, just hold up your hands." Every hand in the hall went up, and the farmers came up and asked a hundred questions, and everything was lovely from then on.

In our attitude toward the farmers, let us work with them and through their organizations just as far as we can.

Now, I think that milk inspection service ought to be held up to an ideal of that kind, and when that time comes, gentlemen, the official milk inspectors who are doing good work in this country will be gobbled up at twice the salary the State is paying you. The farmers themselves will want to take the best inspectors into their own employ, because they themselves will have high standards, and they will want good leadership. I believe it would be a fine thing if a system of milk inspection was started somewhat like this:

At a shipping station I would designate the dairyman who was doing the best work as a local inspector. Mind you, I would take him right out of his own neighborhood and say

he is to inspect in this neighborhood all the dairies, and he is only to work at it about two hours a day, during milking time, except occasionally if there are special reasons he can work some other time, and I would pay that farmer by the hour. You say he could not do anything among his own neighbors and friends, they would just make it so hot for him if he was honest he could not live in the neighborhood. If he were not honest, he would fall into their hands and gloss things over. No, he wouldn't. Neither one of those things would happen, because I have given you only half of the plan. I would put into that intelligent farmer's hands a score card which would name every part in the dairy that needed to be looked at, and he would go into his neighbor's dairy with his score card in his hand, and he would say, "John, I have to report that your cows are not clean." John would say, "No, don't do that; you are a friend of mine; you have known me all my life, and you must not send in a report like that." "But, John, I have got to send that in as it is, because the State officer who gets a copy of this report may come back here this very afternoon and come out here to your farm with me, and with this score card, and if he finds I have made a false statement I will be punished." John says, "Well, then, put it down as it is; I don't want to get you into trouble."

Do you get the idea? There is a simple method of inspecting milk dairies, which is educational. It throws the responsibility right upon the industry, and it makes it possible for the men who are doing the instruction to make correct reports, because their neighbors know that any minute the State officer may come in there, and he will have to come occasionally, you know, to pick up the few cards here and there, and go right out and visit the dairies. If he finds the local inspector has not been stating the truth, then of course that local inspector would have to be punished. I think that is a system of dairy inspection which ought to be tried out. I believe it would bring good results.

What about the attitude toward the milk dealers? Just the same as toward the farmers. A whole lot of them are honest. I would like to have them get to the point where they would see it is to their advantage also to form a little group, and that they would agree among themselves that they would not permit anybody to come into that group who would not maintain certain essential conditions. Somebody says, "Oh, but that would not do, because that would interfere with competition." Well, bless you, what they would lose on account of coming together that way would be gained several times over, because it would contribute so much to develop a confidence in the minds of the public in regard to the purity of milk that is coming into their town, and if the public can get such a notion as that, they will use a whole lot more milk than they are using now, and all the dealers will be benefited. I want to tell you, where one dealer or two dealers send out and advertise the pure, fine quality of milk they are selling, their sales are nevertheless held down by the third and fourth dealer that they have nothing to do with, who is selling dirty and impure milk, and who is haled up once in a while in court, and advertised. The public does not distinguish as much as it ought to.

It will be a benefit to the dealers if they can eliminate the undesirable kind, and by having their own associations they can succeed in doing that to a large extent. I appreciate that this is quite a long distance in the future, but nevertheless it is right.

The great fundamental reasons for milk inspection are not to help the individual farmer, but to help agriculture, because we want to help make our country grow. There are not many industries in this country that mean a greater and a better country as the industry becomes greater. It is not so with the automobile business. That is overdone now. Our country would be better off if it did not have so many automobiles. It is not so with the moving picture

business. We do not want to develop that further, it is overdeveloped now. It is not so with a great many other industries, but with dairying it is true. The more dairying, the better agriculture, and the better United States. That ought to be a great incentive to the man engaged in this work.

"There is nothing difficult in the world; the only fear is that men will be lacking in perseverance."

ADDRESS

MISS JESSIE M. HOOVER, *Milk Utilization Specialist*, Dairy Division, U. S. Department of Agriculture, Washington, D. C.

A gentleman who visited the Milk Utilization booth at the Dairy Show this afternoon said, "Why, six years ago I was taking fifteen to twenty drinks of whisky every day, and I was in a very sorry plight." He added, "In the past five years I have just been using water and milk. I am sixty-eight years old, and nobody believes I am fifty." He said he found he could get along without the whisky and that the milk was simply straightening him right out.

I have been engaged in the educational campaign to try to teach the great importance of milk and its products as a food. I was in Wyoming last January when the State University had all their field extension people in, and these people were being told about all the wonderful things that were going on every place else in the United States except where they lived, and so it came to my turn to expatiate. I had some pictures of these wonderful rats, how they had grown plump and strong and well when they had plenty of butterfat and lots of milk. One of the young women wanted to know why she couldn't have a set of those pictures, as she wanted to use them. So I turned them over to her. Later on, when I was out in the field, I noticed a story in the Government News Letter. It said, "And they tried it on the cats." Well, this woman had taken her rat pictures out, and she had told the children about what a wonderful thing milk was for rats. There were three very scrawny, puny little boys there who came from the same family, who were never caught drinking milk, and they went home and told their mother of this story.

Now they don't have very many rats in Wyoming, so the boys were quite alarmed about how they were going to find out if the lady told the truth or not. They had two kittens, and they tried it on the kittens. One little kitten was given skimmed milk for two months, and the other little kitten was given whole milk with an extra spoonful of cream, and at the end of the demonstration the little boys came back and said, "The milk lady told the truth. Here are the cats."

You folks know milk is just the best food on earth. You have seen what it will do, and I have a notion there is a way of getting this food value of milk speedily over that is far more vigorous, more effective than to just preach about it all the time, and that is through the demonstration method.

When we started the campaigns in which the Department of Agriculture cooperated directly with the State agricultural colleges and with their extension forces, we had an idea that we could go around and talk to the women's clubs and get results that way. Now the women's clubs are fine to talk to, and the men's clubs are fine too, but every time we would start to talk they would say, "Yes, that is very well, but my Johnnie won't drink milk"; and after all, that is just the point.

When I was a child it did not make any difference what I wanted to do, I had the strong hand of discipline making me do what was good for me, whether I wanted to or not. But that is not the style today. If Johnnie does not want milk he is not required to take it. Obviously it was necessary, then, to go to Johnnie himself. So we started these appeals to Johnnie, and Johnnie went home and asked for milk. He not only asked for it but he demanded it, and he got it.

I will sketch briefly a form of organization so you will understand we not only create demand, and get temporary results, but we get such a strong grip on our follow-up

that we do not lose the ground that we gain in the first place.

The State College puts its machinery to work. Cooperation is secured from every available source. A campaign should not be put on in any place where it is not needed. I have never been any place where it was not needed, but we want to know that there is a need there, that the people rcognize it to the extent that every organized group interested in civic welfare will get in and work; and so at our organization meetings we usually have about 50 representatives of every kind of group, including the official family of the city, the public schools, the Board of Health, which, of course, belongs to the official family, the medical association, all the women's clubs, the Chamber of Commerce, etc. They all agree they are going to have a campaign, and they are going to work for it.

The next point is to get the children interested, so five and ten-minute talks are usually given in the public schools. Do you know these little youngsters will get so interested they sometimes stay twenty minutes after school and ask the speaker about the food value of milk.

Another way in which the children cooperate is through their essays. I remember out in Spokane the children were going to write essays. We asked the milk inspectors to furnish these children with a story about how their milk supply is protected, how much milk is brought into this city and how it is distributed, and of course the milk inspector was kind enough to do it. Why, the milk distributers said their plants were simply swarming with children to see how milk was actually distributed and delivered to the people in the city, and when the speakers went in there, there was not one room they spoke to they did not have to stay twenty to thirty minutes longer to answer questions.

In the United States there are almost twenty-one million children, and we are told by the Bureau of Education that six million of them are under-nourished. There is as a

"follow-up" of every milk campaign a demonstration of what milk will do for boys and girls. They tried it on the cats in Wyoming, and we are trying it on the boys and girls in a good many other places; but every time the story is the same. Somebody said, "I don't think these campaigns amount to anything anyhow, they are over in a week." Oh, no, they are not. They are not over for years, because there is that extension organization, the home demonstration agents, the county agents, right there on the job, looking after the followup, seeing that interest does not lag.

About two weeks ago I went to the Eastern States Exposition. There were 425 boys and girls in camp. They were offered coffee, cocoa and milk for drink. The most coffee that was ever taken in Camp Vale by those 425 boys and girls was 12 cups, 40 cups of cocoa, and the rest was milk, and at many, many meals, no coffee at all. I call that a pretty good recommendation for milk campaign work, and these were country boys, and nearly all of them had been coffee drinkers before. We asked them, "How does it happen you boys are using milk?" "Oh, we have got work to do, we have to keep strong; we have to have good strong, wholesome, healthy food so that we can stand to do our work."

A story which I picked up in Kansas City I think illustrates the fact that the lack of use of milk by the average American boy or girl is not a matter of material wealth. In Kansas City a survey in fifty public schools was made. In the poorer colored district they found that 12 per cent of the children were under-nourished; in the rich residential district, 52.09 per cent. Purely a matter of education there and the lack of parental discipline.

Now, we went out to a colored teachers' association, and the presiding officer said, "In March, 1919, there were 37 per cent of our children here under-nourished." They began a milk feeding demonstration, and in September, 1919,

there were only 25 per cent of them under-nourished, and by the last of March, 1920, 3.7 per cent. She said, "Ladies, I want to tell you that by June 15, 1920, it is our slogan that there shall be no under-nourishment in this school district."

A great deal of attention has been paid to the city work. People think that all the under-nourishment is in the city. The reports which the Bureau of Education give out state that there is actually more under-nourishment and more sickness in the rural communities than in the city, not excepting the slums of New York.

In Madison County, Iowa, 125 rural children were investigated and questioned. Of these children in the schools of Scott Township, Madison County, Iowa, only 11 per cent were using milk daily, and they were getting at least a cup of milk a day. The town, which is located in that township was then investigated, and they found 136 children who were questioned. Out of this number 62 per cent were getting at least a cup of milk daily. Now of this rural group who lived on the farms, all but two of the families kept cows, and the question is why was it that only 11 per cent were getting as much as a cup of milk daily. I take it that the milk was being marketed and that the rural child, who is supposed to have everything that is fine and good for children to grow on, was being left, with only about one-tenth of those children getting as much as a cup of milk a day.

So in the work which is done cooperatively by the United States Department of Agriculture and the State agricultural colleges, we are beginning, not only to give attention to the city child, but not to forget that we must pay a little attention to these country boys and girls as well.

This morning it was my privilege to go out to Montgomery Ward's plant. They have 7,000 employees. They furnish every person who is in their employ with a glass of milk in the morning and one in the afternoon. They are

furnished with milk from 9.30 to 11.30 in the morning and from 3.30 to 4.30 in the afternoon.

They have 7,000 employees there. It costs the company 12½ cents to serve this milk to each one of these individuals. The individual does not pay for the milk. They are not only giving the milk, but they are giving 15 minutes a day that it takes to go and get the milk. They were trying to curtail expenses out there. Their efficiency man said, "We will take out the non-productive departments. We will just knock out this milk enterprise entirely." When he studied this, to be sure that he was scientifically correct, he began going around to first one department and then another. When do the employees begin to lose their vigor? When do they begin to lose their pep? They found out it is about 10 o'clock in the morning, and the company has found that it pays them to maintain this non-productive department, because it keeps their people right up on tiptoe. So it is in all the factories where the milk service is started.

When we first began this work do you know that we had two big campaigns where we only made a two or three per cent increase, but that was before we learned how to get results. Since then the increases have averaged about 25 per cent.

Now the United States Department of Agriculture and the State agricultural colleges never go into any milk campaign unless they are assured of three things: First, that the community needs the campaign because of the undernourishment; second, that the supply of milk is adequate to meet an increase of, say, 20 per cent; third, that the milk is clean and that the Board of Health will say, "Our milk in this town is decent and fit for people to use;" and then the price must be right to all parties concerned.

I believe that in all of this work it does not pay to lose sight of the rural child in our anxiety to do much for the city child. As long as the city is looking to the rural dis-

trict to produce leadership for the city, the rural child must be looked after. The immortal Cato said, "The agricultural population produces the brainiest men, the most valiant soldiers, and the class of citizens least given of all to evil desires." Now if that is true, then I think that those who are interested in bettering the race, in seeing that every child has a square deal, an opportunity for health, for becoming one of these fine citizens, must look not only to our city campaigns but to our rural campaigns.

Just a word about the follow-up. If we are coming into a city and make a big fuss, if the managing editors say, "Yes, you can have columns of news space;" if the public school superintendents say, "Yes, you can come into the schools;" if the Bishop of the Catholic Church says, "Yes, you can go into the parochial schools;" and if the Board of Health says, "You will have every support from us;" if all these things happen, and your posters are made, and all that sort of thing, if that is the end of it, then it is not worth doing. But when it is followed up by the public schools introducing milk service talks, it is good for boys and girls. When we realize it takes over $60 a year to educate every city child; that it takes over $40 a year to educate every rural child, and the under-nourished child is not a well child; the under-nourished child does not get along well in studies; when all of these things happen, and when we think about these repeaters, the child who does not pass his grade, every one of them costing the city over $60 a year for every failure he makes, and every one of them costing the rural community $40 a year for his mistakes, I think it pays a city school board financially, just in cold cash, to see to it that provisions are made so that this great percentage of under-nourishment of children may be reduced.

In 1914 there was only 5 per cent of under-nourishment in the city of New York. In 1917 there was 21 per cent, and the consumption of milk had fallen off 25 per cent.

The health officials there said they attributed it very largely to the reduction in the use of milk.

Little Tom in Kansas City was underweight seven pounds, and he wanted to play on the ball team. They would not have him. So for eight weeks he took a pint of milk a day, and he gained two pounds and a half, but that still did not put him up in the class where he could go on the ball team. Then he took a quart of milk a day for two weeks, and he gained the same amount and he got on the team. Now Tom is drinking milk all the time because it paid him and put him on the team.

"If we could grapple with the whole child situation for one generation, our public health, our economic efficiency, the moral character, sanity, and stability of our people would advance three generations in one."

THE VALUE OF THE BACTERIAL COUNT IN RAW AND PASTEURIZED MILK AND MILK PRODUCTS

CHARLES H. KILBOURNE, New York City

I would call your attention to a belief of mine—which I am convinced is well founded—that we who are or who have been connected with the public control of milk and milk products have pinned too much faith upon the idea that bacteriology is an exact science, and I think we have too much faith in the counts which our laboratories report.

Many of our cities and States have so-called bacteriological standards for these products, and the health authorities consider that counts which exceed these standards indicate that the products are adulterated, and are unsafe for food. In many cases milk and cream have been excluded from sale, and in some instances they have been destroyed when the counts have been high. Prosecutions have been instituted when the counts have exceeded the legal standards. Dealers who have suffered from such action have felt that they have been unjustly treated at times and they feel resentful. They also feel, however, that any expression of such feeling would subject them to the suspicion that they are willing to put something over on the public if by this means they can save some money.

Because I am no longer connected with the official control of milk supplies, but am now a free lance trying to help various dealers in foods to solve their problems, I trust that no one will get the idea that I am retained by them to oppose the public officials and their action. This is not true, for I recognize the great and important work which has been and is still being done by you milk and dairy in-

spectors. I have in the past had some small part in the establishment and enforcing of the milk and dairy standards of New York City, and would be the last to wish to turn public confidence from the honest and well considered efforts made to maintain and improve public milk supplies. I feel, however, that we are in danger of bowing down to an ideal, and that we may find that our *ideal* is after all only an *idol* which is not all gold, but whose feet are of clay.

If bacteriology were an exact science we would be safe in holding to it without wavering. But is it an exact science? If so, it must conform to certain definite requirements. The very meaning of the word "science" indicates *clear seeing, see-ance,* if you will pardon a play upon words. It means knowledge which can be successfully applied to the solving of recurrent problems. In the statements of its fundamental principles, certain theories are propounded which may appear to be reasonable. The theory, however, is not scientific unless in its application to the problems at hand it is found to be workable. When it does work, then and not till then is it entitled to be called scientific. This statement applies to all science.

Very few sciences fully conform to this exact understanding of the word. There are usually a great many exceptions, and while it is a common saying that the exception proves the rule, it is more nearly true to say that the exception indicates some ignorance of facts, which if understood would help us to formulate a more exact rule.

Mathematics is the only really exact science, because here when we know certain unvarying conditions we can successfully solve problems into which these conditions enter. For instance, the relationship of the circumference of the circle to its diameter, or of the triangle to its angles, is absolutely unvarying. Physics closely approaches to an exact science, and chemistry is getting to be an exact science. Most other so-called sciences, however, such as botany,

geology, etc., are only collections of observed facts, from which facts theories have been evolved. These theories do not always work out in practice.

Now, let us see how bacteriology as applied to the examination of foods complies with these scientific rules.

First, how many exact conditions surround the obtaining of bacterial counts? There are varying conditions under which the milk is produced; there are various kinds of infection to which it may be subjected. Its age and the kind of treatment to which it has been subjected must be considered. Then, too, regarding the manner in which samples are obtained, there are variable factors. Men who obtain samples of foods do not all use the same methods. Different apparatus is employed. The samples may or may not be properly iced after taking. The time which elapses between the taking and the examination of samples may vary. Again, when these food samples get to the laboratory there are varying methods of treatment. Different details of technique are employed. The unequal personalities of the workers enter into the problem, and the changing mental and physical conditions of the same worker at different times affect the reported results. Instead of expecting exact results we ought to expect uncertain results. Granted that much of the work has been partly standardized, we still do not approach mathematical exactness.

In the game of chess there are six different forms of pieces employed, each of which has a different form of move. There are thirty-two men on the board. Almost any number of moves is possible in each game. In view of this it is not far from the truth to say that no two games were ever played exactly alike, although when you play chess you can see the board and watch the varying conditions. In the bacteriological game, you know there are varying conditions, but with the individual sample you can only guess at what these may be. With all these fluctuat-

ing influences surrounding your counts, exact results are more unlikely than in the game of chess. This being true, is it fair to base legal action upon such results—action which involves at times loss of property and of business? The only excuse, of course, must be that we believe the general good of the public will be best served when these admittedly uncertain results are taken to indicate that conditions exist in the handling of the foods which render them dangerous for use.

Now to what extent in actual practice can we rely on these bacteria counts as safe indicators of unsafe conditions?

A letter recently came to me from a western city in which the writer asked why pasteurized milk which had been allowed to stand in bottles for some time sometimes showed a lower count than it did just after being pasteurized. Of course we can think of possible reasons for this. We can also think of possible reasons why milk which has been pasteurized under proper methods sometimes shows more bacteria than the same milk showed before it had been pasteurized. We can think of possible reasons why samples which are as nearly exact duplicates as it is possible to get them will be reported by different laboratories as containing numbers of bacteria which are hundreds of per cents apart, and why two samples examined by the same worker will show these differences. We can guess at reasons why milk from a farm which is known to be clean and well cared for will show a high count, while milk from a farm which is known to be filthy will show a low count.

Now it is interesting to theorize about these reasons when we know the results. The practical difficulty is that in the public control of milk and milk products we are usually given the results only, but cannot or do not take the opportunity to prove the reasons for them. We only guess. The results which we may receive from one laboratory would indicate that the milk was entitled to a pre-

mium, while the results obtained from another laboratory on duplicate samples may cause the milk to be degraded or excluded from sale altogether.

Recently I took samples of cream from two cans standing side by side. One was undoubtedly sour and the other was unquestionably sweet. When the examinations were reported, the sour cream was found to contain 39,000 bacteria, and the sweet cream had 59,000. "Oh," you say, "you got the samples mixed." Well, even if I did, why was the one only 50 per cent higher than the other? Now it happened that I took duplicate samples from the cream and sent to another laboratory. The report from this laboratory showed the sour cream to have 170,000 bacteria and the sweet 190,000. "Mixed again," you say, but still one was only 12 per cent higher than the other, and the count of one laboratory was 338 per cent higher than the count from the other. Now taken on the count alone, even the highest figures would indicate a satisfactory product.

Again, ice cream samples were taken which were as nearly quadruplicate as was possible to get them. These were sent to four laboratories. Results:

Laboratory No. 1.....	600,000
Laboratory No. 2.....	43,000
Laboratory No. 3.....	480,000
Laboratory No. 4.....	13,000,000

On another date the same four laboratories show:

Laboratory No. 1.....	36,000
Laboratory No. 2.....	275,000
Laboratory No. 3.....	470,000
Laboratory No. 4.....	4,000,000

Admitted that ice cream cannot be as fully mixed as can milk, and that exact duplicates cannot be taken. If this is so, how can we have legal standards, and how can legal actions be based on such results?

You say, "Insist that laboratory methods at least be standardized." All right. You remember that Prof. Conn some years ago conducted a long series of tests through various laboratories in order to ascertain the differences in technique used, and in order to establish standard methods. Such standards were later adopted by the American Public Health Association and were accepted by laboratories of the higher grade. After this, I found that in my own work I was getting results which did not correspond with those obtained by the New York City Health Department laboratories. I therefore determined to find out how the results on duplicate samples would compare when they as a practical commercial routine were made by various laboratories. Accordingly I conducted a series of tests, the results of which were published in The Creamery and Milk Plant Monthly of October and November, 1918. Briefly this is what happened.

I took a series of samples in triplicate at the same time and from the same containers from which the Department of Health inspector took samples. These were given to four laboratories without informing them that checking was being done. Here are some of the results:

Kind of Milk	*Counts as Reported by Laboratories*			
	No. 1	*No. 2*	*No. 3*	*No. 4*
No. 1 Raw	Lost	435 000	41 400,000	1,850.000
" 2 "	"	600,000	33,400,000	1,520,000
" 3 "	"	280,000	28 900,000	1,344,000
" 4 "	"	670.000	1,840,000	586,000
" 5 "	"	780,000	37,100,000	1,792,000
" 6 "	"	775.000	36 200,000	1,920,000
Average		590,000	29,806,000	1,502,300

Percentage of difference between lowest and highest count on sample No. 1, 9.417 per cent.

Percentage of difference between lowest and highest average, 5,036 per cent.

Kind of Milk	*Counts as Reported by Laboratories*			
	No. 1	*No. 2*	*No. 3*	*No. 4*
No. 10 Pasteurized Cream	Lost	860,000	13,920,000	1,369,000

Percentage of difference between lowest and highest, 1,618 per cent.

Kind of Milk	*Counts as Reported by Laboratories*			
	No. 1	*No. 2*	*No. 3*	*No. 4*
No. 12 Pasteurized Milk	Lost	50,000	126,000	358 000
" 13 " "	"	52,000	158,000	227,000
" 14 " "	10,000	3,600	3,300	5,200
" 15 "	900	3,000	4 200	2 600
Average	5,450	27,150	72,870	143,800

Percentage of difference between lowest and highest average, 2,538 per cent.

These laboratories were all understood to be using the standard methods.

Again samples were taken and given to the laboratories without their knowing that they were being checked. The results were:

Kind of Milk	*Counts as Reported by Laboratories*		
	No. 1	*No. 2*	*No. 3*
No. 1 Raw Milk	140.000	490 000	39 200,000
" 2 " "	80,000	445,000	56,000,000
" 3 " "	140,000	200,000	3,700,000
" 4 " "	.....	295,000	9,100,000
Average	153,000	357,500	27,000 000

Percentage of difference between lowest and highest average, 17,547 per cent.

Kind of Milk	*Counts as Reported by Laboratories*		
	No. 1	*No. 2*	*No. 3*
No. 5 Pasteurized Milk	6 000	3 000	10.000
" 6 " "	9,000	2,000	6,400
" 7 " "	9.000	2 500	12 000
" 8 " "	4,500	4,500	5,300
" 9 " "	.....	27,000	2,060,000
" 10 " "	.....	2,000	10 000
" 11 " "	6,000	26,000	326,000
" 12 " "	9,000	25,000	442,000
" 13 " "	9,000	22,000	812 000
" 14 " "	4,500	20,000	160 000
Average	7,125	13,400	384,270

Percentage of difference between lowest and highest counts, 5,294 per cent.

Workers from all these laboratories then met at the Department of Health laboratory and discussed and compared

methods. After this they agreed to make further tests. Again samples were taken and this time they were not in duplicate, but workers from all laboratories met at the Department of Health laboratory and all worked on the same samples, a routine of work being agreed upon which would assure accuracy in so far as possible. All plates were incubated in the same oven, and at the end of 48 hours the workers met and counted their plates. Here are the results:

Kind of Milk	*Counts as Reported by Laboratories*			
	No. 1	*No. 2*	*No. 3*	*No. 4*
No. 1 Raw Milk	1,000,000	1,650,000	670,000	826,000
" 2 " "	3,260,000	3,700,000	640,000	4,860,000
" 3 " "	4,240,000	2,750,000	2,240 000	4,880,000
" 4 Raw—all taken	1,000,000	1 900,000	810,000	4,060,000
" 5 from same can	1 200,000	1 150,000	1,220,000	1,856,000
" 6 As nearly du-	640 000	1,600,000	760,000	1,765 000
" 6 plicates as possible.	1,280,000	1,050,000	1,600,000	1,638,000
Average	1,802,800	1,971,400	1,134,400	2,640,700

Percentage of difference between lowest and highest counts, 132 per cent.

Kind of Milk	*Counts as Reported by Laboratories*			
	No. 1	*No. 2*	*No. 3*	*No. 4*
No. 12 Pasteurized Milk	9,300	25,000	13,000	24,500
" 13 " "	48,000	52,000	Mishap	37,400
" 14 " "	41,900	50,400	"	43,000
" 15 " "	52,200	30,000	38 000	51,200
" 16 " "	48,000	23 000	Mishap	60,000
Average	39,880	36,080	25,500	43,220

Percentage of difference between lowest and highest counts, 69 per cent.

This is better, you see, than was the case when the samples were previously taken, but it is still far from exact, even under these most favorable conditions.

After this I again took samples, unknown to the laboratories, and submitted to them. Results were as follows:

Kind of Milk	*Counts as Reported by Laboratories*				
	No. 1	*No. 2*	*No. 3*	*No. 4*	*No. 5*
No. 1 Raw Milk	650,000	1,940,000	650,000	20,000,000	1,300,000
" 2 Duplicate	500,000	1,965,000	890,000	6,100,000	1,240,000
" 3 Raw Milk	4,800,000	1,590,000	9,100,000	1,590,000	4,750,000
" 4 Duplicate	6,000,000	4,600,000	9,900,000	950,000	4,900,000
" 5 Raw Milk	8,000,000	5,700,000	25,000,000	.....	18,000,000
" 6 Duplicate	6,000,000	4,450,000	19,000,000	14,200,000	18,000,000
" 7 Raw Milk	3,000,000	4,000,000	13,000,000	14,200,000	2,200,000
" 8 Duplicate	2,000,000	1,240,000	18,000,000	11,000,000	2,800,000
Average	3,868,750	3,173,120	11,942,200	8,400,000	6,523,700

Percentage of difference between lowest and highest average, 276 per cent.

Percentage of difference between lowest and highest individual counts (No. 1), 2,977 per cent.

Kind of Milk	*Counts as Reported by Laboratories*				
	No. 1	*No. 2*	*No. 3*	*No. 4*	*No. 5*
No. 13 Pasteurized Cream	.....	Spilled	28,000,000	360,000	1,500,000
" 14 Duplicate	.....	1,600,000	31,000,000	560,000	1,350,000
" 15 Grade A Raw	210,000	8,000,000	212,000	1,600,000	339,000
" 16 Duplicate	250,000	.....	264,000	850,000	176,000

Do you wonder that I felt a slight earthquake under my faith in the ideal that milk bacteriology was an exact science?

Now what is the conclusion to be drawn? Is it that all bacteria work should be abandoned? No, by no means. It has been recognized by some public officials that bacterial standards can be no longer worshipped. But what happens in some cases is this. Milk dealers whose milk is repeatedly found to have a high bacterial count are notified of the fact and are told that inspections will be made to determine if Department of Health regulations are being complied with. And in some cases, when the inspections are actually made, it is found that a floor is badly worn, or that there are walls which need painting or that windows need screens, and forthwith the dealer is notified that his milk is excluded from sale. The rules, you see, are not being fully complied with. Please do not think that this is an exaggeration, or that I am trying to be sarcastic. I am stating facts.

Now it is all right to make these inspections, and it is all right to insist that the dealer shall comply with the rules which the authorities have established. But I consider that no inspector or public Department has any right to use the violation of minor rules as a cloak to cover the real reasons for exclusions, when the real reason is that the counts are higher than the standards which have been adopted. They should either exclude on the count alone, or else find the real cause for the unsatisfactory counts and if they are not corrected, then exclude the milk.

Now while it is manifestly unwise to take legal action or to exercise the police power when arbitrary standards for bacterial contents of foods are exceeded, there can be no question that laboratory examinations are of great value in directing attention to possible wrong methods in the handling of such foods. When carefully and consistently made, such tests are exceedingly helpful, both to the public officials and also to the dealers themselves. By wisely using them improper and sometimes dangerous conditions may be discovered and changed. They should not, however, take the place of sane inspections, nor of the giving of intelligent advice for the correction of faults.

Probably the help which is most reliable in tracing bad conditions is obtained when all the workers connected with the taking and testing are the same at all times. That is to say, when a series of tests is made on the milk, we will say, from a certain creamery the results are more comparable if the same person takes the samples at all times, using a routine which does not vary, and the same laboratory worker examines the samples than is the case if the workers are changed from time to time. In large health department laboratories such an arrangement is difficult to secure. In laboratories conducted or employed by the dealers themselves more uniformity can be secured.

If we begin by swearing *by* our standard bacterial counts, we will end by swearing *at* them, for if we hitch the vehicle

of our public control to these alone and do not keep a firm, intelligent hold on the guiding reins, or the steering wheel, we are likely to land in the ditch.

It may be difficult to make a change in the attitude of the public authorities whom you represent, for it is almost an axiom that laws are sometimes amended, but seldom repealed. We are all of us inclined to bow down to authority, whether in religion, in politics, or in the line of official duty, and when an authority has once been accepted it is hard to alter the state of mind in which we find ourselves. I am convinced, however, that a radical change is needed in the outlook which government officials have upon the value of so-called bacterial standards. They should be guides to investigations, but they should not be fiats which shall dictate final action.

"Quarrels would not last long if the fault was only on one side."

THE ORIGIN, HISTORY AND DEVELOPMENT OF THE AYRSHIRE CATTLE

MR. J. G. WATSON, *Secretary,* Ayrshire Breeders' Association, Brandon, Vt.

This program has been designed with the idea that we may present to you something of the development of the Ayrshire breed of cattle. We do not claim that the Ayrshire is the best breed of cattle, although some small breeder in his exuberance for his own particular animals and his breed may claim that. There is a place for every breed of cattle on the American continent today. Our breed, in common with all other breeds, is striving at the present time to develop more good cattle and fewer of the inferior kind.

The Ayrshire breed of cattle is a breed that has been bred for some three or four hundred years, and it is practically the result of man's development and man's ingenuity. The breed is native of the southwest county of Ayr, a very rough, hilly country, rising from the sea level to a height of about 2,000 feet. The climate is damp, and with the pasturage, although rich in the valleys, extremely poor on the mountains, it was necessary to breed in that particular community cattle that could rustle for themselves. The Scotchman, with his ingenuity for breeding all kinds of live stock, took the native cattle, and by cross-breeding and mating with imported stock, was able within a few years to develop a strain of cattle that is today, from a standpoint of breed type, unexcelled by any other class of stock on the market, and that refers not only to dairy breeds, but it refers to beef breeds as well. Any man who has studied breeding of dairy cattle realizes and admits that there is no breed of cattle today that breeds nearer to type, year in and year out, one generation after another, than does the Ayrshire breed of cattle.

As you go through our barns and view the stock, I think the first thing that will impress you is the fact that every one of these individual animals carries that uniformity of type all the way through. The cattle are from practically the same origin as the Shorthorn, although the Shorthorn was developed for beef production, whereas the Ayrshire was developed, and is today, a specialized dairy animal.

Unfortunately, in the early history of importation from Scotland we brought into this country a class of animals that were not representative of the Ayrshire breed. We had two types at that time, one used exclusively for show purposes. They were not bred for milk purposes at all. They were bred simply to come in and have a nice udder at the time of the show, and as soon as the show was finished they were dried up.

On the other hand, we had a great big, strong type that weighed in the neighborhood of between fourteen and sixteen hundred pounds, that was used entirely as a commercial cow, and although not so stylish in appearance, possessed nice udders and teats.

Our Americans were naturally attracted in the show yard to these stylish-looking animals with short teats, and as a result, they were brought over here and they were palmed off on the American public as the type of Ayrshire cow that was popular at that time.

Fortunately the breeders in the United States soon realized the difference, and within the last fifteen years an entirely different type of Ayrshire cow is found, not only on the American farm, but on the Scotch farm as well. When you hear the Ayrshire breed criticised for being a short-teated breed, bear in mind the critic is living in a past age. We can take you through farms here in our Eastern country where the breed is predominant at the present time, and show you much more uniform udders and teats on

the Ayrshire cows than you can find on any other dairy breed today.

What do you see in the Ayrshire cow to make her popular with the Ayrshire farmer? We have a number of things. I mentioned first of all the fact that we have a uniform breed type, and that is one thing that is pleasing to any breeder of stock. Every breeder wants to see something come along that is just a little bit better than the previous generation. Take a rope and put it on the top of the head of the Ayrshire cow, and come then to the tail, and you have a line that is almost perfect. Very seldom do you find a drooping Ayrshire, or an Ayrshire with a low back. The breeders have developed that straight body line, and along with that we have developed one of the most perfect types that you can find in any breed of cattle.

These are the two main things in the breed, great constitution and capacity, things that were necessary on the mountainous, hilly sections of Scotland. They had to be strong to stand the rigors of the Atlantic storms which blow right across that expanse up to an altitude of 2,000 feet. They are not housed as our cattle here in the United States are. For nine months of the year they roam those hills of Scotland, and for probably eight weeks they are in the barns, but have to rough it. We have a Scotchman over here to judge our dairy cattle. In conversation with him he told me yesterday he has a herd of 300 dairy cows that for nine months and a half receive nothing but what they can pick up in these mountains, all of them producing uniformly a little over ten thousand pounds of milk per year.

Ayrshires are uniform producers. We don't care whether Ayrshire cows ever make a world record, but what we do want is a breed of cattle which, on the American farm, will bring the farmer a good, uniform production, not for one year, but for a series of years; and, gentle-

men, there is no living cow on the American farm today that will outlive the Ayrshire breed. We have probably more cows between the ages of ten and twenty than any other dairy breed in the nation. It might interest you to know that just this last April we had a cow finishing a test under the supervision of our agricultural college at the age of twenty-one years, that produced 11,138 pounds of milk, and had produced nineteen living calves in that time. That is the class of stock we are trying to develop in the Ayrshire breed. We have in our breed the only cow that has eleven consecutive annual records, and that is the record average, over 11,000 pounds each year. Not a world's record by any means, but a wonderful record for uniform production and production for a long period of years.

The Ayrshires are slower in maturing. You take the other breeds of cattle; the Jersey comes much sooner to maturity; the Guernsey comes much sooner to maturity, as does the Holstein. A Holstein, when she is seven or eight years of age, is in her prime, but an Ayrshire is just coming to her full bloom when between ten and eleven years of age. Practically all of our big records in Ayrshire breeds have been made by cows after they passed eleven years of age.

That is one thing that should appeal to the dairy farmer and to the breeder, because if a cow comes along and makes a world record of, say, 35 or 40 pounds, and does it when she is seven or eight years old, and she is lost to the breed, which most of our world record cows have been—as a matter of fact there are today mighty few world record cows living.

We have a record of a little over 25,000 pounds by an old white cow in Pennsylvania. She has dropped something like eight or nine living calves, and she is still producing, and looks as if she might produce for a considerable number of years.

We are also trying to produce a little better stock from generation to generation. We have in our breed probably one of the best examples of constructive breeding. We can trace back in this particular family for five straight generations. This family traces back originally to Canada to a cow that was named Sarah. That cow produced a little over 9,000 pounds of milk. Her daughter produced a little over 10,000 pounds of milk. Her daughter, the first cow of the Ayrshire breed to make 20,000 pounds, made it on the rough hills of Vermont, and her daughter again, as a three-year-old, produced a little over 22,000 pounds, and her daughter is a much larger cow, and we are hoping to make a finer and better record with her.

From the product standpoint there are a number of things to comment on. In the first place, from a cheese standpoint, we are willing to put the Ayrshire cow against any other breed, and we can do that by taking you to the records of every big cheese show that has been held in the world, and show you that the cheese made from the Ayrshire product almost invariably has won first and grand championship. At the recent show held in New England, only two months past, the first, second, third and fourth prizes were given to cheese that was made from milk of Ayrshire cows. At the greatest cheese show in Europe, for the last ten or fifteen years, the Ayrshire product has been given first premiums in every one of these events.

Now, you may say we have good cheese makers. Yes, we have good cheese makers, and we have the right kind of milk to make good cheese. The Ayrshire cow today from the milk standpoint produces the ideal milk. Some other breeds are low in butterfat, others high in butterfat, but we claim for the Ayrshire breed of cattle a standard quality of milk to begin with. For the last two years, the records of our advanced registry shows our cows have uniformly produced a little over 11,000 pounds of milk. Why take some other breeds that have to be standardized?

A large percentage of Ayrshires are found in the East, but we are gradually working west and south. In the eastern provinces of Canada the Ayrshire is the predominating breed. We are hoping to get breeders enough so that we will be able to supply the demands of our western States. In the neighborhood of Philadelphia we have approximately 2,000 head of Ayrshire cows, and almost all of the products from these are being used for baby milk in Philadelphia and the adjoining suburbs, and the same thing is true in New Jersey and New York City. The recommendations for Ayrshire milk that we are getting from many physicians are certainly encouraging.

You find Ayrshire cattle today in more countries of the civilized world than any other bovine species that we have, not only here on the American farm, but on the farms of every other country in the world. You find Ayrshire cattle today under more varying conditions and adapting themselves to these conditions more successfully than any other breed of cattle. You know the conditions that we have in Quebec, the coldest spot on the North American continent. The Ayrshire are the predominating breed in that section. In hottest South Africa, where the conditions are almost tropical, we find the breed of cattle doing the best in that section are the Ayrshire cows.

I have simply tried to outline, in a short, hurried way, some of the outstanding points in our breed. If you gentlemen at any time need any assistance from our organization, we don't care whether you are Guernsey, Jersey, Holstein or Ayrshire people, we are always willing to lend any moral support we can to you men in your particular line of work. We realize the benefit of the Milk Inspectors' organization. You can do a wonderful lot of good, not only for our breed, but for all breeds, and any support that we as an organization can give you, we are only too willing to give.

THE ORIGIN, HISTORY AND DEVELOPMENT OF THE GUERNSEY CATTLE

PROF. WM. H. CALDWELL, *Secretary*, American Guernsey Cattle Club, Peterboro, N. H.

It is a pleasure to represent the American Guernsey Cattle Club here this morning, to say in our humble way anything we can that may be of interest to you in connection with the Guernsey cow.

Manager Hallgood, some third of a century ago, said to a number of us in a class room that he believed to know a breed of dairy cattle was to know what had contributed to its origin and foundation, what the surroundings under which the breed had then developed had contributed to it, and finally, what was the result and what the breed was specially adapted to do.

It is a very interesting thing to run back in history and see what conditions contributed toward the settlement of the Channel Islands. Fate might have been different if they had not been located as they were, protected by those bits of sea that are lashing in fury around their shores. Those peasants that were persecuted in England and on the Continent sought refuge on those islands, and it is to the sturdy characteristics of those men who were banished from among their neighbors and who took up their abode in these places that we owe much for both the Jersey and the Guernsey breeds and for their characteristics of today.

Naturally those islands, being a little closer to the French coast, got fully as much of the influence as the two predominant breeds in France, the little dark Brittany and the larger red Normandy, and I think it is safe to say that the preponderance of blood that laid the foundation for these two breeds, the Jersey and the Guernsey, came from those breeds in France.

There is and always has been a great deal of rivalry between the islands. Jersey never forgave Guernsey for being a little nearer to the London market, and Guernsey has always pointed with pride to the fact that she was never conquered. It seems that the preponderance of blood on the island of Jersey must have come from the Brittany breed, while on the island of Guernsey the more open, the larger sized, the red and white cow, from the Normandy breed, seems to have predominated. The fact, however, exists that early in the 18th century they determined to shut the door from importation of foreign blood to their island, and later even stopped the interchange of animals from one island to the other.

When I was on the island in 1896 I took particular pains on Jersey to observe animals that the islanders considered were more representative of the early type on the island. I wish I had the picture of some animals that I took at that time here to show you to compare with pictures that were taken of the Guernsey island cows. There is very little difference between the two. However, I will say in that connection that the black points predominated more than the light points.

Undoubtedly the divergence came when the Jersey islanders sought to give to the English gentlemen a cow that would grace their lawns, and a family cow; and they did their work very cleverly. They created in the Jersey breed a class of cow that we are all very willing to say has been a rich reward for their work. Fortunately for us, the Guernsey men, the islanders had faith in the old-time yellow and white cow, the farmer's cow. Little attention was paid to inbreeding or to line breeding. They drifted along on the island. It was simply a question of producing a class of milk, and particularly a grade of butter, that would find favor in the London market.

We come from Guernsey over to England, and we find, in the earliest years before the organized effort of the Eng-

lish Guernsey Cattle Society, that on many of the English estates you would find a cow or two tethered, a cow or two that had come from the island of Guernsey. You know that next to the Englishman's heart are the shorthorn or heavy breeds. When asking why they are there, we will hear something like this: "Oh, those cows are kept because the owner wishes that grade of milk for his family use; the natural color, the accompanying flavor that is with that grade of milk, are what he desires for his personal use."

We find that even in this country the early introduction of Guernseys was much along the same line; quite different as compared with the Jersey breed. There was very little speculative effort in the introduction of the Guernseys in the earlier stages of the market. Mr. Carbon, one of our past presidents, visited the Islands in 1870. I think that was the last year that there was a fair, that is, of intercommunication between the islands, and he was present on the island of Jersey when some Guernsey cows were being exhibited at the fair. He was so impressed with them and their products that he went over to Guernsey and made a study of the breed and brought home to his place near Boston a few head. He could not make his friends around Boston believe that the butter and milk and cream that came from those cows did not have artificial coloring. He invited his friends out to his place and made an exhibition to prove to them that the color of the product was natural. The result was that they asked him to return to Guernsey and bring an importation, which he did the following year, and that laid the foundation of the herds for several wealthy families around Boston.

In Philadelphia some Guernseys had been introduced prior to that date, and they were brought over by some importers of other cattle. Gradually from that little beginning, and with the growing realization of the quality of the product of the Guernsey, there has been the steady

growth of the breed. Ten years later, when some gentlemen got together and established the American Guernsey Cattle Club, there were in this country but a very few hundred head of Guernseys. When I took hold of the cattle club work 27 years ago we had but 11,000 animals recorded in the book. Today we have practically 200,000. We have doubled the register in the last six years. We have imported more cattle than almost any other of the dairy breeds within the last few years. We feel that the characteristics of the Guernsey, based on what they have inherited from these Brittany and Normandy foundations, and their later development by Guernsey Islanders working for superior quality result in a cow designed specifically for the production of a good quantity of the highest grade of dairy products. There is no breed that is producing, as shown by the A. R. work, that will give as much milk and of as high a grade as will the Guernsey; but the one great feature in addition to all this is that wherever there has been an impartial competition by breeds, we have been able to produce this grade of milk at the least cost and to return the greatest income for a dollar invested in food.

The first real public exhibition of the Guernseys occurred in connection with the New York experiment station in 1888, and the fact was brought out in that trial. Next we come to 1893, the World's Fair test, where amid conditions that were absolutely prejudicial to our best work we succeeded in making butter at the least cost per pound, and in having a butter that would have scored the highest in the market had it been allowed to be scored on its merits; but the unfortunate ruling in that test, where the superintendents were allowed to use coloring matter, robbed us of what we might have had in our favor. The result was that we averaged just under 95; the Jersey averaged just over 95, less than half a point difference in our average score for the entire year. So great was the injustice that the committee of scorers asked, after a few weeks, that

the question of scoring on butter be eliminated, for they said that our butter would have sold in the uptown market for much better than the butter from the other two breeds, and yet we were not allowed to benefit from it.

Next we come to the Pan-American test, the only test that has ever been made where all dairy products were pitted together on an equality, and where their real management was in the hands of a disinterested party, and there the Guernseys took the awards on butter and cream production. This has led up to the establishment of our advanced register.

Now we have something like 2,400 cows under test. We have practically 10,000 records that are averaging very close to 9,000 pounds of milk and 50 pounds of butterfat.

We have now a cow which we are expecting and hoping will prove our topnotch cow. She has 162 pounds more of fat to make in the last two months of her record, and we are very much in hopes she will do it and pass the 1,100-pound mark.

Within the last few years at the dairy shows, in connection with the exhibit of milk and cream, we find that almost 50 per cent of the exhibits that have won the first prize have been products of the Guernsey full bloods or their grades. Last year Guernsey milk was shipped 2,000 miles to the National Dairy Show, and came in here and was scored by the Department of Agriculture as the only perfect milk that had ever been exhibited. At Portland, Oregon, at the exhibition there, the Guernsey milk won the first place. We have never had any difficulty in getting high awards on butter. A story is told of an American breeder who had exhibited several years and had received the first place. At the next exhibition the judge marked his product in second place. After the scoring was over, the breeder went up to him and said, "Why was it that I fell down this year? It is the butter that I have exhibited here for the last few years and you have given me first

place." The judge said, "I thought I recognized that butter; I thought it was your butter. But," he said, "you made the mistake this year of using just a little bit too much coloring." The breeder said, "I know it, Judge; I have talked to the cows just the best I could, but I can't help it, they will do it."

Recently at the Los Angeles fair, a prize was offered of a $150 cup to the best cow of any breed that would score on her individual excellence and the excellence of her products, and it was won by a Guernsey cow with a score of 99 and a fraction.

Now, friends, we are pinning our faith on the yellow and white cow, the Guernsey cow, because we believe she makes possible the most economical production of the highest grades of dairy products. We only hope that through some system of educating the public and of inspection of the products the time will come when the public will buy milk as it should buy it—that is, according to its food value.

"The Guernsey cow is the cow for me
For my bucket she always fills.
Her milk so rich and her cream so fine
Are the products that pay my bills."

REPORT OF COMMITTEE ON FOOD VALUE OF MILK.

GEORGE B. TAYLOR, *Chairman*

Leaving out of the question the purely commercial aspect of the campaign to promote the increased use of milk and milk products, there are four agencies which are capable of exerting great influence in bringing before the public the value of milk as a food. These are:

1. The National Dairy Council.
2. The United States Department of Agriculture.
3. The State agricultural colleges.
4. City and State health departments.

The report of the Committee on the Food Value of Milk to this Association for 1919 dealt principally with the plans, opinions, and work done by the agricultural colleges to bring before the public the food value of milk. This year's report is to a certain extent a continuation of the 1919 report, taking into consideration, however, the three other agencies.

1.

The following letter was sent to health officers of 100 representative cities in 48 States:

"The value of milk as a food is realized more perhaps by physicians and health officers than by any other profession or class of people. Until lately, however, the importance of this subject has not been generally considered. An effort is now being made to bring to the attention of all persons the facts regarding the food value of milk.

"To gather information along such lines, there was appointed two years ago a committee on the food value of

milk for the International Association of Dairy and Milk Inspectors. The first committee report, published in the proceedings of the association for 1919, showed what was being done by dairy departments of agricultural colleges to bring before the people the value of milk as a food.

"We now desire to obtain information along similar lines from health departments of 100 representative cities and shall appreciate very much your prompt consideration of this request. It is realized, of course, that the word 'milk' as here used means that which is reasonably safe, clean and pure.

"1. Do you regard it as a proper function of health departments to bring before their communities the value of milk as a food?

"2. Is your department doing any active work to educate consumers along such lines?

"3. Will you give us a short synopsis of any work your department is doing along such lines?

"4. Have you any suggestions or plans which health departments could use in conducting propaganda to encourage the more general use of milk?

"There is enclosed for your reply a self-addressed stamped envelope."

Replies were received from health departments of 43 cities in 25 States and the District of Columbia. Comprehensive answers were received from the health departments of such cities as Boston, Chicago, Cincinnati, New York, Cleveland, Detroit, Buffalo, Los Angeles, San Francisco, St. Louis and Washington.

To the first question, "Do you regard it as a proper function of health departments to bring before their communities the value of milk as a food?" 38 out of 43, or 88 per cent, replied in the affirmative. Three health officers were of the opinion that such duties did not devolve upon them, and two were non-committal.

One of the officials replying in the negative stated: "I

do not regard it as a proper function of the health department to advertise the value of milk as a food; that can be amply attended to by the commercial interests connected with the sale of milk.

"The work of a health department in my opinion consists in maintaining a fair standard of quality in the milk sold, and of placing its findings before the public in such a way that they may make intelligent choice of a source of milk supply."

On the other hand the reply of Doctor Copeland of New York City seems to sum up the expressions of most of the other health officers:

"I wish to inform you that I do regard it as not only a proper but a necessary function of health departments to make the food value of milk known in their respective communities."

Dr. Woodward of Boston says in part: "I believe that health departments and all other agencies and persons having at heart the welfare of the people should undertake to promote the use of good milk, but I believe also that no movement intended to increase the consumption of milk is expedient unless it is accompanied by some movement in favor of the producer of sound and wholesome milk as compared with those who put out a product that is possibly dangerous and at least of poor quality."

To the second and third questions regarding work being done, only 25 health departments replied in the affirmative. The opinions of health officers as to what constitutes active work along these lines vary considerably. Some state that their inspection service gives information to housewives regarding the quality of their milk supply. Others are encouraging the use of milk through public health nurses in children's clinics, infant welfare stations, and in the home where mal-nutrition is indicated. Others, such as New York City, hold expositions, campaigns and demonstrations and feature baby contests. Some cities

have invited the extension workers of the U. S. Department of Agriculture and have put on short intensive campaigns, putting out posters and literature issued by the National Dairy Council.

Detroit waged a two-months' campaign and not only distributed literature, put up posters and advertised extensively in the newspapers, but staged the play, "Milk Fairies," in school so that the children could appreciate most readily the lesson taught.

Some of the western cities, for example Los Angeles, arouse interest by holding regularly two or three times a year milk contests. The city veterinarian says in conclusion to an interesting description of these contests:

"Our department has taken a position that the advertising of the quality of milk through the contest work and the work of the Municipal Milk Depot have been to date our chief means of presenting to the consumer milk and its value as a food."

San Francisco last year made a survey of all schools in order to determine the amount of milk used by the children.

Question 4 brings out the fact that health officers as a rule are becoming interested in the question to promote the use of milk as a food and are planning work along these lines. Lack of funds and lack of a sufficient supply of the product keep many cities from taking up the question. The health officer of San Francisco says:

"We had intended during this coming year to inaugurate a campaign of providing twice each day a pint of milk without cost to those who might desire this commodity and whom we could induce to take the same, but because of the increased cost of milk and lack of appropriation sufficient to cover other needs of our department, it was impossible to continue with the plan. However I feel that if this could have been carried out it would have done more to educate the people in the use of milk as a food than any

other propaganda that we could have undertaken. The procedure would have been to furnish children under height and weight for their age at least one quart of milk each day and at the end of a definite period re-measure and re-weigh to determine results obtained by the food thus given and bring home to the parents, not only of this group of children, but to others in the schools, the results obtained, hoping thereby to convince them of the need for increased consumption of the product."

Returning again to the letter sent out to health officers of 100 representative cities, to which 43 replied, we must conclude that the other 57 departments are either indifferent, not interested, or are opposed to bringing up the subject of the food value of milk. From the list of cities answering the questionnaire we believe that the most active health departments are very much interested in the subject of the food value of milk and are planning ways to bring its importance before the public.

We believe emphatically, however, that no campaign to increase the use of milk should be undertaken in any city in which the supply is not reasonably safe, clean and pure.

2.

The plans and work of the National Dairy Council are best expressed in a small leaflet which they have distributed to those interested in milk and its products:

"The National Dairy Council is purely an educational organization of and for the dairy industry.

"Its purpose is to encourage the production, stimulate the manufacture and increase the consumption of milk and its products by

"(1) Conducting municipal, state and national milk and dairy products campaigns.

"(2) By preparing and distributing educational literature and posters which will increase both production and consumption of milk and its products.

"The National Dairy Council now has ready for your use colored hangers, plain and colored posters, illustrated booklets, envelope inserts, newspaper advertisements, picture show slides, showing by printed facts and colored picture display the real food value of milk and its products.

"Why not begin now and use this valuable material? It will build your business and help us develop this vital industry and serve mankind."

Up to this time most of the work of the National Dairy Council has been confined to the distribution of leaflets, booklets, and posters. Following is a list of posters, booklets and leaflets which are available for distribution:

Posters:

"Spend Your Money Wisely." (Comparative costs.) "Population Increase vs. Increase in Dairy Cows in the United States." (1914-1918.) "Use More Ice Cream." (Colored poster with comparative food values.) "The Dairy Cow versus Other Food Producing Animals." (Comparative edible solids.) "Food Comparisons." "Use More Butter." (Colored poster with comparative food values.) "Use More Milk." (Colored poster with comparative food values.) "Use More Cheese." (Colored poster with comparative food values.) "Ice Cream a Nutritious Food." (Colored.) "The Magic of Milk." (Colored.) "The Greatest Nation Must Be Built On These." (Colored.)

Booklets:

"Food Facts." "Milk the Necessary Food for Growth and Health." "The Milk Way Is the Health Way." "One Hundred Thirty Two Recipes for Preparing Delicious Dairy Dishes and Milk Drinks."

Press series:

A series of prepared advertisements for newspaper advertising, as follows:

"Liberal Use of Milk the Children's Need." "At Least a Quart of Milk Per Day Per Child." "The Milk Way Is

the Health Way." "Mothers, Which Will You Have?" "Milk Makes Mentality." "After the Movies, Milk." "The Food of All Ages—Milk." "Milk Time Is Health Time." "Use Milk First." "Use More Ice Cream."

Inserts: Small copies in colors of the large posters.

3.

The United States Department of Agriculture through its Dairy Division began during the war, in cooperation with the U. S. Food Administration, systematic work to promote the more liberal use of dairy products. This work is still continuing and remarkable results seem to have been achieved. Health Officer Letter No. 40, entitled "Milk Campaigns," says in part:

"The Dairy Division of the U. S. Department of Agriculture is cooperating in such campaigns, and the results so far have been remarkable. Experts of the Division cooperate with the extension departments of the State agricultural colleges in organizing the work and securing the aid of local boards of health, boards of education, chambers of commerce, welfare societies and similar bodies. The work consists of child feeding demonstrations, lectures, published material, etc. Special work is done in schools, homes and factories.

"About 35 campaigns have so far been conducted in this manner, covering the country from Boston to Seattle. Cities having an aggregate population of over 5,000,000 have had milk campaigns lasting from one to two weeks. Careful reports show that these cities have increased their milk consumption about 16 per cent since the beginning of the campaigns. The record city had a 50 per cent increase."

The above figures were for the year 1919. Reports of work in 5 cities during the spring of 1920 show an average increased consumption of 19 per cent.

A six-page mimeographed booklet, entitled "Detailed Plan of Urban Milk Campaign," has just been issued. Miss Jessie M. Hoover, Milk Utilization Specialist, Dairy Division, gives the following two conditions which determine the need for a milk campaign:

"1. A condition of undernourishment among growing children as shown by the weighing and measuring tests made by authorized persons or organizations.

"2. A surplus of market milk occasioned by the seasonal aspects of the dairy industry or an otherwise abundant supply, to meet an increased demand for milk."

This booklet goes into very complete detail regarding the ways to plan and conduct milk campaigns.

The following paragraph taken from Miss Hoover's plan should be of interest to this Association:

"The Board of Health should be consulted before the general committee is called to be sure that the milk supply is clean and satisfactory and that their cooperation is available."

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.

"Time wasted is Existence; used is Life."

REPORT OF COMMITTEE ON DAIRY METHODS

PROF. T. J. MCINERNEY, *Chairman*

This report on Dairy Methods has been subdivided as follows: (a) Sterilization of Utensils; (b) Cooling of Milk; (c) Cleanliness of Buildings and Surroundings; (d) Care of Cattle.

For several years milk inspection for the city of Ithaca, N. Y., has been carried on by some member of the Dairy Department at Cornell University. A large amount of data has been collected during that time which has never been published.

STERILIZATION OF UTENSILS

The following table shows the effect of properly scalding the milk pails and coolers as compared to rinsing them with cold water.

Experiment I.			*Experiment II.*		
Date	*Bacteria per c. c.*		*Date*	*Bacteria per c. c.*	
	(a) Utensils scalded	(b) Utensils not scalded		(a) Utensils scalded	(b) Utensils not scalded
11/1	2,000	98,000	11/1	2 000	95,000
1/20	2,500	141,000	11/10	4,000	2,250,000
1/30	6 000	4,697,000	11/18	2,125	91,500
3/14	19,000	54,000	11/25	1,500	1,500,000
3/28	50,000	5,400,000	12/2	32 000	93 000
4/11	2,500	600,000	12/16	16 000	200,000
4/20	3,000	680,000	1/6	6,250	170,000
5/18	3,500	172,500	1/20	26 000	260,000
5/25	7 000	965,000	1/30	12,500	241,000
6/1	6,000	6,750 000	3/7	21,000	1,430 000
6/9	23,000	1,600 000	3/14	6 000	300,000
6/18	9,500	1 200,000	3/28	2,500	72,500
6/26	9,000	600,000	5/28	19,000	495,000
			6/1	49 500	181,000
			6/9	13 000	600,000
			6/18	19,000	1,500,000
			6/26	17,500	600,000

In Experiment I, Farmer A and Farmer B lived about one mile apart on the same road and sold their milk to a dealer in the city of Ithaca. On inspecting the dairies it

was found that Farmer B had a milk house about an eighth of a mile from the house. He thought it was too far to carry the milk pails to the house or to carry hot water to the milk house. Because of this the milk pails were washed in cold well water after each milking.

Farmer A washed and scalded all the dairy utensils after each milking. The bacteria counts from the same dairies on the same day show the effect of the different operations.

In Experiment II we have another similar case. Farmer A washed and scalded all his dairy utensils after each milking. Farmer B used an aerator which he washed with cold water only. On inspecting this dairy the cooler was standing on a bench in the barnyard. The seams and crevices were filled with old and dried milk, which was an excellent breeding place for bacteria. This was no doubt the reason why the milk from this dairy had such a high bacteria count.

CLEANLINESS OF BUILDINGS AND SURROUNDINGS

At the time the milk inspection began, according to the following table, there were 98 farmers producing milk for the city of Ithaca. Of these 98 producers, 31 were provided with milk houses, 4 used the small-top or covered milk pail, and one used a damp cloth on the cow's udder just before milking. After 7 years, there were 124 farms producing milk for Ithaca. Sixty-two of these farms were provided with milk houses, 60 of them used the small-top or covered milk pail, while 12 used a damp cloth on the cow's udder just before milking. There was the least increase in the use of the damp cloth, although this was the most inexpensive of all.

TABLE I.

Year	1	2	3	4	5	6	7	8
Producers	98	112	116	113	114	113	113	124
Small-top pails	4	24	38	42	45	46	48	60
Milk houses	31	35	45	47	50	51	59	62
Damp cloth	1	3	5	4	3	5	7	12

The reason for great increase of the use of the small-top milk pail from the seventh to the eighth year was due to the fact that one of the large milk companies purchased the small-top pails in a large quantity and sold them to the producers for the cost price, and in some cases they were given to the producers.

Out of the 98 farms that were producing milk for Ithaca in the beginning there are 40 that have continued to do so up to the present time. They have made improvements according to the following table.

TABLE II.

Year	1	2	3	4	5	6	7	8
Producers	40	40	40	40	40	40	40	40
Small-top pails	4	15	20	21	21	21	23	24
Milk houses	19	19	22	24	24	24	25	27
Damp cloth	0	2	2	3	3	3	5	5

Out of the 40 producers there were twelve who not only produced milk, but also retailed it in the city. The following table shows how they have improved their dairies.

TABLE III.

Year	1	2	3	4	5	6	7	8
Producers	12	12	12	12	12	12	12	12
Small-top pails	2	8	9	9	9	9	9	9
Milk houses	8	8	10	10	10	10	10	10
Damp cloth	0	2	2	2	2	3	5	5

This table shows that at the present time 10 of those 12 dealers have a milk house, 9 of them use the small-top or covered milk pail and five of them use the damp cloth on the cow's udder just before milking. It will be noticed in all cases that the greatest improvement was seen after the first year of inspection. There were a great many improvements made during the first two years while in the remaining years the improvements were slow but gradual.

The probable reason why the twelve producers mentioned in Table III made the greatest improvement was that these producers were not only producing milk but

they were also retailing it in the city. While retailing it in the city they came in direct contact with the consumer who could complain to them directly if the milk was not always satisfactory. Then again they met the milk inspector more often and as a result of this more samples of milk were taken and in this way a continuous check was kept on the general cleanliness of the dairy and the methods of handling the milk. The general conclusions drawn would seem to be that by continuously taking samples of the milk as it is being delivered to the producer a close watch can be kept on the general conditions of cleanliness at the dairy.

Table XI shows the average yearly bacteria count of seven dealers who were supplying milk for the city for eight years. In nearly all cases there has been a general decrease in the average bacteria count for all the eight producers each year, the average decrease being 33,000 bacteria per c.c., or a percentage decrease of 71.73 per cent. The table also shows the year and also indicates what improvements were made in the dairy in an effort to produce cleaner milk. There seems to be a general relation between the improvements made and the average bacteria count. In nearly all cases the bacteria count was decreased when certain improvements were made.

TABLE XI.

The small-top milk pail as a factor in reducing the bacteria count.

	Bacteria per c. c. 1st year	*Bacteria per c. c. 2nd year*	*Bacteria per c. c. 3rd year*	*Bacteria per c. c. 4th year*	*Bacteria per c. c. 5th year*	*Bacteria per c. c. 6th year*	*Bacteria per c. c. 7th year*	*Bacteria per c. c. 8th year*	*When pail was used first time for an entire year*
Dealer No. 1	88,950	203,000	17,500	17,500	5,400	4,200	4,500	4,000	3rd year
" " *2*	34,760	34,450	8,000	49,700	144,000	10,500	26,500	50,000	2nd year
" " *3*	56 000	17,800	9,760	9,000	4,000	30,000	5,000	13,800	3rd year
" " *4*	15 500	21,250	16,000	11,000	11,000	11,000	5,500	4,500	3rd year
" " *5*	25,000	5,000	11,500	10,000	10,000	17,000	17,000	4,000	2nd year
" " *6*	20 000	12 000	3,000	10,500	30,000	59,000	5,000	8,000	3rd year
" " *7*	84,000	12,000	149,000	60 000	16 000	11,000	8,000	12,000	4th year
Average	46,000	43,000	32,000	24,000	32 000	20,000	10,000	13,000	

TABLE XII.

An example of how care in the handling of milk kept the number of bacteria low although the dairies did not score high. Average number of bacteria per c. c. per month for one year.

Producer's No.	*Dairy Score Equipment + Methods = Total Score.*	*Jan.*	*Feb.*	*Mar.*	*Apr.*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
1	22.4 + 38.4 = 60.8	27,000	1,000	8,650	2,400	.....	8,000	17,500	34,000	.....	7,000	3,500	1,500
2	20.3 + 37.7 = 58	40,000	8,000	66,000	4,100	.....	2,000	35,000	4,500	5,500	5,000	3,500	3,000
3	20 + 37.8 = 57.8	66,000	.....	7,680	.....	1,500	1,500	5,000	1,000	.....	5,000	7,500	.....
4	18.3 + 35.2 = 53.5	70,000	1,000	42.500	10,000	.....	.....	11,000	1,000	3,000	.....	22,500	2,300

All producers represented in Table XII sold their milk to one man, who in turn retailed the milk in Ithaca. He required that each producer should deliver the milk immediately after milking. He did not require them to cool the milk. When the milk was received at the creamery it was immediately cooled and kept cool. This, in all probability, was why the number of bacteria was so low.

The table also indicates that the milk dealer should have the milk which he furnishes to his consumer under his personal control as much as possible.

SOME RESULTS OF A CLEAN MILK CONTEST

Since the spring of 1913 an annual clean milk contest has been conducted at the University dairy barn under the direct supervision of one of the members of the Dairy Department. The Animal Husbandry Department has cooperated in selecting the cows used in the contest.

The number of students allowed to compete for the prize has been limited to twenty. This is necessary because every contestant is allowed six trials. This means 120 samples to be tested in all and since six samples are secured at a time, there being six cows selected for the contest, it required thirty visits to the dairy by the person in charge.

The Dairy Department furnishes sterilized milking pails and sterilized toweling for the contestants. The small-top milk pails are sterilized in the large steam sterilizer at the dairy building, and the opening is securely covered with clean paper until ready for use. The toweling is sterilized in the autoclave in the bacteriological laboratory and is protected from contamination until ready for use. Each milker is furnished with two sterile towels, one for the final wiping of the cow's udder and the other for wiping his hands just before milking.

Each contestant has one trial at each of the cows furnished. There have been a few exceptions to this rule. The milkers were allowed to spend as much time as they

wished in washing and cleaning the cow before milking. The usual time spent in doing this work was about 15 minutes.

When the cow was properly cleaned the milker put on a clean white suit, wiped his hands with a sterile towel and sat down to the cow with the paper covering still on the pail. The cow's udder was then wiped with the second sterile towel, the paper covering removed from the pail and the cow was milked as rapidly as possible, to reduce as much as possible the time the milk must be exposed to the stable air.

When the cow was completely milked the person in charge of the contest drew about 50 c.c. of the milk directly from the pail with a sterile glass tube and placed it in a sterile glass stoppered bottle. The bottles were iced, taken directly to the laboratory and plated.

CONTEST OF 1914

Table showing the effect of the cow and the milker on the germ content of the milk.

Milkers	*Coreva*	*Flora*	*Zelma*	*Aurora*	*Candida*	*Elora*	*Avg.*
1	58	1,135	95	235	487	343	393
2	23	2,413	8	40	5	353	474
3	25	1,128	35	5	650	255	350
4	43	848	28	200	210	728	343
5	13	65	35	80	425	445	177
6	128	1,405	8	1,240	558	280	600
7	25	910	103	530	428	360	396
8	33	445	63	378	20	455	232
9	35	518	58	145	840	385	330
10	3	778	8	150	105	725	295
11	8	830	38	83	278	115	225
12	25	1,100	20	123	415	243	321
13	8	1,285	825	210	150	253	456
14	100	128	33	110	813	495	297
15	10	1 777	115	185	474	288	475
16	113	683	5	50	220	430	250
17	8	2,710	5	273	193	300	581
18	8	900	45	43	205	90	215
19	68	453	5	370	725	1,487	518
Average	38	1,026	80	235	378	422	

CONTEST OF 1915

Table showing the effect of the cow and the milker on the germ content of the milk.

Milkers	*Aurora*	*Elaine*	*Coreva*	*Elora*	*Endora*	*Dewdrop*	*Avg.*
1	100	100	100	2,750	55	385	582
2	75	100	35	3,000	275	1,500	831
3	158	70	110	10,850	3,400	2,218	2,801
4	100	85	40	6,550	200	910	1,314
5	360	380	55	2,700	1,800	2,355	1,275
6	16	200	410	1 390	210	1,200	571
7	10	125	100	5,400	200	570	1,068
8	110	150	50	4,050	1,875	5,400	1,939
9	25	150	10	4 950	210	900	1,048
10	40	40	20	8,000	75	1,473	1,608
11	250	40	40	2,400	225	1,220	696
12	70	90	50	5,042	462	1,750	1,244
13	50	105	20	5,900	100	400	1,096
14	70	105	30	4,200	263	1,550	1,036
15	295	250	160	5,050	6,150	2,400	2 385
16	317	55	10	5,750	375	2,100	1,435
17	315	160	60	12,900	3,155	19,000	5,932
Average	139	130	76	5,346	1,120	2,666	

CONTEST OF 1916

Table showing the effect of the cow and the milker on the germ content of the milk.

Milkers	*Aurora*	*Elora*	*Della*	*Coreva*	*Elf*	*Fidelia*	*Avg.*
1	545	2,950	15	10	270	423	702
2	13	24,000	4	9	132	230	4,064
3	330	19,925	30	11	64	265	3,437
4	29	5 340	25	8	253	1,257	9,162
5	530	5,325	105	20	3,153	52	1,560
6	1,692	28,150	70	19	540	650	5,186
7	112	15,500	49	30	87	365	2,698
8	1,340	40,000	64	20	365	92	6,980
9	530	10 550	235	40	450	125	1,988
10	98	1,493	64	17	150	2,140	660
11	55	19,800	310	86	320	556	3,521
12	86	10,150	36	51	374	9,525	3,370
13	57	4,975	44	160	253	77	927
14	14	31,150	50	30	450	27	5,286
15	29	9,400	47	54	305	1,428	1.877
16	60	143 850	40	25	150	111	24,039
17	130	34,800	84	94	154	126	5,896
18	57	30,400	11	27	445	275	5,202
Average	317	26,992	71	39	439	984	

This data shows the value of the small-top or covered milk pail, the washing of the cow's udder just before milking and the use of properly sterilized utensils. By the proper observance of these rules milk of a very low bacteria count may be produced. This data also shows that it is practically impossible to produce milk free from bacteria. After taking all the above mentioned precautions, no cow at any time produced milk entirely free from bacteria, and in some cases the differences are noteworthy.

Take, for instance, the cow known as Coreva, with an average for each year for the three consecutive years of less than 100 bacteria per c.c., while Elora consistently gave milk having a high count. This data seems to indicate that it may be advisable for certified milk producers to make bacteriological tests of the milk of individual cows and to put out of the herd any cow that produces milk with a high count.

COOLING OF MILK ON THE FARM AND KEEPING IT COOL DURING TRANSIT TO MARKET

It is easy to prevent the souring of milk and cream. A little indispensable equipment and a few rules carefully followed will usually accomplish this purpose.

Full use of the cooling facilities available on each farm will result in a great improvement in the quality of the milk at little if any additional cost. It is well known that no matter how clean and healthy the cows and utensils or how sanitary the methods, milk soon deteriorates in quality if not effectively cooled. If cooling is even delayed, the bacteria will multiply and be present in large numbers even though the milk is eventually cooled to a low temperature. Prompt cooling and storage at low temperatures, then, are the most important factors in preventing souring.

Surface Coolers.

Water at a temperature of 50° Fahrenheit to 60° Fahrenheit is available for cooling milk on most dairy farms.

To cool milk rapidly and economically, a surface cooler should be used. This should be simple, durable and easy to clean and sterilize. Special attention should be given to regulating the flow of milk over the cooler so that milk flows over during the entire time between the beginning and the end of the herd milking. Start milk from each cow over the cooler as soon as drawn. When cold running water is available, the temperature of milk will be promptly lowered from 30 to 35 degrees by the time the milking is completed. Ten to fifteen gallons of water should flow through for each gallon of milk flowing over the cooler. In cooling to 50° Fahrenheit, a surface cooler means the use of one-half as much ice.

Milk Cooling Tanks.

To complete the cooling and keep milk cold, a properly constructed cooling tank is also necessary. The first essential is that such be built so as to prevent, so far as possible, the loss of cooling effect through radiation. The water should be as high on the outside of the cans as the milk is on the inside. Drainage outlets should be provided, the tank kept clean, and the water in it be fresh and pure. The size of the tank depends upon the quantity of milk to be cooled. A tank holding a little more than four gallons of water for each gallon of milk is more efficient than a larger one when ice is used. Under other conditions eight or more gallons of water for each gallon of milk cooled should be provided. Insulated concrete tanks give best results. These are best made with a two-inch layer of cork between a double shell of four-inch concrete. Tanks should in addition be provided with a tight cover and be located in the milk house.

Spring Water for Cooling.

Spring water, if conveyed any distance through a pipe, is seldom cold enough to cool milk promptly to 50° Fahrenheit during hot weather. When the dairy house cannot be

located at a spring such water should be carried to the cooling tank in a pipe laid several feet underground. Spring water is seldom as cold as it is thought to be. Spring waters "colder than ice" frequently have a temperature as high as 65° Fahrenheit. Use an accurate thermometer in determining the temperature of water used in cooling milk.

Keeping Milk Cold During Shipment.

To make sure that milk reaches the city in good condition, it should not only be promptly cooled to 50° Fahrenheit or below on the farms, but must in addition be protected during shipment. Jackets around the cans are excellent for this purpose.

Directions for Cooling and Shipping Milk at Low Temperatures.

1. See that the cooling tank water is 40° Fahrenheit or lower before starting to milk. If the milk is surface cooled with water at 55° Fahrenheit or below, see that there are two pounds of ice in the tank for every gallon of milk to be stored.

2. Turn on the water running through the surface cooler. Ten to fifteen gallons of water should pass through the cooler for each gallon of milk passing over.

3. Pour milk over the cooler as soon as drawn from the cow and so adjust the faucet that milk passes over in a continuous stream during the entire period of milking.

4. As each can is filled with milk from the surface cooler, set it immediately into the cooling tank. The cold water should always be as high on the outside of the cans as the milk is on the inside.

5. Keep cans in the storage tank until ready to ship. During hauling protect with a blanket or with felt jackets.

6. Never guess temperatures; use a thermometer. Eighty-five per cent of the milk and cream sold from farms in this country is produced in sections where natural ice can be had for the harvesting. Ten gallons of spoiled milk cost more than one-half ton of such ice.

THE STANDARD OF OUR MILK PRODUCTS

PROF. M. MORTENSEN, *President,* American Dairy Science Association, Ames, Iowa.

You as dairy and milk inspectors are interested in standards. Judging from the subjects discussed at this meeting you are interested in milk standards in particular, but you are evidently also vitally interested in standards for all dairy products.

To an inspector the term "standard" will naturally suggest a legal standard, while to the instructor it will possibly more often suggest what we might term a quality standard. The legal standard and the quality standard are not entirely distinct terms. The legal standard is to a certain extent also a quality standard inasmuch as it defines the fat content of dairy products, wholesomeness of milk and milk products, etc., but it does not concern itself with the flavors or the delicacy of the products. This, however, is a standard of importance. You may call it a market standard but it is the standard which immediately suggests itself to consumers. It is a great problem for the manufacturers of dairy products to reach a high quality standard. The legal standards can easily be complied with. The sanitary standard is usually complied with in products that are of high quality. I shall not at this time consider the legal standards for dairy products as such are well known to all of you, but I will prefer to make my remarks on the quality standards and on such phases thereof as are not included under any portion of our legal standards.

The American people as a nation are wealthy. Moreover they are liberal spenders and are willing to pay a good price for any product or commodity possessing quality. As an illustration of this we may point to the ice cream industry. Ice cream has been known and used in Europe to a

limited extent for centuries but it has not been commercialized to any great extent. This may be attributed primarily to the fact that the commercial ice cream sold in Europe in generally of an inferior quality. In America the ice cream industry has developed at a tremendous rate because the manufacturers in this country have adopted a high standard for their product. Even a material increase in price has not seemed to reduce the consumption of ice cream to any extent. The manufacturer is wise who is maintaining this high standard. He is providing a better market for the producers of good, clean, sweet cream. He is making available to the consumers a most healthful food product. Moreover, he is, by pleasing his customers, adding considerable to their happiness which should also increase his own happiness and incidentally increase his financial returns. Let not the day come when the standard of that product is reduced. You as inspectors will be most influential in encouraging the maintenance of our present high standard so that the ice cream industry may continue to enjoy that enviable reputation established therefor by our good old pioneers in the ice cream business.

The butter industry is the great dairy industry of our country, but it has been more difficult to maintain a high quality standard there than in any of the other dairy industries. This is a matter with which we are considerably concerned at this time when butter is being imported to the United States from foreign countries, especially from Holland and Denmark. In those countries they are unfamiliar with the difficulties which many of our American buttermakers must face. The milk is being cared for by producers who make dairying their life's work. The milk is delivered to the creameries daily where it is being skimmed and the ripening of the cream is under the buttermaker's control at all times. The system of manufacturing is practically uniform in all of the plants, and nearly all the butter shipped from one entire country is of such

uniform quality that it becomes difficult for the consumers to detect any difference.

We have not reached this degree of perfection with us. Dairying is too much of a sideline. In the best dairy district conditions are as favorable as in the European countries and our butter is there of as high if not of higher quality, but in certain sections where dairying becomes more of a sideline the cream is delivered to the creameries at less frequent intervals. At times the cream may be delivered to the creamery in sweet condition but more often it is sour and frequently overripe and the buttermaker has therefore very little or no control over quality and the butter made is often most inferior and as a rule of very irregular quality.

The annual losses to the American producers on account of poor cream from which is manufactured poor butter amount to many million dollars. Moreover it injures the reputation of the American butter. The consumers are not always receiving what they want from the American dairies and they buy the imported products. These conditions must be changed as neither the consumers, producers, or manufacturers can afford to have them continue. I shall just mention in the following a few of the methods employed by which it has been or may be possible to make some changes which will lead to general improvement.

In some of the states a special state trade-mark has been granted to creameries making butter of a certain quality. Such a state trade-mark has been established in Minnesota, Michigan, and Iowa. In Iowa this trade-mark is controlled by the State Dairy and Food Commissioner and the Dairy Department of the Iowa State College. As the requirements for the use of this trade mark are rather high and butter must score 93 per cent or above, there are only a limited number of creameries that have been able to qualify. Permission has been granted to only eight creameries in Iowa, but it is the standard which must be reached

ly our creameries if we desire to uphold the reputation of the American butter.

For the purpose of gradually bringing our butter up to this high standard a general educational campaign must be conducted among our cream producers and among our creameries. This line of work is being carried on in the state of Iowa under the leadership of Professor Rudnick, who is in charge of dairy extension. This campaign is carried on in different ways. In some of the creameries they conduct cream scoring contests. Creameries entering in these contests will have the cream, delivered by their individual patrons, scored monthly. Professor Rudnick or an assistant will appear at the creamery some certain day each month without the knowledge of the patrons. Each patron is informed in reference to his score and the highest scores are published in the local papers. Monthly premiums are also offered to the highest scores and usually larger premiums are offered to the highest average for every twelve months. At Forest City, Iowa, annual premiums to the amount of about a thousand dollars are offered. The premiums are furnished by the town merchants. These contests have aroused interest in the six creameries where they are being conducted at present. The producers become interested in caring for their cream and as a result the standard of quality in these plants has been raised.

The following score card for scoring the cream is being used:

Flavor	45
Acidity	25
Richness	20
Body and Cleanliness	10
Total	100

These contests are responsible not merely for increasing interest among the cream producers, but the creamery operators are becoming much interested, and had it been pos-

sible for us to secure more assistance in dairy extension we could have carried on this work with many other creameries. Another contest known as the "Cream Improvement Contest" is carried on in Iowa among the creamery operators. This is operated jointly by the dairy extension and the buttermakers' association. A number of premiums are awarded to buttermakers who obtain the highest number of points for the year figured on the following basis:

For every cream cooling tank installed on the farms .....10 points
For every milk house built on the farms.....20 "
For every hand separator removed from an unclean to a clean place.....10 "

Many buttermakers have through this contest become more interested in working for improvements and they have realized very satisfactory results from this work.

We have for the past three or four years made some efforts along the line of forming district associations among the creameries for the purpose of having the products standardized. It has been planned to have enough creameries join together so the total amount of butter manufactured by the association will amount to about five million pounds annually. One-tenth of a cent should be paid per pound of butterfat for the purpose of employing an expert who could introduce uniform methods of manufacture and also possibly assist in marketing the butter. After the butter has been standardized so it is all of high and uniform quality, then it may be profitably advertised, but a product which has not been standardized does not lend itself to advertising.

You dairy inspectors can do much for the advancement of our quality standards. A monthly letter written by the health board of Flint, Michigan, addressed to the milk producers contains a great deal of valuable information and many suggestions which I feel certain the producers appreciate. The inspector has there taken the place of an educator and it appears to me that he will there have a broad

field for doing an endless amount of good work. The problem of quality standards for dairy products is a big one and it requires the efforts and cooperation of all of us. We all agree that there is no time for us to rest or to feel content until we have brought the standards of all our American dairy products up to the point where we can say that our products have no equals.

"Who never wins can rarely lose, who never climbs as rarely falls."

THE KEEPING QUALITY OF MILK AS JUDGED BY A pH METHOD

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The method usually applied in a study of the sanitary condition of dairy products is the bacteriological count. This is determined by the plating method, which gives an approximation of the number of groups of live bacteria present in the sample, or by the microscopic method which gives an approximation of the total number of bacteria, both dead and living, which are present. Either of these methods is a valuable aid to the sanitarian in judging the care which has been exercised in producing the milk, and the precautions observed to prevent the growth of any bacteria present.

The bacterial count tells little or nothing about the actual ability of the bacteria present to produce the changes which would make the dairy product unfit for consumption, and it is often the case that the sample with so high a bacterial count that it would be condemned by most of our city ordinances is actually a good grade of milk when judged as to keeping quality and type of fermentation which develops when held at temperatures common to the home.

To find a method which would give a reading more nearly representing the actual ability of the bacteria and enzymes present to produce the changes of interest to the producer and consumer, Cooledge and Wyant (1) made a study of the ability of bacteria and enzymes present in milk to cause a change in hydrogen ion concentration of an incubated broth solution to which the milk was added.

The object of this paper is to call attention to the value of this method in the hands of the milk inspector, and as a means of classifying milk as to keeping quality, that the

producer delivering an excellent milk may be suitably rewarded and that the poorer grade of milk may be used for purposes not requiring good keeping quality.

The work of Clark and Lubs (2) and a number of other investigators show that the hydrogen ion determination furnishes a delicate means for measuring the reaction of biological solutions and that the same may be determined with a fair degree of accuracy by colorimetric methods.

METHODS

The only medium necessary for classifying milk by the change in pH method is bouillon cube broth containing the indicator Di-brom thymol sulphonephthalein (Brom thymol blue). The broth is adjusted to the neutral point, tubed and sterilized. Large test tubes (¾x6½ in.) are used and 10 c.c. of the broth is placed in each tube.

In making the test 0.1 c.c. of milk to be tested is placed in a tube of the broth-indicator solution and the whole incubated at 37° C. in either an incubator or water bath.

At the end of successive one-hour periods the tubes are inspected and any showing pronounced change in color are placed in the comparator and the amount of change noted by comparing with the standard tubes containing buffer solution of known pH.

STANDARDS

The standards are the buffer solutions described by Clark and Lubs (2). 10 c.c. portions are placed in large test tubes with the same amount of indicator that was placed in each 10 c.c. of the broth solution. In this way the standards will keep for a considerable period if sealed.

The standards may be prepared in any chemical laboratory or may be bought ready for use of Hynson, Wescott and Dunning of Baltimore.

COMPARATORS

Two types of comparators have been designed at this laboratory for convenience in comparing the unknown tubes with the standard tubes. The smaller of these, which is suitable for the laboratory making few tests daily, is supplied with the standard tubes furnished by Hynson, Westcott, and Dunning. The larger comparator, which is necessary if a large number of samples are run, may be obtained from the Central Scientific Company of Chicago.

APPLICATION OF TEST

A method suitable for judging the keeping quality of milk as it is delivered to the city milk plant, creamery, ice cream plant, and condensery has long been needed. Methods which are in use at the present time are faulty in that they do not give a true index of the keeping quality of milk, are subject to considerable error, require a trained technician, are expensive of material and labor, or require too long a time before results are available.

A summary of the results obtained by testing several hundred samples of milk by this method shows that while the average bacterial count checks up quite close with the score based upon rate of change in pH there are many cases in which a high bacterial count does not indicate a sample of milk with poor keeping quality, nor does a low bacterial count always indicate good keeping quality. Samples with counts of 100,000—120,000, and 185,000 bacteria per cubic centimeter were sweet at the end of 24 hours at room temperature, while samples with counts of 11,000-30,000 and 36,000 were sour. This was undoubtedly due to the fact that the former three samples were composed largely of inert or slow-growing bacteria, while the latter three samples contained very active varieties which quickly soured the milk. In the actual practice of grading milk by the bacterial count alone the former three samples might have been

condemned while the latter three with low counts and poor keeping quality would have passed as a very good grade of milk. In this way an injustice is often done when milk is graded upon the bacterial count alone.

SCORING MILK

A method has been adopted whereby each sample is given a score based upon the activity of the bacteria and enzymes present. Samples showing no change due to the action of bacteria at the end of eight hours are given a score of 100, while samples showing activity at the end of one to 8 hours are given scores varying from 20 to 100.

The score based upon the change in pH, while it does not check accurately with the bacterial count, does check with the actual keeping quality of the milk. The samples scoring 75 will be just on the verge of souring at the end of 24 hours if kept at room temperature. The samples scoring better than 75 will be sweet and those scoring under 75 will be sour before the end of 24 hours. It is thus possible to predict from the score the time required for the milk to sour.

By weighing the samples scoring 75 or better on the previous test into a separate vat the milk of excellent keeping quality may be separated from the milk of poor keeping quality, the better grade of milk being used for market milk purposes and the poorer grade for skimming. This plan may be used as a basis for paying a bonus on the better grade of milk. To divide the samples into two grades it would be necessary to make but one pH reading for each sample at the end of eight hours incubation. Milk is dumped into the Grade A or Grade B tank each day, depending upon whether the previous day's score was above or below 75. By means of daily notification of the producer as to his score it is thought that his interest and cooperation might be secured and an increasing percentage of the daily milk brought to a score above 75.

PASTEURIZED MILK

In examining pasteurized milk the "change in pH" method may be applied in the same way that it is applied in examining raw milk but the pasteurized sample should come up to a higher standard, a large percentage of the active organisms having been destroyed by the heating process. Work is under way which will show the value and limitations of this test when applied to pasteurized milk.

CONCLUSIONS

The method described furnishes a simple, accurate, and economical method for measuring the ability of the bacteria and enzymes present in a sample of milk to produce the changes which are of greatest interest to the dairyman.

The results check well with actual keeping quality of the milk.

The method may be used to advantage as a basis for rewarding producers who supply a milk of excellent keeping quality, and to eliminate the milk of poor keeping quality.

If desired the milk may be divided into over ten classes as to keeping quality.

1. Cooledge, L. H. and Wyant, R. W., Journal of Dairy Science, Vol. III, No. 2 (1920) March p. 156.

2. Clark, Wm. M. and Lubs, H. A., Journal of Bacteriology, II (1917) Nos. 1, 2, and 3.

"The desire for knowledge increases ever with the acquisition of it."

PLAN ADOPTED AND RESULTS OBTAINED IN GRADING THE MILK SUPPLY OF RICHMOND, VA.

T. J. STRAUCH, *Chief Dairy Inspector,* Bureau of Health, Richmond, Va.

Richmond, Va., is a city with a population of 171,000 people, using 7,000 gallons of milk daily, or about one-third of a pint per capita. This small consumption per capita is accounted for by the fact that about one-third of the population is colored, this race buying very little milk.

The milk supply of the city is produced on 150 dairy farms, a number of these farms being located within a radius of 12 miles of the center of city. The milk from a large percentage of these farms is delivered to the distributing plants in the city twice daily, the farmer milking at 5 A. M. and 2 P. M.

The milk supply of the city is handled by three distributing plants and two farmers selling their product direct to the consumer.

The first steps taken toward bettering the milk supply was in May, 1907, when stringent regulations regarding the production and handling of milk were adopted by the Board of Health. An inspector was also appointed at this time to make regular inspections of the farms supplying the city with milk and cream. The same antagonism was met as has been encountered in other localities where nothing had ever been attempted in improving the milk supply. It therefore took about three years of hard work before very much was accomplished, and it was not until April, 1913, that conditions were considered on such a satisfactory basis that measures against bovine tuberculosis were attempted.

At the time above mentioned the Board of Health adopt-

ed a rule requiring, after May 13, 1913, that all new shippers of milk must have herds free from tuberculosis as demonstrated by the tuberculin test, and that all cows added to old herds should comply with the same requirement.

A year later, March 30, 1914, the Board of Health took the next step, by adopting a rule that, on and after September 1, 1915, all herds from which milk came into Richmond should be free from tuberculosis as shown by the tuberculin test. In allowing what seemed to us an ample time (seventeen months) from the adoption of this rule until it went into effect, we hoped that the testing would be gradually done, thus avoiding a shortage of milk and also allowing time for the replacing of reacting animals.

Under the rule of April, 1913, a number of herds had been tested. Besides this, a number of herds had been tested by individual dairymen, for their own protection and because they felt they might as well get the testing over and done for.

In all, probably between fifty and sixty herds had been tested. The losses, through reactors, had been quite light except in a few instances. It was therefore confidently believed that tests of the remaining herds would show up in about the same way. When, however, the herds of a small number of dairymen close to Richmond (and it is from these that Richmond gets almost its entire supply of milk) came to be tested, the percentage of reactors was very much higher; in fact several herds were almost completely wiped out.

It seemed almost certain, in the light of these facts, that to insist on general, compulsory tuberculin testing by September 1, 1915, would result in the ruin of a number of dairymen and a great shortage in our milk supply, since experience of the dairymen had clearly shown that dairy cows guaranteed free from tuberculosis, under a three months' clause, were simply not to be had in any considerable numbers.

The explanation of the great and vital difference between the percentage of reactors in the fifty or sixty herds first tested and that found in herds near the city was not difficult. The more distant herds had nearly all been assembled from farmers who owned a few cows, which had never been in large herds and thus never exposed to bovine tuberculosis. On the other hand, our nearby producers had been for years trying to build up herds of a good dairy type of animals. In doing this they had frequently gone outside of the State and had gotten into their herds a number of animals which, probably "plugged," had reacted on the next test after purchase. It then became apparent that, while it was not by any means an impossible, or even an especially difficult, matter to get any number of cows which would stand the tuberculin test, these cows were not at all of the dairy type. Their small production did not stand in the way of their being useful to the farmer who lived on cheaper land some distance from Richmond, but they could not profitably be kept on the more expensive land near the city.

When these facts were ascertained, it seemed absolutely necessary to postpone for a long time the enforcement of compulsory testing of all herds. Consequently, three years additional time was allowed by the Board of Health. But it was evident that the matter could not be allowed to rest there. There were many reasons for this.

First, while believing that only a very small proportion of all human tuberculosis is due to the bovine bacillus ingested with milk from reacting animals, and while this amount was believed to be so small that little risk was involved in not insisting on the pasteurization of milk from untested cows, it seemed best to provide that, with extension of the time for testing prolonged for three years, pasteurization of milk from untested herds should be required. Protection against bovine tuberculosis is far from being the chief reason why so many of the leading sanitarians

teach that all milk should be pasteurized. From a health standpoint, pasteurization is done mainly as a safeguard against the acute contagious and infectious diseases of man himself—notably typhoid fever, diphtheria and scarlet fever. Therefore, to insist on pasteurization of all milk from untested herds emphasizes only one of several important things.

In the second place, a number of dairymen, believing that they would be forced to test their herds prior to September 1, 1915, did what appeared to be the wise thing and tested their herds well before the expiration of the time limit. These men had followed just the advice we had given them —to test early—and they had, in consequence, sustained heavy losses. It thus came about that the dairymen who put off testing and who, in many instances, would most probably have fought us strongly, would after all escape the necessity of testing. This was, evidently, not a pleasant thing to consider.

GRADING THE MILK SUPPLY

The situation was indeed a difficult one, but the remedy was found. It was necessary to find some means whereby the dairymen who had not tested would be allowed to put this off and pasteurize their milk, while, at the same time, those dairymen who had tested and rid their herds of tuberculosis would be rewarded for having done so.

Grading the milk supply hit the situation exactly. But in order to have this grading accomplish the end in view, it was necessary to grade rather differently from the standards set by the National Commission on Milk Standards. For us it was highly important that all our Grade A milk should be from tuberculin tested herds—whether this milk was to be sold raw or pasteurized. Of course tuberculin tested herds constituted only one of several requirements for the production of Grade A milk.

After considerable thought, the following rules were adopted for grading the milk supply:

GRADE A MILK

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

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

GRADE B MILK

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

CREAM

CREAM shall be classified in the same grades as milk, in accordance with the requirements for the grades of milk, excepting the bacteria standards. In 20 per cent cream the bacteria count shall not exceed five times the count allowed in the corresponding grade of milk.

It will be noted by those familiar with the recommendations for the grading of milk made by the National Commission on Milk Standards that the grades adopted by the Richmond Board of Health are very much higher.

We have now had our milk supply on a graded basis for over five years, and it has proven satisfactory in every way. The dairymen have found it to their advantage and the consumer knows just what milk he is getting. The dairymen who have their herds tested are in a position to sell Grade A milk—provided, of course, they come up to the other requirements of that Grade, and since this Grade commands four cents per gallon more wholesale than Grade B, they thus profit by having tested. On the other hand, the man who is not able to get into Grade A because he has not tested his herd cannot complain, for he can get into Grade A class by doing just what the others in that class have done.

The present prices for milk in Richmond are as follows:

Grade A

Producer receives 48 cents per gallon;
Consumer pays 17 cents per quart, 10 cents per pint

Grade B

Producer receives 44 cents per gallon;
Consumer pays 16 cents per quart, 9 cents per pint.

"Knowledge is boundless—human capacity limited."

REPORT OF COMMITTEE ON TRANSPORTATION AND MARKETING OF MILK AND MILK PRODUCTS

RUSSELL S. SMITH, *Chairman*

The material in this report has been gathered from many and varied sources and is presented for the information of the members, rather than for any suggestion of action or criticism from the Association. It is rather a citation of events in the recent history of transportation rates and rulings and plans for making the service more efficient.

With the change of management of railroads back to private ownership and the increases in freight and express rates, a more or less uncertain condition exists. That railroad transportation is necessary for the dairy industry is well known, and just how necessary it really is has been proven by recent events.

TRANSPORTATION AND HEALTH

The moment a railroad tie-up threatens our food, and especially our milk supply, we realize how vitally important these arteries are to the health of the people.

Congested traffic conditions have recently brought to light a new and serious menace to the health of the nation and indirectly to the dairy industry, as it has to do with the water supply used for drinking purposes as well as the water used in cleaning dairy apparatus and utensils. On July 20 the Public Health Service announced from Washington that the water supply of 30,000,000 city residents was in imminent danger of becoming disease-infected because of the impossibility of obtaining the necessary purifying chemicals. Emergency appeals for railroad priorities on alum and chlorine were received from the boards

of health of ten States and numerous cities. It was impossible to secure priority shipments of chemicals for other than carload lots, and so local authorities were advised to buy at once in carload lots and to have less than car lot shipments made by express. It was also advised that by notifying the Interstate Commerce Commission all shipments could be expedited.

IMPORTANCE OF DAIRY INDUSTRY

The importance of the dairy industry is indicated by the fact that during the calendar year 1919 approximately ninety billion pounds of milk were produced in the United States.

Approximately half of the milk produced is used in the production of various manufactured dairy products, and such products usually have to be transported to some distant market.

On the basis of the average 1919 prices for milk, the total quantity had a cash value to the producer of more than $2,000,000,000. As approximately half of the milk was used in the production of manufactured dairy products, the value of such a business would reach beyond the billion dollar mark for this branch of the industry.

OWNERSHIP OF REFRIGERATOR CARS

The consent decree recently entered into between the Attorney General and the meat packers, as approved by the Federal Court, may have the effect of diverting to the dairy products industries a large amount of capital previously invested in the numerous industries from which, by the terms of the decree, the packers are forced to withdraw. The Federal Trade Commission Act guarantees the prevention of unfair methods of competition, provided its provisions are vigorously enforced by the Commission and sustained by the courts.

It seems equally important, however, that the existing system of private ownership of refrigerator cars by shippers be abolished by providing for their ownership either by the railroads or by some organization which is neither a shipper nor has any interest in common with shippers.

In the "Private Car Line Report" to the President in August, 1919, the Federal Trade Commission stated that "in order to correct the present inequalities of service and rates, as well as to prevent the dangers of monopolistic advantages in the use of certain types of cars, the following recommendation is made: That the Government acquire all refrigerator cars and all necessary equipment for their proper operation, and that such ownership and operation be declared a Government monopoly; or that such cars and equipment be owned and operated by the railroads under Government license regulation." This recommendation, together with one other, contemplated the acquisition and operation not only of live stock and refrigerator cars but also of all necessary facilities for their operation, such as car shops for their construction and repair, feeding and watering facilities for the live stock in transit, precooling equipment for refrigerator cars and icing stations for the refrigeration of perishables in transit, ice manufacturing plants and natural ice producing privileges connected therewith or necessary thereto, together with such other facilities as may be needed to secure the efficient transportation of meat animals and perishable food products.

Under the provisions of the recent Transportation Act the Interstate Commerce Commission has advocated the formation of a national equipment corporation.

We have, then, as the latest development, the possibility of a national equipment corporation as authorized by Congress in Section 210 of the Transportation Act, which is no doubt the result of the many suggestions from different sources relative to the problem of transportation and especially of refrigerator car service.

INCREASED FREIGHT RATES

The application of the railroads of the country to the Interstate Commerce Commission for the 6 per cent guaranteed them by the recent Transportation Act has taken prompt and tangible form in the petition of the roads for an increase in freight rates, to become effective by September 2, 1920. The commission had already divided the country into three territorial groups, known as Official (Eastern), Southern and Western. The railroads of these sections have asked for increased revenues upon freight business amounting to about 31 per cent in Official and Southern divisions and 24 per cent in Western. These percentages were reached by taking the book value of the portion of the road's investments devoted to freight movements and determining the increase in revenue upon that value which will produce the stipulated return of not to exceed 6 per cent per year.

The option of increasing revenues does not lie with the Interstate Commerce Commission; that is required by the law itself. But the adjustment of rates is within the powers defined for the Commission.

Hearings on the case began May 24, 1920, and it might be interesting to cite some of the varied positions taken by various industries.

The coal trade was not a unit in its contention, but practically each section or district pleaded for some special favor.

Grain agreed to such increases as the Commission might determine, provided all existing differentials be maintained.

Steel advocated prompt straight percentage increase to enable the carriers to furnish equipment for moving traffic.

Sand and gravel and brick opposed any increase, using many of the arguments which were used by the Association of Ice Industries.

Live stock opposed any increase as a positive restriction to the future of the business.

The condition of the railroads and their failure to furnish suitable equipment were constantly assailed. The roads countered with charges against Government management and labor conditions. Their attitude was one of demand for money to get sufficient equipment and to pay the requirements of labor, or the present situation cannot be improved. Constant effort was made by railway counsel to show that prices of various commodities had advanced in far greater proportion than had freight rates, or if that were not true that the prices today warrant payment of higher costs for transportation.

INCREASED EXPRESS RATES

The application of the express companies to the Interstate Commerce Commission for increased rates also took prompt and tangible form in the petition of the express companies for an increase in express rates.

The ice cream industry brought its arguments before the Interstate Commerce Commission in concrete form, part of which follows:

1. Agree to reasonable compensation for service rendered, or which the express company may reasonably be expected to render.

2. Opposed to an unqualified percentage increase discriminating against the ice cream industry because it would place a heavier burden on ice cream than on other articles and it would penalize the ice cream industry for the losses and damages suffered in the transportation of other commodities.

3. Opposed to an unqualified percentage increase because it will curtail the factory production of ice cream, thereby causing financial loss, working against the production of the most wholesome product possible, discouraging milk

production to a certain extent, and in all probability decreasing the revenue of the express company.

4. Opposed to the proposed increase in express terminal charges to ice cream manufacturer when he performs the pick-up service and when he hauls empties.

What seems to be the consensus of opinion for the milk producers against advanced express rates was voiced by the California Dairy Council as follows:

"Any advance in rates would be passed on to consumers, which would not only add to their cost, to which the public has already vigorously objected, but it would serve to curtail consumption of milk to the detriment of public welfare and especially the proper nourishment of children."

That this opinion was nationwide and that it agreed with the opinion of milk dealers is clearly brought out by the announcements of a dealer in Boston, Mass., across the country from California. This dealer issued a statement to the effect that one-half of the increase in price which he had asked from the consumer was to go for transportation and the other half to the producer, both having asked for an increase from him.

Late in September the Interstate Commerce Commission granted additional express rates averaging 13.5 per cent to express companies, this increase applying to class and commodity rates, and making a total of 26 per cent increase in express rates within the past few months.

Express companies had asked for additional increases up to 15 per cent to offset heavy wage increases. The only exceptions made in the new rates were in the case of milk and cream shipments. In announcing the rate increase the commission said:

"With the very substantial increases in express rates, shippers have a right to demand an improved service. On our part, while at all times ready to accord to a common carrier that relief to which it may be justly entitled, we shall not view with complacency anything other than a pains-

taking and unremitting effort to reduce the item of loss and damage to the lowest possible figure."

ASSISTANCE TO BE GIVEN

To assist in providing for more equipment a part of the $300,000,000 revolving fund provided by Congress for loans to railroads has been made available.

"It is essential," the Commission says, "that a substantial portion of the fund be put to work at once to aid in acquiring new equipment. The apportionment is fixed at $75,000,000 to aid in the acquisition of freight cars and $50,000,000 to aid in the acquisition of locomotives. Since freight cars are interchanged and enter into general use, serving the general transportation needs of the public regardless of ownership, the Commission will endeavor to apportion the $75,000,000 in such a manner as to bring about acquisition of the largest number of cars. For this purpose it has urged the formation of a national equipment corporation, as advocated by the National Association of Owners of Railroad Securities and as authorized by Congress in Section 210 of the Transportation Act. Recommendation for such a corporation is particularly made in the case of refrigerator equipment. The railroads themselves, however, must present plans for the formation of such an organization. The apportionment will be used primarily to aid in the acquisition of 20,000 refrigerator cars. Allotment for such cars will be made first to those carriers which offer the largest proportional contributions to meet the advances of the Government, and will be continued in the order of proportions of carrier contributions until the total of 20,000 refrigerator cars is provided for or the applications exhausted. Other things being equal, preference will be given to loans to equipment corporations supplying the needs of a number of lines."

While this financial aid is too late to remedy the car shortages, which have recently been reported to be very

acute, it is expected that by the end of this year upwards of 7,000 new cars will be completed and ready for service.

ADVISORY COMMITTEE INVITED

The Interstate Commerce Commission has recently requested the National Industrial Traffic League to appoint a committee to sit with a committee of the American Railroad Association for the purpose of making joint recommendations to the Interstate Commerce Commission, both as to the things they agree should be done and as to the things on which they think action should be taken, but as to the nature of which action they cannot agree.

The National Traffic League is the national organization of industrial traffic men as distinguished from business organizations interested in transportation in a general way but not composed of traffic men.

CARRIERS UNITED

The carriers have always, from the very nature of their business, been so organized that they could act in concert at any time in matters of general importance. But the shippers and receivers of freight—the persons who buy transportation from the railroads—by reason of the diversified nature of their businesses and the division of their interests, generally speaking, have not been so organized.

The National Industrial Traffic League has gradually grown to the point where it now represents the shippers in much the same way that the American Railroad Association represents the carriers, and both have been recognized as representative bodies by the Interstate Commerce Commission.

To be sure, all shippers do not belong to the Traffic League, but most of the largest shippers and many of the small ones do belong. Hundreds of small shippers are represented through the membership of the traffic men of their commercial associations or traffic organizations. Its mem-

bers are the practical traffic men of the business of the country.

TRAFFIC MEN FOR DAIRY INTERESTS

The day seems to be not far ahead when the milk business, creamery business and other allied dairy businesses which depend upon rail transportation for their supplies and as a method of reaching a market with their products, will be represented by traffic men well versed in the essentials of transportation and the needs of the dairy business.

The dairy industry needs to be represented by men who are thoroughly familiar with the technicalities of the traffic game, so that the individual claims and grievances can be looked after in the most efficient manner possible. Such traffic men should be so equipped in knowledge, experience and breadth of vision that they will be able to deal with transportation problems from the point of view of the welfare of all business, treating transportation as an instrumentality of commerce and not as a mere commodity which must be bought at the lowest possible price.

ROLE OF THE DAIRY AND MILK INSPECTOR

There seems to be an important place for an association of dairy and milk inspectors in the general transportation and distributing problem. Surely no one is better informed as to the problems of both producers and dealers than a milk and dairy inspector whose duties bring him into almost daily contact with all who produce, handle and deliver milk.

It is therefore fitting that an association of dairy and milk inspectors should volunteer its unbiased opinion, advice and recommendations to the transportation agencies and to those who use such agencies. Such an effort might help to reduce spoilage, to reduce costs to a minimum, to provide for satisfactory service, and to promote confidence, harmony and good will all along the line for the good of the business.

SERVICE OF THE BUSINESS

With all of the agitation associated with advancing costs and unsettled conditions, we must realize that the milk business is essentially a business where service is paid for entirely by the consumer and that the economies which he may desire along this line are entirely within his control, and it has developed because the public wants the milk brought to its door. No other business calls for the accomplishments in transportation which have been fulfilled by the milk business. No other business calls for a highly perishable article of food, which has to be kept cold and delivered daily within a small range of hours in order that it may be outside the door in the early morning, regardless of rain, wind, snow, cold or otherwise disagreeable weather. Under such adverse conditions the milk business has proved itself to be unusually dependable, and when the word service is mentioned, it should be closely allied with the milk business.

While it has become more or less of a custom to expect those engaged in the milk business to be servants of the public, the following quotation of a Boston milk dealer relating to free milk should be read by all who have been accustomed to reading diverse and misleading opinions about milk dealers in general.

"For those worthy persons who cannot afford to buy milk at these prices for their babies and children, we shall furnish it to them without charge, delivered at their doorsteps. All that is necessary is for the mother to furnish a certificate from a reputable, recognized charitable organization, hospital or physician that she is worthy of this charity."

QUESTIONNAIRE TO MILK DEALERS

The city milk dealer's problems are large, varied and many, and he has been used as a sort of buffer by all persons and societies who would criticise the milk business.

On a questionnaire recently sent to milk dealers throughout the country the following questions, among others, were asked:

"1. In your opinion, what are the principal causes for spoilage of milk under shipping conditions?

"2. What suggestions would you make to milk shippers for stopping spoilage of milk?

"3. What suggestions would you make to transporting agencies for stopping spoilage of milk?

"4. What changes in the present services or equipment of transporting agencies do you consider as necessary for the dairy industry?

While these questionnaires have not all been returned, it is possible to quote some of the answers which indicate consensus of opinion.

Ten answers to Question No. 1 selected at random:

"Milk not properly cooled at farms." "High initial temperature." "Warm cars and railway delays." "Lack of farmer cooling properly." "Careless methods." "Careless milking methods and insufficient cooling." "Lack of refrigeration." "Carelessness." "Dirty cans and high temperature." "Condition of milk when it leaves the farm."

Ten answers to Question No. 2 selected at random:

"Better care of utensils and more efficient cooling." "Better care and lower temperature before shipping." "Cool properly—keep in shade—jacket on cans." "Get a supply of cold water handy and use aerator as it should be used." "Proper sterilization of utensils, good cooling, clean milking, no delay in shipping." "Low temperature and sterilize all cans and vessels." "More ice." "Milk it clean, cool at once to 45° and hold." "Learn how to cool milk." "Ice on cans in cars."

Ten answers to Question No. 3 selected at random:

"By hauling milk on all trains." "Provide covered terminals." "More ice and better cars." "Cut out delay in unloading." "Eliminate errors causing delays, as over-

looking cans or delivery to wrong place." "Better service and arrangements for the use of ice." "Keep milk out of sun and heated rooms." "Use refrigerator cars." "By refusing to ship milk not properly cooled." "Speed."

Ten answers to Question No. 4 selected at random:

"Faster trains in South and a refrigerator service when quantity warrants such. Method of protection of cans at junction points." "Every milk train carrying an iced car." "Return shipments of empty cans should be accompanied with waybill and rate for transporting milk be so divided as to apply both on the shipment of full and empty containers." "To cause the railroad to realize the advantage of the use of ice and to allow ice to be used freely at station and in the cars." "Refrigerator cars or else icing stations where the milk can be iced and covered with canvas." "Proper and rigid police service on return of empty containers and loss of containers by stealing." "Prompt service—careful in handling cans—and impress upon the men of the railroad company that milk is a necessity and should be given preference over all merchandise or foods." "Speed and refrigeration." "Adequate records (waybills, etc.) showing movement of full and empty cans and placing of responsibility for shipments." "On railroad lines where a great deal of milk is shipped daily, refrigerator cars or compartments should be provided."

The preceding answers are from milk dealers and they show clearly what they believe to be the causes and the remedy for existing conditions.

As milk and dairy inspectors we should continue to drive away at the essential factors which are so closely associated with the production, transportation, handling and delivery of milk to the satisfaction of all concerned, for in so doing we are privileged to perform a service which cannot be measured in ordinary terms.

"The highest knowledge can be nothing more than the shortest and clearest road to truth."

THE DAIRY SITUATION OF THIS AND OTHER COUNTRIES

DR. CARL W. LARSON, *Acting Chief,* Dairy Division, U. S. Department of Agriculture, Washington, D. C.

I have never before had the privilege of speaking before the Inspectors' Association. I have, however, realized the importance of your association and your activities to the dairy industry. The dairy industry is a great industry; it produces not only a fifth of our food, but it produces the most vital food we have. The people of this country spend about four billion dollars for the dairy products they consume. Dairy products are among the products most easily contaminated and therefore need the most protection. The producers of this country are interested in consumption, and it seems to me there is no organization that has more to do with the consumption of dairy products in this country than the people represented here. We must have products of good quality, and above all things, we must have safe products. Without an abundant and safe supply we shall not succeed in increasing the consumption of our products. Therefore, it is important that the inspection and safeguarding of our products be extended even further.

I am not in a position to tell you the dairy situation of the world. I wish I could do that. I would not be here, because to know what is going to happen in the dairy business in the next few months or years would be worth millions. Your President did tell me, however, that you were interested to know more about the dairy business.

In the first place I want to tell you something of the production of the products in this country, the trend of that production over the last fifty years, and what has been done during the last five or six years, which is of great importance. I have several charts that I thought would make

it much simpler than to give you figures, and I will avoid figures as much as possible.

Most of our milk is used for butter, and an enormous quantity of butter is manufactured. This is the greatest butter country of the world. We produced in this country in 1850, 300,000,000 pounds of butter, much of which was farm butter. We had no factories at all.

Not until 1888 did we have factory butter coming into our markets. Since 1900 the production of farm butter has decreased and the factory-made butter increased rapidly, until today we have more factory butter than farm butter.

In 1914 the tariff was changed. We did have a tariff of 5 cents per pound, and reduced it to two and a half cents in 1914, and immediately after that we had butter houses open up in this country and some butter was imported; but the war came on in Europe, and those were soon stopped, and the butter started in other directions. We have exported a little bit occasionally, but this is only 20,000,000 pounds. We have never exported over 40,000,000 pounds out of our 1,800,000,000.

Compared with some other countries, we are not great cheese makers or cheese eaters. Back in 1850 we were making all the cheese on the farm, and it was not until 1870 we began to make it in the factories; the farm product disappeared some years ago and the factory product now has increased, with some ups and downs. During the last year there has been a decrease in production. The cheese trade, however, has been somewhat different from the butter trade. We have exported cheese from this country in large quantities. Back in 1880 we were sending out as much as 160,000,000 pounds of cheese, going largely to England. But about that time some of the "wise" people of America discovered how they could put foreign fats into cheese. In other words, they substituted for butterfat other animal fats. That cheese was sent to England, and very soon there was objection to it. I have copies of publications from

England at that time showing that the trade was going to look to other countries for its cheese, because the slick Americans were trying to put something over on them. The American cheese trade in England was destroyed, due largely to the attempt to sell a substitute product for the real article. There were other factors which were somewhat influential, but that was the chief reason why we lost the foreign trade at that time. Imports of cheese immediately started to come in, and instead of being an exporting country, we turned to an importing country, and it has gradually increased until the war, when our imports dropped again. Now they have started up, and today our imports are above our exports.

Eighteen hundred and eighty is the first year we have recorded; a small amount of condensed milk. This line represents 200,000,000 pounds of condensed milk for the year 1910. The war came on and it increased here to over 2,000,000,000 pounds. Of this amount 800,000,000 was exported. During the war, in spite of the fact that we were exporting enormous quantities of condensed milk, we were still importing. Today there is more milk used for condensed milk than there is for making cheese, but the butter uses more milk than the two combined.

One million, six hundred thousand pounds of farm and dairy butter was made in 1909. Russia comes next to the United States. Then we have France, coming next as a butter producer; then Denmark; then Austria; then Canada, the United Kingdom, the Netherlands and Italy, New Zealand, Sweden, Switzerland, the Argentine Republic, and Union of South Africa.

If all of those countries sent us all they produced it would not be as much as we produce here at home.

England was the greatest buyer of butter, buying 64 per cent of all butter entering into the world trade. Germany was the next buyer, buying 17 per cent. Belgium was buying 2 per cent; Austria-Hungary two, France two, Switzerland one and one-half, and all of the other countries nine.

Now, let us see who supplied these countries with the butter. We have Denmark supplying 27.9 per cent of that butter. We have Russia next, supplying 23 per cent. The Netherlands next with 11 per cent; Australia with 10.6 per cent; Sweden 6½ per cent, and New Zealand 5.8 per cent.

Now, the war came on and what happened? It is not difficult to see why we have the situation we have today, if you will just compare those two. Instead of the United Kingdom buying 64 per cent of this same quantity, today they buy 24.7 per cent. The United Kingdom alone bought from other countries of the world about 450,000,000 pounds of butter. Today they are buying less than half of that amount. Now, is it any wonder that we get a little butter in this country from some of the other countries that did not ship it here before? We have Germany buying 7.8 per cent, instead of 17 as she did before the war. We have France buying 1.8, practically the same as before the war; Belgium, 1.6; the other countries, 9.8. We have a decrease in the world trade of 54.8 as compared with 1914.

In 1914 Denmark supplied 27.9. This past year she supplied 11 per cent of the butter that went into the world trade, or 11 per cent of the quantity that was used in 1914; New Zealand, 6.7, practically the same as before; Australia 5.7, practically the same; but we have Argentina coming in here, and she did not appear back there in 1914 as one of the producers of butter in world trade. This, it seems to me, explains clearly why Denmark and Holland have some butter shipped to this country. The chief reason is that England is not consuming one half the butter she did before the war. There has been a restriction of the amount of the consumption of butter in England all during the war. It started soon after the beginning of the war, but it was continued even after its close, and up to last July there were still restrictions on the amount of butter that could be consumed by the average individual in England. Also, the price

has been fixed so low that butter did not go there from other countries if it was of good quality and could be sold elsewhere, and this tax restriction has also had a tendency to divert the butter from Denmark and Holland to this country.

The cheese situation is practically the same, except they have been buying just as much cheese right up to the present time as they bought before the war. It indicates to me that the cheese market is more stable than the butter market. The history of the cheese industry, of course, has indicated that, but this emphasizes the fact that they have used cheese when they were willing to give up butter.

The countries that have supplied the products in cheese have changed materially. We find several countries now increasing the amount of cheese in the world trade, and in some of the others it is disappearing.

In January, 1918, we had practically no imports of cheese and no cheese going out of the country. In May our imports had greatly increased, and then diminished at the end of the war. We have practically no exports since, but we have imports right along, and today we are having more cheese come into this country than there is going out.

At the present time, our exports have dropped out entirely, and we have imports of considerable quantity of butter coming from Denmark and Holland, and recently, since the first of October, Australian and New Zealand butter is coming this way. Up to October 1st, Australia and New Zealand had a contract with the United Kingdom for their entire supply. That contract has expired, and since they they have been letting contracts in this country.

We have practically no imports of condensed milk, but we have an enormous export trade built up during the war, reaching its highest point in May, 1919.

You have heard much in the last few days about the milk situation, condenseries closing, and all that sort of thing. Some people were surprised to think that could happen so

suddenly. That trade is gone. It has been going down rapidly. Production has been twice as much as the amount consumed in this country. We were depending on foreign trade, and that foreign trade largely stopped a year ago last May.

At present the dealers in butter do not know how much butter is coming, and they naturally are a little afraid, and it is depressing on the market. We have had one million to three million pounds some months. It has depressed the market. You know there was a drop of two cents yesterday, and two and a half today, despite the fact that the winter season is coming on when butter prices naturally increase. I picked up the morning paper, and I noticed that woolen yarn in quantity of a certain grade had dropped greatly in price yesterday. A man from one of the Middle Western States told me yesterday that they were selling corn in his town for 65 cents a bushel, and they were selling hay for $4 to $8 a ton. If the price of milk, or the necessary feeds for the production of milk, is based on the cost of production, then a decrease in the price of products to a limited amount is not, it seems to me, so serious at the present time in the face of what has happened in the price of products that go to make up the cost of a quart of milk or a pound of butter.

Referring to the number of dairy cows, we find the grand total for the principal dairy countries shows that we have just about maintained the cow population of the world; there has been no material increase or decrease of the total as a result of the war.

We do not have included here the countries of what formerly was Austria-Hungary nor Russia, nor the Balkans. These countries have suffered most in the loss of dairy cattle. In the central countries, I am informed and believe on good authority, more than a million and a half were lost. In some of the smaller countries nearly all of their dairy cattle have been lost. Russia, however, has not lost

any of her cattle; that is, the part of Russia that produces butter and dairy products for export, but it is assumed that product will go to other parts of Russia that are without the product now.

In conclusion I would say that England is the biggest factor of all; she is below consumption of butter. If England bought today a normal amount of butter, all the countries that are now exporting butter could send it all to England and there would not be a pound left over to come to this or to any other country.

If Germany had a mark that was of sufficient value in other countries, she would buy all of the butter that Denmark and Holland have to spare. So we have exchange as the factor. If, therefore, England will gradually get back to her normal consumption, if Germany gets her exchange so that she can afford to buy butter—she cannot afford to now in any large quantities—the countries of Europe will be unable to send a single pound to this country. But while those conditions exist, we dairymen in this country, it seems to me, should meet the situation by greater economy of production. I believe the producers of milk in this country can produce it today so that no other country can compete with us on any large scale. There is no country that I know of, unless perhaps it might be Australia, that can send butter or any other product to this country and compete on our market, or that can produce milk as economically as we ought to produce it in this country. After all, I think that problem is not a very difficult one. What we need is better cows in the United States. Denmark, as you know, is shipping butter here, someone made the statement here, at the rate of 2,000,000 pounds a month. That, I understood, was the butter they had left over after supplying England. But they are producing that butter with feed bought in this country, shipping it over and making it into the product and shipping it back.

It is true their labor is somewhat cheaper than ours is here, but not very much cheaper.

Furthermore, I believe that the average good dairy in this country produces 100 pounds of milk with no greater outlay and cost of labor than is spent in Denmark. They devote more hours of labor, or units of labor, to 100 pounds of milk than we do here. But they have better cows; they have cows that produce on an average of over 250 pounds of butterfat a year, while our average is probably 150 to 160.

It seems to me that is our goal, and I think it is not a difficult one to reach, and if we reach it we will meet foreign competition. We want greater consumption, and there is no better way of getting it than through economy of production and lower prices.

"Wise men ne'er sit and wail their loss, but cheerily seek how to redress their harms."

THE RELATION OF LABOR TO THE PRODUCTION AND SALE OF MILK.

PROF. JAMES O. JORDAN, *Inspector of Milk,* Boston, Mass.

Of the various agencies connected with providing milk supplies during the war period, producers apparently have had the greatest trouble in procuring labor. The reasons for this situation have been many, but were chiefly due to the long hours required of farm help, and the fact that labor was able through the prevailing shortage of workers to obtain higher wages in other undertakings than farmers could afford to pay. At the same time, producers had to contend with, perhaps, unreasonable independence on the part of employes. Illustrations of this latter and the monetary feature may be cited without number, but a few will suffice.

In haying time this year, an employe was asked one Saturday afternoon to assist in getting in the crop. He refused because he had planned to go to a distant city to attend a movie show. A son of a Vermont farmer is now receiving each week $54.00 and over as a brakeman on a freight train. Another Vermonter is being paid $10.00 daily, for himself and two horses, for a teaming job. An authority in Michigan recently made the statement that a canvass of one county in that State showed that the men remaining on the farms were all 55 years of age or older. The automobile industry of Detroit was undoubtedly largely responsible for this state of affairs.. The farmers supplying milk to Washington, D. C., assert that one of the greatest obstacles in producing that commodity at this time is the difficulty of securing competent labor, or even any labor, at a reasonable wage.

It is little wonder that under circumstances like those mentioned, producers were handicapped, not alone in the production of milk, but in other allied operations. How well they succeeded we all know. They deserve the fullest credit in view of all of the drawbacks for the part of the burden, not alone theirs, but ours, which they so admirably sustained. They maintained a fairly even production; they brought us through. All of which again demonstrates that the dependability, the brawn and backbone of the nation, still exists in plus amounts in our country districts, and that the little red schoolhouse has again registered a decisive note for our wellbeing.

For some producers, however, the inability to procure labor has meant disaster, and has caused abandonment of this endeavor. In at least one instance, a farmer of repute as a dealer in high grade milk was compelled by the arbitrary and unreasonable demands of his employes to dispose of his business summarily, and at a loss. This was unfair not only to the producer in question, but to his customers of years standing, who in more than one instance were both inconvenienced and aggrieved at the outcome.

In considering labor as applied to industry, it is well to bear in mind the fact that of all of the purchasable commodities, labor is the most expensive. We pay more for it, in proportion to the return received, than for any other single item. Likewise we are more wasteful in the utilization of labor, than with the products from other expenditures. This loss is not confined to official walks of life; it predominates in private callings. Every consumer is taxed for this prodigality, either directly or indirectly, with every money expenditure. The advantageous utilization of this dissipated energy for our well-being is a task not within the scope of this paper. But the opinion is ventured that it will not be brought about other than by an upheaval of public sentiment, accompanied by the determination to no longer tolerate "loafing on the job."

Until there comes this changed viewpoint on the part of the masses, prevailing conditions must be accepted, and business operations planned in accordance with existing facts. Labor and capital should be brought to the point of functioning with the least possible friction. Those who conduct their operations on this basis will attain something of the efficiency which must characterize successful operations of the near future.

In the production and sale of milk, labor is an essential, not a necessary evil. The importance of labor to the milk industry was never so fully demonstrated as during the period beginning with our entrance into the war and down to the present time. Realizing, then, what labor means to this great enterprise, it follows that the best results are not to be obtained by the abuse of labor, but from its constructive use. Labor adjustments call for vision, not visionary consideration.

May it not follow that it is well to take a lesson from the book of the past in dealing with labor? This can only apply in part as we now operate on a larger scale, under changed conditions—conditions which are in no wise permanent. Formerly the relations between employe and employer were of the intimate order. The latter knew his aides and generally addressed them by their first names. The help were interested; they knew the business and naturally felt they were a part of it. There was a greater degree of contentment. This feeling was propagated to a maximum degree by the greater opportunity for individuality and responsibility.

Now operations are conducted under higher pressure and increased volume. The worker and the big boss do not know each other. The intimacy of olden days is no longer supreme. Under this state of affairs workers, with some justice, contend that they are only a part of a big machine. They feel that they are being handled not as individuals, but

on the unit plan. Naturally they make their demands on this latter basis.

With the milk traffic and more particularly with the delivery portion of the business, the aides are something more than machines, if success is the end in view. The helpers are the real eyes of the management; their duty calls for more ability than that entailed in the mere delivery of milk. The task requires intelligence, an insight into the intricacies of the traffic, courtesy, and good salesmanship. For this there should be an additional incentive outside of monetary reward. That portion of the business is, in one sense, as much that of a particular driver as it is of the management. The man on the route may well view it from this basis; if he does, and realizes his responsibility to his partner-employer and to that portion of the community which he serves, are we not on the way to at least minimizing some of the difficulties now attending the delivery of milk?

Much also may be expected from concurrent effort, interchange of ideas and vital information, analysis of facts and standardization of methods, so that the public may receive the benefits of lower costs of distribution, and a high degree of human efficiency. The best lubricant for the business machine is interest on the part of employes.

How best to obtain this cooperation and interest from employes of milk concerns requires the careful consideration which it is undoubtedly receiving from alert distributers of milk.

There are extremists in labor circles as well as elsewhere. Probably there were more of the immoderate type employed during the acute war period by both producers and dealers than ever before. To this condition may be attributed the many arbitrary and unbalanced proceedings which have at times threatened to seriously interfere with both the production and distribution of milk.

Such activities as the summary breaking of agreements, attempts to secure increases in wages by threats of strike

during the processing of large quantities of milk, refusals to work on Sundays and holidays and inadequately protecting milk from high temperatures on the day of delivery, are only a few of the developments which have troubled the management of milk concerns. So far as known, Detroit is the only city which during the last year had to deal with strikes on the part of milk wagon drivers. In handling these situations, which were characterized by many acts of violence, the dealers prevailed and succeeded in expelling the violent element from their connection with this traffic. This was accomplished partly through the assistance of loyal employes.

Strikes on the part of employes of milk producers or dealers indicate reckless disregard of the rights of others. It involves vastly more than a question of differences between employe and employer; the main element in the proposition is the consumer. The question is not so much whether or not a helper has his pay increased, as it is that there should be no interference with the delivery of milk to the trade. This latter is so vital that its importance ought to be recognized by even the unruly. Those who from selfish motives imperil community rights and possibly the health of individuals, through attempts to check the normal traffic in milk, brand themselves as irrational individuals, unfit to be connected with the business; and they should be ejected from it as speedily as possible. Apparently these irresponsibles do not recognize that it is "not those who inflict the most, but those who suffer the most, who conquer in the end."

Despite unfavorable comment and criticism on the part of the public over milk prices of the last four years, both dealers and producers have failed to take advantage of the fact that a substantial part of the advance in the cost of this commodity is due to very significant amounts paid by the milk industry for labor. It was demonstrated in 1919,*

* Presidential address by James O. Jordan, in Eighth Annual Report of International Association of Dairy and Milk Inspectors, p. 31.

that of the amount paid for a quart of milk, at least $0.0633 cents represented direct outgo on the part of producers, dealers and railroads for labor. In addition to this traceable outlay, there are involved labor expenditures for supplies used by the three factors mentioned, which if determined would materially increase the above conservative labor cost for a quart of milk. The prices paid for labor by producers, dealers and railroads have advanced since 1919, and enhance the present labor cost of a quart of milk over the sum mentioned above.

The public is unaware of this circumstance. Possession of the facts would not necessarily call forth greater willingness on the part of purchasers to continue present expenditures for milk, but by demonstrating that a material portion of the outlay for a quart of milk went for labor remuneration, a better understanding of the difficulties of producers and dealers would be instilled into the minds of consumers. The public would, at least, have an opportunity to note that the producers and dealers were not getting all of the money. Labor has taken no part in presenting this phase of the subject, and yet it is as much an element of the business as are the producer and dealer. It should be as keenly interested in its success and continuation as the producer and dealer. Labor has acquired the rewards and escaped the censure. Whether or not this is to continue is a problem for future determination.

Casual recognition of the part which labor fills in the milk industry ended with the beginning of our war troubles. There was good reason for the former attitude because of the previous existence of a surplus of people seeking employment. Responsible labor was available. This was followed by a complete reversal of this condition. The ranks of competent helpers were thinned; in many instances the recruits were of the undesirable type, such as would not ordinarily be employed. Thus from the beginning pro-

ducers and dealers were hampered in their endeavors. History demonstrates that the yoke was a heavy one, but business has proceeded despite the handicap.

We are now nearing the time when darkness is being penetrated by light, and there will soon be available for both producer and dealer more labor and of a higher degree of efficiency. Statistics show that in industrial pursuits there is a conservative curtailment of output, and that fewer workers are needed.

A recent survey made by the U. S. Department of Labor's Bureau of Statistics indicated that the number of employes in the automobile manufacturing industry decreased 10 per cent in August as compared with July. Other decreases were 6 per cent in the woolen industry and 5 per cent in the leather, hosiery and underwear industries. Increases of 3.5 per cent and 1.5 per cent were shown in car building and repairing and in paper making. This investigation furthermore demonstrated that as compared with July, the payrolls in August showed decreases in nine industries and increases in five.

A significant feature is also discernible from the fact that immigration is rapidly increasing. As showing the reality of this contention, the number of immigrants entering the port of Boston from July 1, 1919, to July 1, 1920, was 17,268. Dividing the year into two periods, the arrivals, July 1, 1919, to January, 1920, were 6,071 as compared with 11,197 from January 1, 1920, to July 1, 1920. Accurate data concerning the port of New York was not readily procurable, but the rate of arrivals, compared to Boston, is about twenty to one in favor of New York. Employment of this information indicates that about 345,360 of the foreign born reached that city from July 1, 1919, to July 1, 1920, divided as follows: 121,420 for the first half of period and 223,940 for the latter half. The above points to what is happening in other cities where immigrants are received. These substantial arrivals cannot but have an

important influence upon all industries, and milk production and sale in the immediate future.

These situations do not mean hardships for individuals, but they point to readjustments. Opportunities are not lacking for those willing to work. The outlook for a period of sane prosperity is promising. We are returning to a prewar industrial basis; casting out our ills, rapidly completing the cure, and paving the way for permanent stability.

In closing there is this apt quotation from a distinguished citizen of the United States. Although intended as a general statement, in application it forcibly applies to the milk industry:

*"The country is turning again to realities. It wants to get away from the mirage of false hopes and false security. It wants to be done with the miasms of war. It wants the security of peace. It wants to live again under the government of the Constitution."

* An address by His Excellency, Calvin Coolidge, Governor of Massachusetts.

"Labor disgraces no man; unfortunately, you occasionally find men who disgrace labor."

SUMMARY OF WORK DONE IN BOSTON MILK CAMPAIGN, COST OF SAME, AND SOME RESULTS

PROF. W. P. B. LOCKWOOD, Massachusetts Agricultural College, Amherst, Mass.

1. ADVERTISING.

(a) Newspapers.

Month	*No. Insertions*	*Circulation*
June	54	11,033,500
July	29	4,454,300
August	9	106,000
Sept.	5	74,000
Oct.	5	6,534,200
Nov.	55	4,524,600
Dec.	47	
Total	204	26,726,600

Number newspapers used, 14.

(b) Car Cards.

Month	*No. cards used*
July	1,400
August	1,400
Dec.	1,400
Jan.	1,400
Total	5,600

Number persons reached (estimated) 1,000 000 per day.

2. LECTURES AND TALKS.

Month	*Workers*
June	3
July	4
August	2
Sept.	3
Oct.	4½
Nov.	4½
Dec.	4½
Jan.	4½
Feb.	3½
March	2½
April	1½

No. lectures and talks at schools	663
Children reached	157,034
No. lectures and talks at factories, stores, clubs, etc	246
Adults reached	55,015
3. Play (Milk Fairies)	
No. times given on playgrounds	70
No. children who saw it (Also given in schools and clubs)	40,000
4. Literature and posters distributed	261,350
5. Bulletins prepared	3
6. Posters prepared	5
7. Exhibits, shows, etc	9
8. Mechanical exhibit at shows, etc	4
No. days exhibited	43

SUMMARY OF EXPENDITURES.

Advertising	$27,075.31
Administration	2,532.09
Lectures and demonstrations	4,237.52
Printing	1,886.27
Milk conference	375.58
Total	$36,106.87

Massachusetts Agricultural College contributed one man, one-half year expense $1,750.00

U. S. Department of Agriculture contributed some workers first part.

USE OF MILK.

Some Store Results Checked Week of August 3, 1920.

Store	*June, 1919 Before lecture*	*People served*	*July, 1919 After lecture*	*Per cent increase*	*July, 1920 1 year*	*Per cent increase*	*People served*
Jordan Marsh	140 qts.	1,800	201 qts.*	42.5	235 qts.*	67	1,800
R. H. White	30 pts.	?	60 pts.*	100.0	60 pts.*	100	?
C. F. Hovey	30 pts.	500	60 pts.*	100.0	60 pts.*	100	500
Gilchrist & Co	65 pts.	?	380 pts.*	442.0	250 pts.*	256	?
United Drug Co.	90 ½pts.	427	370 ½pts.*	311.0	800 ½pts.*	788	800

* Increase in bulk milk sold, but no data. Milk soups, etc., used more.

One large company, influenced by the propaganda, posters, etc. (no talks given to workers) realized the need of the use of more milk by its workers so much that they gave a ten-ounce glass instead of an eight-ounce, reducing the cost to the workers from four cents to two cents per glass, the company standing the loss. The following month showed an increased sale of 5,625 quarts of milk and 795 quarts of cream. At the present time they report a 100 per cent increase in sales above that of a year ago.

Receipts of Dairy and Substitute Products, Boston Market, 1918 to 1919, Inclusive.

TABLE I.

Milk and Cream—R. R. Com. Report.*

Year	*Quarts*†	*Lbs. Equivalent*	*Per cent increase over 1916*	*Per Quart high*
1913	106,672,315	229,345,447		
1914	104,035,461	223,676,241		
1915	109,700,117	235,855,251		
1916	121,720,009	261,698,019		9c
1917	140,721,776	302,551 818	15.6	
1918	146,314,615	314,676,423	20.2	
1919	156,719,282	336,946 456	28.7	17c

TABLE II.

Evaporated and Condensed Milk—C. C. Report.‡

Year	*Cases*§	*Lbs. Equivalent*	*Per cent increase over 1916*
1913	321,946	38,633,760	
1914	432,601	51,912,120	
1915	409,472	49,136,640	
1916	762,446	91,493,270	
1817	880,072	106,608 640	
1918	1 237,647	148,367,640	
1919	1,943,793	233,255,160	154

* Does not include milk from cows in city or hauled in by wagon.
† One qt. milk = 2.15 lbs.
‡ No export reported.
§ One case condensed = 120 lbs. liquid.

TABLE III.

Powdered Milk—Three concerns*—Jordan.

Year	*Pounds*†	*Lbs. Equivalent*	*Per cent increase over 1916*
1916	735,809	8,461,803	
1917	789,457	9,079,755	
1918	913,575	10,506,112	
1919	1,021,555	11,747,882	38

TABLE IV.

Butter—C. C. Report.

Year	*Lbs. Received*	*Lbs. Exported*
1913	71,702,585	
1914	73,028,434	
1915	82,081,681	308,380
1916	71,439,530	698,142
1917	69,167,568	767,414
1918	79,305,534	
1919	74,765,556	

TABLE V.

Oleo—C. C. Report.*

Year	*Lbs. Received*	*Packages*	*Per cent increase over 1916*
1916	1,229,640	40,988	
1917	2,269,860	75,662	
1918	2,942,760	98,092	
1919	2,706,400	.....	120

TABLE VI.

Daily Sales of Milk, Given by Dr. J. O. Jordan, Boston.

Year	*Quarts*	*Population*	*Per Capita*	*Decrease Per capita*
1916	347,735	760,400	.457 qts.	
1917	342,244	772,370	.443 qts.	.014 qts.
1918	342,451	784,340	.436 qts.	.007 qts.
1919	333,506	796,310	.418 qts.	.018 qts.
				.039 qts. in 4 yrs.

Milk increased 88 per cent in cost; decreased 8.7 per cent daily per capita consumption.

†1 lb. milk powder = 11.3 lbs. milk.
* No export reported.

PARTIAL ANALYSIS AND SUMMARY OF RECEIPTS OF DAIRY AND SUBSTITUTE PRODUCTS IN BOSTON MARKET

1. In 1919 there was 28.7 per cent more milk and cream shipped into the Boston market by rail than in 1916.

2. The price had advanced from 9c to 17c per quart, or 88.8 per cent.

3. According to Dr. J. O. Jordan (Table VI) in Boston proper the per capita consumption of milk had only decreased 8.7 per cent in four years, in spite of 88.8 per cent increase in cost.

4. For a four-year period under old price conditions with the high price at 9c per quart in 1916, the rail-shipped milk increased practically 15,000,000 quarts. On the other hand, for the four-year period ending with 1919, with a high price of 17c per quart, there was an increase of rail-shipped milk of 47,000,000 quarts.

During this time several agencies have helped the business.

(a) The Regional Milk Commission was appointed. The data presented and accepted helped to fix in the public mind that milk should be paid for according to cost.

(b) The Agricultural College and the U. S. Department of Agriculture were working on educational work showing consumers that they were getting high values for money spent for milk.

(c) In 1918 the Food Administration did all possible through advertising, etc., to stimulate the use of milk and dairy products.

(d) In 1919 the Boston Milk Campaign spent $36,000 in advertising and on educational work relative to milk in the schools.

(e) During this time there has been no derogatory outbreak of the press against the milk business in general.

5. Table II shows an increase of 154 per cent in the use of condensed milk in four years. The liquid milk equiva-

lent to the condensed milk going through the Boston market was equal to 69 per cent of the rail-shipped milk going into this market.

Part of the large increases may be traced to the shortage of sugar, people buying sugar condensed. Dr. Jordan says that at one time the sugar condensed sold at a price that made the milk cost 14c per quart, when liquid milk was selling at 17c.

6. Table III shows an increase of 38 per cent in the use of milk powder in four years, having a liquid milk equivalent of 11,750,000 pounds.

7. Table V shows there has been an increase in the receipts of oleo in four years of 120 per cent.

It is difficult to tell the amount of the liquid milk substitutes actually used in Boston. I could find no record of exports, so assume that they were used there and in nearby territory. The liquid milk substitute manufacturers have been active in advertising for years.

"Civic money spent for health is the best possible civic spending."

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

GEORGE E. BOLLING, *Chairman.*

This is the year when the Committee on Standard Methods for the Bacteriological Examination of Milk of the American Public Health Association were to submit a revised report embodying a number of changes in methods and interpretation of results. As that committee has so far furnished us with the only standard technique under which we have worked, it seemed advisable to your committee to cooperate this year with the American Public Health Association in all possible ways in order to bring about a more harmonious understanding. Considerable progress toward this goal has been made. Any criticisms of the first copy of the proposed report submitted to us we tried to make constructive, and as a number of our suggestions appear recognizable in the final draft we feel that they were so received.

The chief changes are:

Introduction of colorimetric methods for determining reaction.

Greater emphasis has been placed upon the necessity for eliminating possible errors in grading milk through the analysis of a series of samples; and more specific cautions are given against attempting to make finer distinctions in quality on the count basis than are justified by the accuracy of results.

3. Specific directions for making media are given.
4. The direct microscopic count is fully described.
5. Recognition is given Frost's technique.
6. The sediment test is described.

A number of laboratories, including the one where the first municipal bacterial limit regulation in the United States was enforced, have consistently adhered to the use of meat infusion agar as giving an unbroken series of results which are comparable from year to year. In recognition of this fact your committee has recommended the inclusion of the following paragraph:

"The committee is not opposed to the continued use of meat infusion agar in those laboratories that have a number of years' records based on its use; but in the interests of uniformity urge the use of meat extract agar."

From our conference we have reason to believe this request will be granted. The final draft of the report was accepted at the San Francisco meeting of the American Public Health Association and ordered printed.

As inspectors of milk seeking efficacy in our work we require efficient methods of technique to attain such a result. Your committee feels that with the addition of the paragraph specified above the latest draft provides us with proper technique and recommend that it be adopted also as standard for this association.

DISCUSSION

Dr. Price: I think that we are under considerable obligation to this committee to have secured this promise of agreement. It seems to me that the great usefulness that might be expected from the bacterial count has been limited by lack of uniformity, or perhaps the lack of understanding with respect to the bacterial count that has prevailed in different places. It seems to me it is advisable that something be said as to the general usefulness of the bacterial count more than has been said in our sessions so far.

Referring to the very interesting paper that Mr. Kilbourne presented, in which reference was made to the wide variation which sometimes occurs under prevailing conditions when samples of the same milk are analyzed in

different laboratories, and even when different samples of the same milk are analyzed by the same personnel, but when that personnel does not know the identity of the two samples: the literature is full of just such statements are that, and most of us are familiar with the instances of such conditions.

It has been my experience that with the bacterial count, like most anything else, you get out of it just about what you put into it; and if the technique of making bacterial counts is conducted by a personnel which has not been trained more than a few weeks, as has been advocated in some places, why then it is to be expected that there will be wide variation in the counts. And if, as has been demonstrated, officers have demanded low bacterial counts within a very short space of time from the personnel who are charged with the control of milk supplies, then the chances are that that personnel will get what is desired by whatever means, and I have heard that such demands have been made on the personnel.

However, if the bacterial count is conducted by trained and competent workers, who are conscientiously seeking to secure exact results, I have no doubt, and it has been my experience, that results are obtainable which are very closely approximate. If the laboratory personnel is informed that the results desired are those which actually exist—if the laboratory personnel has suitable training, though this is not to be excessive training, and if the laboratory personnel is given time to perfect its methods—in other words, if a reasonable amount of diligence is put into the count, then closely approximate results may be obtained, and are the rule.

It seems to me, Mr. President, that some mention should be made during our sessions of that fact, as against the greater amount of attention that has been given to the fact that under prevailing conditions some laboratories do give results that do not approximate even remotely.

"Truth is truth to the end of reckoning."

MILK PLANT CONTROL.

BENJAMIN VENER, *Technical Expert, Tait Bros.,* Springfield, Mass.

To control is to be master and boss of the situation. A moving body cannot be controlled without brakes, checks, or resistance by some other counter force.

So with milk plant control. It is only with knowledge of milk, the source of the supply, its production, handling and transportation, that this great collecting, processing and distributing business can be actually taken in hand and controlled in a way that will enable the consuming public to get the best.

INSPECTION—COUNTRY END.

1. Country Stations.

The country station, be it equipped with milk handling machinery or not, is the major source of any large city milk plant's supply. Periodic inspection of these plants serves to improve the supply: First, by personal contact with producers, thereby learning their problems, such as tenantry conditions, economic difficulties, transportation handicaps, and criticisms of the local representative; second, by suggestions for improvements of sanitary conditions, changes for greater business efficiency; by definite results, such as observing the station's chemical and bacterial records, testing the milk for flavor, odor, temperature, acidity, sediment at the platform, and chemical and bacterial examination at headquarters; and by advice to patrons pertaining to clean milk, milking machines, strainers and the care of milk in general.

2. In Transit.

For perfect control the milk plant must know the conditions under which the milk is shipped into the city. Whether

the milk starts at a proper temperature, is of good flavor and has a low bacteria count. Whether shipped in ice cars or baggage, whether the milk needs reicing, whether thrown off at a junction and how long it remains before picking up, especially if unprotected from the sun and cold. Whether jacketed at certain times of the year, especially cream shipments, whether damage claims can be collected for negligence by carrying shipments by, or for injury to cans or cases by faulty handling. All these things play an important part in the economic handling of milk from the milk plant standpoint. Milk inspectors sometimes lose sight of many of these perplexing problems with which the large milk plant is ever contending. One large milk plant ships thousands of tons of ice to its various country shipping stations, so there can be no excuse for the milk starting on its journey at an improper temperature. If the milk can be kept close to 50° F. throughout its transportation, much of the sour milk loss will be eliminated. Milk on a journey of 60 to 400 miles, certainly, must leave the country station cold, in good condition and subject to no delay. This is the problem of milk transportation.

INSPECTION—CITY END

1. Milk Platform.

Proper handling of milk does not end when the milk reaches the milk platform in the city. Here prompt service must be at hand to meet the milk cars and quickly deliver to the plant. Endless troubles can be thus eliminated, such as pilfering, mix-ups in cans, placing of the cars accessible to the auto trucks, spillage and the elimination of sour or frozen milk exposed to climatic conditions. Some dirty milk was traced to cinders falling into the cans by careless handling.

2. At the Milk Plant.

(a) Station Milk: Here the cans from different stations are checked up. The number in the shipment recorded and

notes taken as to whether the cans are full, temperature, flavor and odor (acidity test is made if necessary) and samples taken of the lot shipments for chemical and bacterial examination.

(b) Local Milk: This is milk usually made within a radius of 10 to 40 miles and comes in by auto, baggage car or wagon. This milk is also checked either by weight or volume. The condition of the milk is noted; if off, samples taken for bacteria, sediment and acidity. Periodic examinations of this local milk are made for chemical and sanitary condition. This report is usually sent to the patrons on a printed form containing all necessary information and the remarks appropriate to these results.

(c) Special Milk: Daily examination of this milk should be made for chemical and bacterial examination and the report immediately mailed to the patrons.

(d) Checks on Washing and Sterilization:

(1) Bottles: Hydraulic bottle washers are very efficient in the rapid washing of the average bottle as returned from household use, and as far as practical leave a milk bottle sterile. Many bottles that are returned from factories, lunch rooms, stores and restaurants come back in very bad condition and these should be given special care and attention, and individually soaked, brushed, and then sent through the hydraulic machine. Most complaints of dirty bottles can be directly traced to the latter class of bottles getting by with the comparatively clean household bottle.

(2) Cans: All cans should be thoroughly hand-brushed occasionally along the seams, especially around the collar and shoulder. Cans that are battered and not dry, even though thoroughly washed offer a fertile field for bacterial growth and subsequent initial contamination for milk placed in these cans. Investigators have shown an increase in count from 80 to 600 times the initial count in cans that were moist and traveling under warm conditions.

(3) Apparatus: Apparently pasteurization is a factor of safety and an economic insurance, but why this costly process, if at the end of a run, due to unclean apparatus, milk has a higher count. We are quite aware of the fact that much apparatus does not offer itself to sterilization in the true sense of the word. In sound milk plant practice it is best to discard the first milk going through the system. Never start up a day's run with special or baby milk. All metallic surfaces coming in contact with milk should be thoroughly washed and dried, especially surface coolers exposed to the air. Pumps and pipes should be daily disconnected, washed, steamed and drained dry. Bottling machines should be taken down and all moving filling parts be cleaned in live steam, and rubber parts sterilized, rinsed and dried. Experience has pointed out that the bottling machine when not properly cared for is as great a source of bacterial increase as all other contamination put together.

(e) Processing of the Milk: Checks are made of the bacteria counts at the various steps in the process, from the receiving tank or storage tank, after clarified, before and after pasteurization, and from the cooler and the final bottle or can. These counts in series are valuable and an index either as to the quality of the milk or the condition of the milk apparatus, but as individual counts from any particular part of the process would to my mind be valueless, excepting the count in the final container. The count in the final container should not mean much to the inspector unless he knows the source of the supply, the age of the milk, whether held positively or not, and the time of the day or period in the day's run which this milk is the result. Five samples of any particular day's run should give a fair index as to the sanitary condition and efficiency of any plant's operation. The milk plant technician should be able to discover any faults in the process of pasteurization, such as rushing the milk through, inaccuracies in chart periods or

temperatures, whether the milk is being cooled properly and quickly. He should trace out contamination from elbows, T's, valves, leaky gear cases or stuffing boxes, leaky coils, recognize whether full efficiency is being derived from the cooling media, whether cold boxes are at a proper temperature or not, and he should be able to recognize any signs of a breakdown or interference with the steady flow of milk.

Care must be taken that the milk is cooled low enough so that the temperature of the milk in the final container shall be lower than 50° F. The average empty quart bottle, stored at room temperature, will raise the milk temperature from seven to nine degrees Fahrenheit and the pints from four to seven degrees Fahrenheit, with still greater jump if milk is placed directly into bottles coming immediately from the washing machine. Consequently it is a sanitary measure to have the milk enter into the bottles close to 40° F., so that the final container's temperature will not be over 50° F. The cold boxes or refrigerator rooms should be so fixed as to hold the peak load below 50° F., preferably around 40° F. The temperature of the box invariably increases, due to the warm cases and to the continual opening and closing of doors. This increase of temperature to a few degrees below or above 50° F. is a source of much trouble in summer. Most plants play safe, especially in the hot days, to ice the cases for the night delivery.

The inspector, now more than ever, should find it his duty, because of his information at hand in regard to the sanitary and chemical analysis, to cooperate with the farmers' organizations, the dairymens' league, or the county agents and state the facts in regard to the poorer class of milk of the farmers supplying his territory, and with these officials stimulate interest and cooperation for the improvement of the milk supply. The country is flooded with milk, and prices are bound to go down, and it is the poorest grades that will be hit the hardest. It is an economic factor in stimulating farm progress and for the furtherance of sani-

tary progress for the inspector to start the ball rolling through the officials—State, farm or Federal—and so improve the supply that when prices fall the farmers in his territory can truthfully say that they received top prices for their product, and the quality was such that it could not be cut for sanitary reasons. The time has come when clean milk propaganda, costly plant routine for the improvement of the supplies, must be taken hold by the farmers or their organizations and the clean milk banner unfurled and carried forward by them and for themselves.

"If a milk supply is persistently high in bacterial count it means carelessness and danger, whereas if a milk supply has a persistently low count it means care and safety."

A SUCCESSFUL FARMERS' COOPERATIVE MILK PLANT.

L. B. Cook, *Manager Kane Dairy Cooperative Association,* Kane, Pa.

During the last few years there has been considerable agitation in regard to cooperative enterprises for farmers. This is especially true in Pennsylvania, where during the last two years several cooperative buying or selling organizations have been organized or reorganized. These cooperative organizations cover many phases of agriculture, including milk distribution. Cooperative milk plants would seem to have their best fields in small cities where now a number of farmers are peddling raw milk, and where no successful milk plant is operated. In our large cities many milk dealers are well equipped and serving the producer and consumer in as satisfactory a manner as could be expected.

Kane, Pa., is a city of 7,000 population, located in McKean County, which is one of the extreme northern counties of the State. The country around Kane is very mountainous and not adapted to farming. Located over 2,000 feet above sea level, the season is so short that some vegetables and crops do not mature. There are a few good farms, mostly operated by Swedes who keep a few cows. A considerable number of dairymen used to peddle milk from house to house. A pasteurizing milk plant was started by a private enterprise, but the shortage of milk and too many farmer dealers in competition soon closed this plant.

At last the county agent and others decided that Kane was a good place for a cooperative milk plant, so they began an agitation and in the early spring of 1919 such an organization was formed.

The delivery equipment, routes, etc., held by the farmer

dealers were purchased by the new organization, and also the old abandoned milk plant, which was located in the basement of one of the stores on a main street. On July 1, 1919, this new organization began buying and selling milk under the name of the Kane Dairy Cooperative Association.

The plant purchased was in a bad condition, which meant considerable repairs and new machinery. The equipment and conditions were not right for a satisfactory product and many complaints were daily received from dissatisfied customers. It was impossible to secure a competent manager at the salary fixed upon, so at times there was no manager and the farmers had to run the plant. This, of course, was not satisfactory. Credit should be given to a few of the farmers who stood by the plant with the determination that cooperation was based on a sound principle and that this plant must succeed.

During the first year many adverse conditions were met. Women's clubs, doctors and others opposed the kind of pasteurized milk that was being sold. Some of the farmers became dissatisfied and wanted to drop out of the association and take up their old milk routes. However, through all these adverse conditions they struggled with the determination to win.

It was finally decided that in order to handle a satisfactory product new machinery was needed. Several thousand dollars were spent for this and soon after April 1, 1920, when I took charge of this plant, the new machinery began to arrive. However, before this new machinery was installed warm weather, a surplus of milk and help shortage combined to make business difficult during the month of April. New machinery was installed, competent help was secured and our complaints of sour milk began to diminish. Our surplus was soon handled through butter, buttermilk and cottage cheese.

Under the old conditions, fresh morning's raw milk would

keep sweet much longer than our pasteurized milk, and consequently the demand was increasing for raw milk; but now that pasteurized milk is giving satisfaction, so no raw milk is sold.

Before the weather became too warm this summer we shipped 200 or 300 pounds of cottage cheese per week to nearby towns. We also developed a demand for fresh creamery butter, which increased our butter trade three or four times. The month of June was our most difficult month to handle the surplus, but even with a big surplus of milk we paid the farmers 7¼ cents per quart.

At present we are receiving milk from about 55 farmers. Our largest amount received per day was about 2,800 quarts. We have no facilities for weighing or testing the milk, so buy it on a quart basis.

Four routes and the counter handle nearly all of the city's business. There are no other milk plants and only two farmer peddlers.

With all the problems to overcome, this association averaged to pay the farmer 8.62 cents per quart, or a little over $4.00 per hundred pounds, for milk during the first year. At our present rate we should do better during the current year. For the month of September, just past, we paid 9½ cents per quart. At present milk is being retailed at 15 cents per quart.

Each month the directors, who are farmers, meet and discuss matters pertaining to the plant. All equipment is paid for by the directors out of stock money. A certain sum each month is paid the stockholders by the plant as depreciation on the equipment. Every one who sends milk to the plant must be a stockholder, and 6 per cent interest is paid on all stock.

Arrangements are made so the association serves the farmer in many other ways than merely buying the milk and returning him all the profits. Fertilizers, seed, milk

cans, milk coolers, etc., are purchased at wholesale and sold at cost.

This milk plant has opened a good all-the-year market for dairymen in this section. Previously there was no good, steady market to induce dairymen to enlarge their herds. Now many are keeping more cows and buying pure breds. I believe this cooperative milk plant will be a big factor in dairy development around Kane.

"A wise man will make more opportunities than he finds."

THE MILK INSPECTOR'S DUTY TO THE PUBLIC

PROF. H. A. HARDING, University of Illinois, Urbana, Ill.

Too often the activities of the milk inspector are limited by the ordinances under which he works or by the caprice of some official to whom he is responsible. If his duty to the public were a simple one or one regarding which we were all in entire accord it would not justify a discussion at this time.

As individuals we are inclined to define the duties of the milk inspector in the light of our local situation. In any community the relation of the public to the milk question changes as the public begins to understand the milk question and the responsibility of the milk inspector to the public changes accordingly. This continual shift in his responsibilities is the basis for much of our differences of opinion regarding his duties.

The longest recognized relation of the milk inspector to the public is that of policeman or protector from fraud and danger. At first the main, if not the sole duty, of the inspector was to protect the public from skimmed and watered milk. The danger of spreading disease through milk was also early appreciated and the responsibility of the inspector to protect public health by finding and removing sources of contagion has since been emphasized.

In many communities the milk question has not progressed beyond the stage at which the milk inspector is regarded as a policeman and in even the most advanced communities this police responsibility must be carried. However, as the situation develops this part of the inspector's work gradually becomes less prominent.

The next stage of development puts the inspector into the role of an educator of the public. Frequently his first duty

in this respect is to impress the public with the danger of raw milk. If the education stops at this point, as is too often the case, the public acquires a vague fear of milk which leads to a reduced consumption of this valuable food. As a result our present consumption of milk is rarely over a pint per capita per day when for the good of the public it should be about double that figure. Education of the public should not stop with instilling this fear of milk. It should make clear how easily milk may be made safe by proper pasteurization and should lead the public to insist on and have faith in properly pasteurized milk. This educational work should include the fact that milk has peculiar food value not only to the growing child but also in maintaining the health of the adult. Milk shows and milk campaigns are matters in which the public have a right to expect the milk inspector to take an active part.

This second stage of the milk situation has been reached in many communities and the wide-awake public are looking forward to the next development of this work. The work of milk improvement in any community should result in the general milk supply being made safe through proper pasteurization. It is also relatively easy to have it made clean by proper supervision and the larger part of it is usually fairly sweet, but in practically all cities there is much difference in the food value.

Having awakened the community first through police activities and later through educational effort there comes to the inspector an increasing number of inquiries from individuals as to the relative value of the local milk supplies. Making lasting improvements in a milk supply is closely connected with the success of the inspector in keeping the inquiring public well informed regarding the true quality of the milk.

It is a matter of common knowledge that in the past inspectors have usually avoided answering the direct questions of the consumer regarding individual supplies. A number

of reasons have been given for this evasion and we have rarely admitted the real reason; namely, we did not have the correct answer in a shape where we could present it clearly to the inquiring public and at the same time defend ourselves from the charge of partiality when approached by the other retailers. If we are to discharge our duty to the public we must assemble the facts obtained by our inspections in such a form as to answer the natural and legitimate questions of the public without at the same time giving occasion for any just criticism on the part of the milk producers or dealers.

What are the natural and legitimate questions of the consumer which he has a right to expect the milk inspector to answer? While it is true that a fool can ask more questions than a wise man can answer and even intelligent people ask a wide range of questions, there is what might be called a normal range of questions regarding milk

The four most common and most pointed questions which the consumer can and does ask are:

1. Is the milk rich?
2. Is the milk safe?
3. Is the milk clean?
4. Is the milk sweet?

In our attempts at impressing the public with the food value of milk we have recently laid great emphasis upon its vitamine content. In our presentations of milk as a source of human energy we have pointed out that in normal milk about one-half of the energy comes from the solids not fat. Notwithstanding the educational work we have done in this matter the public continue to center their interest in the fat content of milk. Accordingly we will be able to answer their question as to the richness of the milk most acceptably if our reports show clearly just what fat content each source of supply carries. This question is being answered in some cities by the dealers voluntarily putting upon the cap of each bottle the fat content of the milk. In such cases it is plainly

the duty of the inspector to inform the public as to the care with which the milk in the bottle is kept up to the amount stated on the cap. It is quite possible that in the further development of this question it may be desirable to furnish additional information regarding the food value of various supplies on the market, but in any case the facts regarding the fat content of each source of supply can be and should be readily available to the public.

While it is probably still true that in a majority of communities the question uppermost in the minds of the public concerns itself with the richness of the milk, it is a hopeful sign that in an increasing proportion of cases the first thought is regarding the safety of the milk supply. Oftentimes this question regarding the safety of the milk arises from a vague feeling that milk is dangerous and mingled with this feeling are often grotesque ideas which have no foundation in fact. At the same time there is the growing appreciation that a very considerable fraction of our raw milk carries living germs of tuberculosis. On this account, in order to be justly considered safe there must be the best of direct evidence that the cattle are free from this disease or that the milk has been properly pasteurized. Milk lacking either of these guarantees of safety should be considered as unsafe milk. While it should be the aim of every milk inspector to have his entire milk supply safe, when this is not the case the responsibility of the milk inspector to the public will not be fairly fulfilled until the facts regarding the safety of each milk supply is plainly reported.

It may not be amiss to remark in this connection that having an ordinance requiring pasteurization or even passing milk through a pasteurizing machine does not necessarily result in safe milk. Given such an ordinance or such a machine it is the duty of the inspector to be sure that the pasteurization is properly done, and if such is not the case the public should be informed.

While richness and safety are the points concerning which

the public most frequently wish information, they are also interested to know regarding the cleanliness of the milk. The public demands and has a right to expect clean milk and it naturally turns to the milk inspector for information as to the varying degrees of cleanliness of the local supplies. In what form shall the inspector present the desired evidence? At present when asked regarding the relative cleanliness of two milk supplies we often refer the consumer to the relative germ content of the milks in question.

Is the germ content of a milk a good measure of the amount of dirt in it? The majority of the discussions of dirt in milk proceed upon the erroneous inference that the dirt in milk is mainly cow dung. Such is not the case, but as the point under discussion is the accuracy of bacterial counts in measuring dirt let us for the moment accept the supposition. Fresh cow dung when tested by the plate methods commonly employed in determining the germ content of milk will ordinarily show about 5,000,000 germs per gram. If for convenience in figuring we take a quart as equalling 1,000 c.c., each gram of cow dung added to a quart of milk will increase the germ count of the quart of milk by 5,000 per c.c. The worst milk on our city markets rarely carries as much as 5/1000 of a gram of dirt per quart. If all of this dirt were composed of fresh cow dung it would accordingly increase the germ count of that milk by only 25 bacteria per c.c.—a number too small to be determined by any means at hand. While the 5,000,000 per gram of dirt as used in this illustration is a liberal estimate for much of the dirt actually falling into milk it should be noted that if this dirt carried a germ content of 50,000,000 per gram, 5/1000 of a gram of dirt per quart would increase the germ count but 250 per c.c. Even if we assume a germ content for the dirt of 500,000,000 per gram, one hundred times the bacterial plate count of fresh cow dung, the corresponding addition to the germ content of our dirtiest milk would rarely be over 2,500 per c.c.

If this illustration of the entire inapplicability of bacterial counts as a measure of dirt does not suffice, let us come at the matter from another angle. Boston has long prided itself upon requiring a germ content in its city milk supply below 500,000 per c.c. As we have already seen, the addition of a gram of fresh cow dung to a quart of milk increases the germ content of the milk by about 5,000 c.c. Accordingly if one started with a fairly low germ content milk it would be possible to add approximately 100 grams, about 4 ounces, of fresh cow dung to a quart of milk before its germ count would exceed the Boston standard. Such being the case, the fact that a milk gives a bacterial count of less than 500,000 per c.c. is far from being evidence that it is a clean milk. To put the matter bluntly, the bacterial count of milk is too crude a measure of the dirt content to be of any practical use for that purpose. Or, put in another way, passing a milk as clean because it has a low bacterial count will provide an official endorsement of milk which is too dirty to have any commercial value.

If the bacterial count is worthless as a measure of the cleanliness of the milk, what evidence of cleanliness of milk shall we offer to the inquiring public? The best thing available is the evidence furnished by the sediment test. The limitations of the sediment test are well known to all but when properly used it will fairly accurately measure dirt present in the proportions of one part of dirt to 1,000,000 parts of milk. As it is the best means we have at hand we will do well to use it in bringing the facts regarding the cleanliness of the milk to the attention of the public. Fortunately, when the facts are at hand it will usually be found that practically all of the milk is surprisingly clean.

The last of these four questions regarding the milk supply in which the public are deeply interested is the question of the sweetness or keeping quality of the milk. It is perhaps significant that the public rarely turns to the milk inspector for information on this subject. This is partly because the

public can readily observe this quality for themselves and partly because they have not been able to make much use of the information which the milk inspector has given them on this subject. We will all agree that the germ content is a good measure of the probable keeping quality of the milk, though by the time the count is available the milk is ordinarily sour. However, the count is at best a highly technical measurement and not easily translated into days or hours of sweetness of the milk. To be sure there are coming to be a number of other measurements of keeping quality available. In an earlier paper at this meeting a new method has been presented and literature contains a number of other methods of estimating the keeping quality of milk. If we are to give the public information regarding keeping quality which they will understand and use there is much to be said in favor of holding a sample of the milk in question for 24 hours at 60 or 65° F. and noting its condition at the end of that time. If we can say to the public that a given milk supply can, or cannot, be depended upon to remain sweet for 24 hours at a given temperature we shall have given a very satisfactory answer to its question regarding the keeping quality of the milk.

This presentation of the duty of the milk inspector to the public may be briefly summarized by saying that when the work of the inspector as policeman and educator has brought individuals to the point where they desire and will use specific information regarding their own milk supply, a twofold responsibility rests upon the inspector; (1) he should accurately determine the facts which the inquiring public desire to know, and (2) he should present these facts so simply and directly that they may be understood and used by the public.

If we can say to an inquiring consumer that a given milk supply is rich, safe, clean, and sweet the consumer will depart satisfied that we are doing our duty and rendering a genuine service.

REPORT OF COMMITTEE ON PASTEURIZATION OF MILK AND CREAM

C. E. CLEMENT, *Chairman*

The committee has not observed especially new methods or gained new ideas of special importance in the short time that has elapsed since the last report on this subject. However, the committee deems it advisable to present in its report some of the more important phases of the question and though some of them have no doubt been mentioned before, a repetition can do no harm.

In the first place, only milk as fresh as possible and of a low bacteria count should be used. At many plants, especially small plants, the only practical tests that can be given the milk are taste and smell. Those tests, however, will usually eliminate any real bad milk.

APPARATUS

All pasteurizing apparatus should be as simple as possible, with the least possible amount of inaccessible parts, so that it can be easily cleaned and sterilized.

Some plants make the mistake of getting a boiler of too small capacity.

HEATERS

The heating area should be large, so that a large quantity of heating medium can be used. In this way the temperature of the medium need not be excessively high and the milk can be heated quickly without danger of overheating any part of it. Slow heating is not desirable as there is some chance of milk souring before it reaches the pasteurization temperature. The heating medium should be hot water or a mixture of steam and hot water, but direct steam should

not be used in the ordinary heater as there is danger of overheating some of the milk.

The "regenerative" system is used by some plants and considerable economy in the use of steam is effected. This system may be "water regenerative," or "milk regenerative." The former is preferable, as with the "milk regenerative" system there is considerable milk piping to be cleaned. With this system the cold milk usually is pumped through the first section of the cooler before it goes to the pasteurizer. In this way the incoming cold milk cools the hot milk from the holder and is itself heated by this hot milk so that when it reaches the heater it has been heated to about 100° F. The pasteurizer should be of large enough capacity to allow milk to be pasteurized without overtaxing the machine and without sending the milk through it too fast.

HOLDERS

Holders are either positive vat or compartment holders or continuous holders. There are several types of continuous holders, and with all of them checks should be made to see that all the milk is held the desired time. Even then we are not sure of the accuracy of this type of holder unless the flow of the milk to the holder is accurately controlled. The speed of the pump must be as accurately controlled as is possible, and when gravity is used, some sort of a control valve can be used that will allow only a certain quantity of milk to the heater and from the holder in a given time.

With automatic compartment holders it is essential that the valves operate properly. The valve leading from the compartment that has been emptied must always close tightly before the milk starts to flow into it from the heater. Much attention should be paid to see that none of the valves leak, as leaky valves in any part of the apparatus will often result in milk passing through without being properly heated and held.

Good results are being obtained by use of a series of vats,

or a battery of jacketed tanks as holders in conjunction with some form of continuous heater.

COOLERS

The quick cooling of the pasteurized milk to a low temperature is essential, and the importance of this part of the operation is sometimes overlooked. In order to properly cool the milk a cooler with a sufficiently large cooling area is necessary. This is very important, especially at small plants where the cooling of the milk is often a serious problem. Many small plants make the mistake of not getting a cooler large enough to cool the milk fast enough. The result is that the men often let the milk over the cooler faster than it can handle it and the milk is not properly cooled.

STORAGE AND DELIVERY

It is especially important that the milk be kept cold from the time the pasteurizing process is finished until it is delivered to the consumer. This is where many plants fall down. If the storage room is not kept at a low temperature, the temperature of the milk will rise and sour milk will be the result. At one plant the temperature of the milk in the storage room rose 5 or 10 degrees during the night. When milk is bottled at a temperature of only 55° F., as is sometimes the case, this is a very serious problem. The storage room must be well insulated and either artificial refrigeration or plenty of ice used, preferably the former for best results. The temperature should be kept well below 50° F. When the customers on delivery routes are at all scattered, the milk should be iced on the delivery wagons during the hot weather.

MISCELLANEOUS

All milk handling apparatus should be thoroughly cleaned and sterilized after each use. This includes tanks, heaters,

holders, coolers, fillers, milk pumps, piping, fittings, etc. Unless this is done good results from pasteurization cannot be expected.

Automatic temperature control apparatus is essential for all continuous types of pasteurizers, and recording thermometers should be used with all pasteurizers.

So-called "electrical sterilization" of milk has been tried in England and the following is quoted from the report of the investigators, Profs. Beattie and Lewis of Liverpool University:

"Milk can be rendered free from B. coli and B. tuberculosis by the new electrical method described without raising the temperature higher than 63° or 64° C. This temperature effect is very short in duration and in itself is not the principal factor in the destruction of the bacteria. Though the milk is not sterilized in the strict sense of the word, yet the percentage reduction of the bacteria taken over a period of a fortnight is 99.93. The keeping power of the milk is considerably increased.

"The taste of the milk is not altered, and so far as careful chemical examination can determine, the properties of the milk are not in any way impaired. The milk can accurately be described as 'raw milk' free from pathogenetic bacteria."

They apparently used a low temperature for a short period of time.

The quantity of milk pumps, piping, fittings, etc., should be reduced to a minimum.

There should be frequent checks made on the pasteurizing process to see that the thermometers are correct and also to see that the holding time is accurate.

Some dealers use the first milk coming from the apparatus for wholesale trade in cans, and this seems a good plan as this milk may often be of a higher bacteria count.

Exhaust steam may be utilized to advantage for pasteurizing.

Some health departments require that pasteurization equipment come up to their standard before they will allow it to be installed or used in their territory.

Pasteurization by means of electricity has been introduced within recent years. Most authorities consider that the destruction of the bacteria by this process is due to the heat produced by the electric current rather than by the electric current itself. The heating is done quickly, and if the heat can be produced as cheaply or more cheaply by this method than with the ordinary steam and hot water method the process should have considerable future possibilities.

For some time the Minnesota Board of Health has had control of the pasteurizing plants of the State. They have a licensing system and unless milk is pasteurized by a process that meets with the approval of the board, it cannot be sold as pasteurized milk. This plan has proved very successful.

The committee believes that one of the greatest problems is to get the public to appreciate the value of pasteurized milk. In many small cities where farmers are peddling milk, many people have come to believe that this milk peddled by the farmer is the best and they do not appreciate or want pasteurized milk. The trouble lies, to a large extent, with the medical men who are advisers to many people on such subjects, and oftentimes they are as ignorant as any of the value of pasteurization. They often prescribe raw milk where pasteurized milk would be as good or better. The matter does not stop with prescribing but many doctors, who should know better, talk against pasteurized milk. Doctors, health officers, etc., need more education on the value of properly pasteurized milk.

SUMMARY

1. Only good milk should be pasteurized.
2. Only efficient apparatus should be used.

3. A boiler of ample capacity is essential for a pasteurization plant.

4. Heaters with a large heating area are desirable and excessive temperatures of heating medium should not be used.

5. The holding process must be positive and accurate. Continuous holders should be checked often for accuracy. Automatic compartment holders must always operate accurately.

6. Automatic temperature control is essential for all continuous pasteurizers.

7. Recording thermometers should be used at all pasteurizing plants.

8. The milk should be heated quickly.

9. The pasteurized milk should be cooled quickly to below 50° F.

10. A cooler of ample capacity is essential.

11. The milk should be stored after pasteurization in a well insulated storage room at a temperature of 45° F. Milk should be iced on the delivery wagons in hot weather.

12. Leaky valves in the apparatus should be eliminated.

13. Foam, especially on continuous holders, results in a high bacteria count.

14. The speed of the milk pump usually depends on the amount the valve is open and on the boiler pressure. The pump should be carefully controlled so that it will run at a uniform speed.

15. Where there is a gravity flow to the heater and from the holder, a control valve is sometimes used so that the flow to the heater and holder is uniform, only a definite quantity being allowed to pass through this valve.

16. Coolers or bottle fillers that have been used for cream or skim milk should not be used for pasteurized milk until they are thoroughly cleaned and sterilized.

17. Live steam under pressure should be used to sterilize milk pasteurizing and handling apparatus.

18. Doctors, health officers, and the public generally should be educated as to the value of pasteurized milk.

19. All market cream as well as milk should be pasteurized.

20. All "pockets," i. e., points where the milk is not subjected to the heat, should be eliminated from the pasteurizing apparatus and any pipe in the holding apparatus that is exposed should be jacketed so that the milk will be held at the proper temperature.

21. Special attention should be given to the first milk and the last milk through the pasteurizer, to see that the proper amount of heat is given it.

22. Where the last milk is drawn out from the holder, as is required in some types, it is important that the piping and pump used have not been used for raw milk.

"Life and business are just like a bank account; you can't take out more than you put in—and get away with it."

THE MILK INSPECTOR, THE PART TIME MAN

A. W. LOMBARD, *Assistant Director,* Massachusetts Division of Reclamation, Soil Survey, and Fairs, Boston, Mass.

Lord help a man who is on the last afternoon's program of a three-day session of any convention; and if he has experienced the weather we have had in the last two days, then the Lord help him twice. We have had moving days in this room almost every day, but I notice this afternoon they are breaking up housekeeping in the next room. I myself am satiated, you might say, with milk inspection information which I have gained during the last three days. I assume you people are in much the same condition, so anybody who speaks this afternoon is in the position of a man who has got to speak to keep awake, to entertain, or furnish a little information if he can.

Your Secretary about three weeks ago sent me a letter. It was not exactly a letter. I would not dignify it by calling it that. It was a slip of paper, simply torn off like that and put into an envelope, in which he said, "Please send title of your paper at once." When our Secretary sends a request like that it is equal to a command, so I immediately got busy. Now, you know when a minister has worn out his usefulness in any locality he moves to another, for the simple reason he cannot think of anything original, and he thinks in his new location he can warm up some of his old sermons and get by with it. So I immediately thought of any papers I had written or any address I had given on milk inspection subjects, and I happened to hit on this: The Milk Inspector, the Part Time Man.

By the way, I wrote that paper and never delivered it, because something came up which prevented my going to

the meeting, so I placed it in my desk, and when I came to hunt for it before I left Boston I could not find it.

Now, we have perhaps in Massachusetts a condition different from many of the other States. Territorially we are small; numerically we are large; agriculturally we are mediocre. We have, however, 148 men in Massachusetts who are dignified with the title of inspector of milk. Of that number 16 receive a salary sufficient for, or at least a salary for which they give their entire time. The other 132 are part time men; that is, men who are devoting from a few hours a week to a few hours a day to milk inspection. These men earn the principal part of their livelihood from some other source, and yet they are doing a very satisfactory piece of work along milk inspection lines. I think I am safe in saying that Massachusetts is second to no State as a State where milk inspection has been carried on. Both in length of time and efficiency, it is perhaps equal to the best.

Now these part time men I have divided in my own mind into four groups. First, the man who receives from nothing to $50 a year for his services. We have, strange as it may seem, some men who are philanthropically inclined who are willing to serve as milk inspector in their community for nothing, simply for the love of the work and for the good they can do to their fellow citizens, and the improvements which they can make in the local milk supply. We do not think we have a right to expect to receive much from those men who work for nothing up to $50 a year. We have a State license law in Massachusetts; where a town has a milk inspector, the dealer in milk must have a license. So the first group men issue licenses to both stores and dealers, thereby keeping a record of those engaged in the milk business.

In addition to that, if complaints are made to him, he in turn takes the matter up with the State Department of

Health, and they attend to or answer the request, or do what they can to help out in that community.

Now the second group men receive from $50 to $200. The men in this group have a testing machine perhaps, possibly a lactometer, and may determine roughly the amount of solid in a given quantity of milk, make sediment tests, etc., and in addition issue licenses. If they find cases they cannot handle themselves, or that their local health department cannot handle, they call on the State Department of Health to help them.

Then we come to the next group of men, receiving from $200 to $500 a year. Strange as it may seem, in this group we have a lot of pretty high-class men, men who are well qualified to fill the position of milk inspector and give their entire time to it. In some of the towns where these men are employed they have no laboratory and no laboratory equipment. Some of these men are bacteriologists, some chemists, some physicians, and some business men, who have made a special study of the subject and have worked out something which we think is very satisfactory. In an adjoining town to the town in which I live is a man who, besides being inspector of milk, is inspector of plumbing, inspector of wiring and inspector of building. You would not say that man was very much of a milk inspector or that he would do very good work. Let me tell you what that man does do. He issues licenses, collects samples, makes his own sanitary inspections and does his analytical work, both chemical and physical. The bacteriological work is done in an adjoining city where they have a milk inspector who is as fine a man as we have in Massachusetts and as well qualified. So that town gets the benefit of what the adjoining city is paying for, because those samples are taken and carried to that city laboratory, and reports come back to those towns. As a side light I might add that during a survey we made of a certain number of cities in Massachusetts, that town stood away up among

the first in the quality of its milk, both in food value and from a health standpoint, showing that that work can be done and excellent work can be done under such conditions. That is a method which I would suggest to other cities where part time men have any appreciable amount of influence, taking advantage of a real laboratory, presided over by a man who knows his business, where you can have your chemical, bacteriological and physical examinations of milk made.

Then we come to the latter class, to the men who are devoting their entire time to milk inspection. Most of those men do good work in Massachusetts. The milk supplies in those cities over which they exert control is very good.

Now, it seems to me that this part time man proposition is a broader, bigger, better proposition than it sounds at first. I think there is no way that we can better create an interest in milk inspection, or make a better start to improve your milk supplies, than by just doing what we have done in Massachusetts. You will find as time goes on that many stations and towns that have a part time man will soon realize the importance of his work and the value of it, and you will soon have more full time men in your milk inspection service.

We do not pay large salaries in Massachusetts to our milk inspectors, even to the best, and even in the large cities, and it seems to me that there is a point that sooner or later must be rectified. Something must be done to increase the compensation given the men who are doing this kind of work. If you have any questions I shall be glad to answer them.

DISCUSSION

Mr. Flanagan: I would like to ask Mr. Lombard about what is the average pay of the milk inspectors, full time?

Mr. Lombard: I believe from $1,200 to $3,500. The average today is slightly over $2,000.

Mr. Archibald: I would like to ask Mr. Lombard how they ship these samples from the city where they do not have laboratories to the cities where they do?

Mr. Lombard: They usually carry them in automobiles. The greatest distance that I know of where one town is carrying milk to a city is about 25 miles. Of course our distances are not as great as in some other sections.

In one instance a laboratory is maintained in one town, and then a group of towns not too far distant unite in using it and pay so much per year for the service. The laboratory collects the samples, makes the analyses, and does the whole work all the way through. That particular laboratory now is doing the work for, I believe, something like seven or eight towns. They had a very fine vision, a dream, if you will, that they were going to do the plumbing inspection, the wiring inspection and the building inspection, and they were going to do all kinds of public health work from this one laboratory. However, it has not gotten far beyond the milk phase. The work they are doing is very satisfactory. Of course it is much better than any town could hope to have by itself alone.

Prof. Gamble: Mr. Lombard, isn't it a fact in Massachusetts and other States that the efficiency of the part time man has been influenced a great deal by State agencies visiting these different towns at intervals, to keep their interest up and keep them going in the right direction?

Mr. Lombard: I think that is true. The State Department of Health has its inspectors broadcast throughout the State all the time; the State Department of Agriculture has had a dairy division, and that dairy division has men constantly in touch with these men. We have a State Milk Inspection Association patterned after this Association here. We hold two or more meetings a year as the case requires, the part time man rubbing elbows with the full time man, or meeting the same men constantly, and thereby getting help in that way.

MILK INSPECTION

HERBERT E. BOWMAN, *Inspector of Milk*, Somerville, Mass.

Competent health officers are products of evolution. No branch of science has undergone more radical changes during the past decade than has the administration of public health control. However capable a health officer may have been a few years ago, his usefulness is limited now unless by study and counsel he has kept pace with the progress of science, aided of course by his own experience. While this is a general statement it has a particular application because the inspection of milk is inseparably connected with public health work and is perhaps its most vitally important division. Without effective milk inspection no community can expect to be free from epidemics or guarded against disease: while if the milk problem is satisfactorily solved, good results may be obtained even though allied agencies may be less effective. Whatever applies to the health officers applies to milk inspectors when the question of health administration is under discussion.

My purpose in this paper is to indicate the need of cooperation among health officers and between them and the communities they serve in order that the best results may be secured. Many methods and ideas in constant practice a few years ago have given way to more effective ones, and the change is constantly going on. Fumigation has had its day and has been discarded by most of the health authorities in large cities as of no practical value. Bacteriological methods are constantly being improved, and we are gradually isolating the organisms responsible for disease or dangerous to health.

The old superstition that pasteurized milk was not wholesome has been exploded, and a hundred other examples

might be quoted to demonstrate that the methods of meeting public health problems are constantly improving.

Public health schools, in a manner identical with other scientific schools, teach the fundamentals governing public health laws and their administration. Such preparation should be a requisite for office, but, like journeymen in any industry, health officers need the opportunity to demonstrate the practicability of various modes of procedure by actual application to given conditions or cases before they can develop into practical and effective executives. Previous preparation is but the basis on which experience and study are to produce the real health officer.

Remembering that health officers, perhaps more than those connected with any other branch of public service, are products of evolution, what should be the attitude of a city or town towards the men who are trying conscientiously to administer the laws of the land and make this country a safe and pleasant place to live for generations yet to come? It is my contention that just as an official owes to the citizens of his municipality the best that is in him, so also does the city or town truly owe to the official heartiest support morally and financially. The campaign for health, for the lives of men, women and children should not be hindered by indifference on the part of the people.

To my mind there is only one way by which a health officer may keep posted as to the best and newest methods. That is by constant study, and nowhere can this be done to better advantage than in a convention such as we hold annually. I know that you who are listening do not need the lesson, but I hope this message may reach those who are at home. While our papers are published in our annual reports and many will say they can read them at home and so save the time and money for travel, it is an absolute fact that the convention has a spirit and inspiration which cannot be conveyed in print and which the stay-at-homes miss completely.

There is the rubbing of shoulders with men from all parts of the land. There is the opportunity to ask questions, to present a problem that is taxing one's ingenuity, and quite possibly to learn how someone else, similarly situated, is meeting this particular difficulty. Subjects are discussed at these meetings from all angles, and not only one idea but many are expressed and supported by personal experience of men actually in the work.

I have never attended one of these conventions without carrying home some ideas that have been of particular value. We may not have the immediate opportunity to apply what we learn, but sooner or later the conditions arise when the knowledge is essential to the well being of the community which we serve. May I say again that it is the duty of every municipality to provide time and funds for the health officer to the end that he may attend conventions, travel and learn the practical application of certain principles in other places, thereby keeping in touch with the latest and most effective methods of the science which he represents.

Milk inspection in its broadest terms is not a "one-man job." If it were, one would need to be a dairy inspector, a railroad man, a sanitarian, a bacteriologist, a chemist, a competent executive and much besides. Each department holds its important place in the cycle of milk inspection, and each representative is indispensable to the rest. In large cities these forces are usually at work, and in smaller communities by cooperation and combination it is possible to obtain similar results.

Therefore the object of this paper is to urge a two-fold obligation. The duty of the official is well understood, but the responsibility of the community is often ignored. Where there is an official qualified by education and training to carry on the work of milk inspection, make the compensation commensurate to these requirements: insist that he keep abreast of the times: see that he attends conventions

and meetings, travels and learns what is being done in other places.

"As ye sow so shall ye also reap."

Citizens, give your earnest support in every way to the man who is trying to make your city safe both now and for your children and your children's children, that the sunshine of health and happiness may abound even in lowly places and the men and women of this nation may continue always to be strong and valiant, clear-thinking, stout-hearted, and maintain this Republic foremost for all time among the nations of the world.

"A man's worth isn't reckoned by the hours he puts in but by what he produces."

THE MILK SITUATION IN THE CITY OF SCRANTON, PA.

FRED J. WIDMAYER, *Food and Milk Inspector,* Scranton, Pa.

In the period from 1893 to 1900 we had a food inspector, who was also expected to look after the milk supply. It was a "hit or miss" proposition.

From 1900 to 1906 the public was gradually educated to the importance of its milk supply. The City Council, in 1906, appropriated funds to install a city laboratory, which was of very great benefit in locating the source of a typhoid epidemic that was traced to the pollution of our water and milk supply.

In this epidemic of 1906-1907, twelve hundred cases were reported, with fatalities of over 10 per cent, and it caused a complete reorganization of the milk inspection. A new inspector for the watersheds and dairies was added to the inspection force. This resulted in a marked improvement of the sanitary conditions at the dairies and in the transportation of milk to market.

In order to locate specific cases of sediment found in milk we adopted a sediment test in 1912, and by its use we soon found the unclean producer and improved the quality.

In 1914 our department recognized the benefits of pasteurized milk and we induced several milk distributers to install the proper machinery. The result was so satisfactory to all concerned that in a very short period we found 85 per cent of the milk consumed in the city was pasteurized.

In the year 1915, through efforts of our department, the City Council passed an ordinance prohibiting the sale of so-called "dip milk," cream and buttermilk, thereby securing a cleaner and better milk supply to the consumer.

During the following years, up to 1919, our department continued to work for an ordinance that would require all milk and cream sold within the city limits to be pasteurized.

Before this ordinance was passed several meetings were held for public discussion. Among the objectors were milk dealers, who claimed it would close up their business. Even members of the medical profession opposed the ordinance; their only excuse was that "they had no pasteurized milk when they were kids."

The strongest support our department had for the passage of the ordinance was given by Dr. T. D. James, of Scranton, whose experience as Major in charge of the milk supply at different camps during the war proved that tuberculosis and other contagious diseases were spread by the use of raw milk.

Mrs. S. S. Spruks, manager of the Baby Welfare Milk Stations of the city, presented figures showing the danger of feeding raw milk to children and the excellent results obtained at the baby welfare stations by the use of pasteurized milk.

Representatives from the department of milk inspection presented an overwhelming stack of evidence based on facts and figures obtained from the records at our office and other sources, showing that the death rate of infants has materially decreased from the year 1914 to 1919. This fact was forcibly explained by an undertaker who remarked that "formerly he used to have 30 funerals of infants per month and now but three or four."

On January 9, 1920, this ordinance was passed, which requires that all milk and cream sold in the city shall be pasteurized, excepting properly certified milk. I have been informed by the State Department of Health of Pennsylvania that the city of Scranton is the first city in the State that has succeeded in passing an ordinance of this nature.

I may add, with all sincerity, that since starting to improve the milk supply of the city of Scranton, up to the present time our department has never been compelled to exercise its legal power, at all times having hearty support of producer, distributer, and the consumers.

During the coming year our department has in mind to conduct a campaign to educate the public of our city to realize more fully the value of milk and its products, properly prepared, as a food for grown-ups as well as for the children.

"We must get more people to using milk, and get people to using more milk."

THE LITTLE PLATE METHOD OF COUNTING BACTERIA IN MILK, WITH SPECIAL REFERENCE TO A FIELD OUTFIT

PROF. W. D. FROST, University of Wisconsin, Madison, Wis.

Several years ago I became interested in the counting of bacteria in milk sooner than is possible by the plate method, and the idea occurred to me that it might be possible to make a plate culture, only instead of waiting until the colonies were visible, to count them while they were still of microscopic size. I have developed that method and published it. My only excuse for appearing before you today is the fact that I have made changes in the method which have not been published that make it very much more satisfactory for ordinary use.

The method as originally described was to take a cubic centimeter of milk, and add to that an equal amount of ordinary nutrient agar, liquified, of course, and cooled down to about 25°. After that had been thoroughly mixed, to take a cubic centimeter or a tenth of a cubic centimeter and spread it on a glass slide, making a little plate. That has become cumbersome, since I use only a tenth of the amount of milk that was mixed up, and I find when I come to put it into practice that it consumes a considerable time.

The method proposed now is to use a small pipe, or at least a small pipette with graduations. I have been using one that delivers a twentieth c.c. The seriological pipettes are very good for that purpose and are easily gotten in the milk.

In making the test, then, the method is briefly this: I mark on an ordinary glass slide by means of a wax pencil an area of four square centimeters. I usually put two on the same slide. There is plenty of room, and that gives me

an opportunity to make duplicate counts or even two plates of different milk on the same slide.

Then these are sterilized in the flame, either in an alcohol flame in the field, or in an ordinary gas flame. I have made a little change on a forceps which makes it possible to handle these very easily by putting a little soap on the lower part. These are then flamed, and then they are put on what I call a warming table. This is just a box that is filled with water at about 45° C. The reason for that is that it is necessary to keep these warm while the plates are being made. At the same time I can keep the melted agar in these tubes here, and I usually leave the corks out, with a pipette in them, and having put on a twentieth of a cubic centimeter of milk I put on a drop of ordinary nutrient agar. It does not make so very much difference what that amount of agar is. I try to get about a twentieth of a c.c. The only difference would be that if I try to put more on some than on others, the consistency of the nutrient would be a little different and the character of the colonies vary slightly. When the agar is added, then the plate is spread by an ordinary wire needle, and for that purpose in the field I have a simple arrangement here which allows me to keep those sterile. With the needle the mixture is made, and then the plates must be kept moist, of course. They dry up very quickly, and for that purpose I have what is called a moist chamber cabinet. It is just a rack, surrounded by a tight wall, and in the bottom of it I put a little moisture. This whole thing is put in the incubator. The plates do not dry up in even 48 hours, so that it is perfectly satisfactory.

The colonies develop with remarkable rapidity. Sometimes in four hours in a milk that contains a good many bacteria, or where they are active to start, these colonies will be actually visible to the naked eye, and contain hundreds of individuals. They would be very small.

The period of incubation for highly contaminated milk

may be as short as four hours, but in pasteurized milk and milk of very low bacteria count it is necessary to give a little longer time—seven or eight hours. At the end of that time these little plates are taken out and dried down. They are dried down fast on a hot plate. It is quite necessary that this drying be done rapidly, because if they are allowed to dry in the ordinary room temperature, for some reason they crack off, split, and they are not so easily handled.

Then these colonies, instead of being examined as they are, are first stained, and the trick in staining these, as I found out, is to first treat it with acetic acid. I make a solution of acetic acid in alcohol, a ten per cent solution. In some way that prevents the agar from finding the stain. If you just dip these in stain the background will be so dark that the colonies will be affected, but if they first have this preliminary treatment with acetic acid, then they stain very readily, and the background, when everything is all right, is almost perfectly clear, while the colonies are dark. I have used an ordinary methylene blue, diluted about one to four. I am sure, however, that carbol-thionine is a better stain, for two reasons. In the first place it is possible to put the acetic acid right into the carbol-thionine, which makes it unnecessary to give it the preliminary treatment, and in the second place, in connection with other work it is possible to get photographs of the bacteria very much better with carbol-thionine than with methylene blue.

These colonies, then, can be counted, and they can be counted much more easily than in the direct microscopical count, for the reason that it is possible to use a low-power microscope.

My practice is to look over the slide and see if the distribution of the colonies is quite uniform, which is usually the case, and if it is, I select a few representative fields, count them, and then multiply that count by the factor that is necessary to convert the number of colonies in the field into the number of bacteria in the cubic centimeter.

I have arranged a carrying case, which is pretty well insulated, and it serves as an incubator while it is being used in traveling. The warming table is filled with water at about 42°. Then the chamber cabinet is put on top of it, and the rest of the material packed in and then closed up. It then makes a box that will maintain the temperature, starting out at about 37° and coming down to 30° in the course of eight or ten hours, so that it gives these colonies a temperature of about 30° for a period sufficiently long to develop.

Some people, when I first suggested the method, thought it would be very inconvenient, because it would bring people into the laboratory at irregular hours. If they started in the afternoon, then eight hours would make it after supper. But it is possible to let these stay in for a longer period of time. It is quite satisfactory to make the cultures and to put them in the incubator in the afternoon, and to dry them down and count them the next morning.

Now the result which I have obtained in general shows that the correspondence between this and the plate culture is quite close when large averages are taken. It is sometimes a little above and sometimes a little below. The general average is about 25 per cent higher than the ordinary plate, but I should be misleading if I did not tell you that while the general average is very good, there are certain, frequently rather large, discrepancies that I cannot fully explain. The culture medium here is slightly different, and is, I believe, more favorable for the development of milk bacteria than the ordinary plate, because it contains half milk, and I know it is a fact that certain kinds of bacteria in milk grow upon the little plates which fail to grow upon the ordinary plates. So that if we take a starter, for example, a butter starter and makes cultures by the ordinary method and by this method, we get on an average 19 or 20 times as many bacteria by the little plate as we do on the ordinary plate.

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